The Journal of Gemmology

Volume 27 No. 8 October 2001

Cultured pearls • Cat's-eyes and star stones • Nephrite jade • Synthetic moissanite

The Gemmological Association and Gem Testing Laboratory of Great Britain

Vol 27, No. 8, October 2001 ISSN: 1355-4565

Cultured pearls and colour-changed cultured pearls: Raman spectra

Li Liping and Chen Zhonghui

Gemmological Institute, China University of Geosciences, Wuhan 430074, P.R. China

ABSTRACT: The numbers of coloured pearls on the market have grown over the past few years and include dyed pearls, irradiated pearls and so-called 'lasered' pearls. In this study, different pearl samples have been experimentally dyed or irradiated. Their Raman spectra have been obtained and found to be useful in identifying the colour origin of pearls.

Keywords: colour origin, dyed pearl, irradiated pearl, natural coloured pearl, Raman spectrum

Introduction

Over the years, the range of coloured freshwater cultured pearls generally available has increased significantly and includes black, peacock green, dark purple and bronze varieties. Some are dyed, some are irradiated freshwater cultured pearls, and some are even labelled as 'lasered'. These are in addition to naturally coloured freshwater cultured pearls. Our research work has shown that the so-called 'lasered' freshwater cultured pearls are actually dyed[1]. Our studies have confirmed that colour features, colour distribution, internal characteristics, ultra-violet fluorescence, and chemical tests are useful in identifying some dyed or irradiated pearls (op. cit.). However, many treated cultured pearls do not show any distinctive features. Furthermore, when

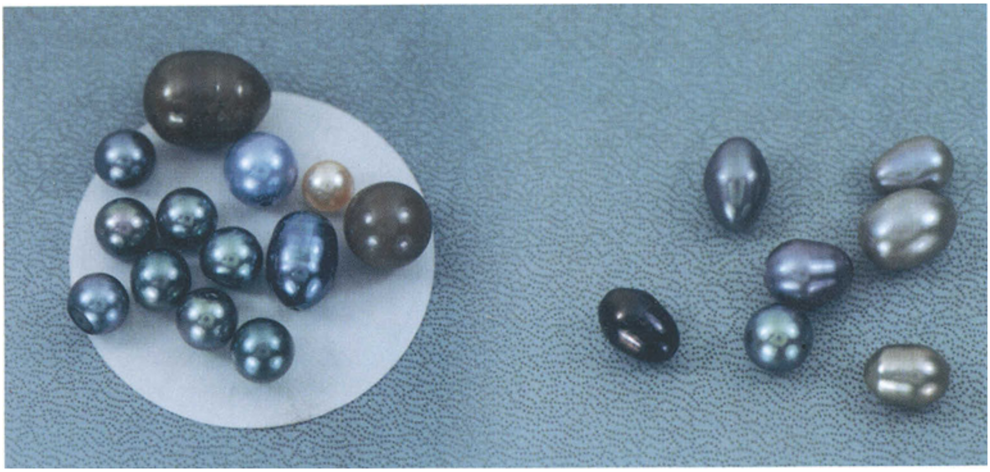


Figure 1: *Some of the pearl samples studied: dyed cultured pearls (left) and irradiated cultured pearls (right).*

 ISSN: 1355-4565

Table I: *Chemical data for five pearls.*

Sample	*Freshwater pearls*				*Tahiti pearl*
	white	*orange*	*purple*	*dyed dark*	
Element				*purple*	
at.%	*F-1*	*F-2*	*F-3*	*F-4*	*F-6*
Ca	37.98	37.78	37.91	38.17	38.12
Na	0.26	0.26	0.28	0.27	0.75
ppm					
Mg	39	25	48	40	79
Si	840	790	1800	1300	1600
P	210	220	190	170	170
Al	9	8	13	24	14
K	56	52	69	238	238
Sr	394	332	402	373	900
Ba	410	550	390	330	190
Fe	5	36	11	21	49
Mn	286	323	643	241	1
Cu	1	1	1	1	2
Zn	4	3	4	4	5
Ni	1	1	2	<1	<1
Co	<1	<1	<1	<1	<1
Cr	<1	<1	<1	<1	<1

N.B.: Results obtained from Hitchi 180-70 atomic absorption spectrometer.

a pearl is mounted, identification of its colour origin is made more difficult.

For this study, some of the samples were obtained directly from the market and others were treated by dyeing or irradiation (*Figure 1*). Some of the cultured pearls were dyed black by immersion over a twelve day period in either 0.025N silver nitrate, or in silver nitrate diluted with ammonia (*Figure 2*). Some were treated by electron accelerator. Eighteen samples were tested using the Renishaw MK1-1000 laser Raman spectrometer at room temperature with the green line (514.5 nm) of an Ar-ion laser as excitation. In order to obtain comparable Raman spectra, the power and exposure times were kept constant for all the samples.

The chemical compositions of natural-coloured and dyed pearls were obtained by dissolving small samples of pearl and analysing the solutions with a Hitachi 180-70 atomic absorption spectrometer; the results are shown in *Table I*.

In this study, all the freshwater cultured pearls are non-nucleated and all the seawater cultured pearls are nucleated.

Figure 2: *Cultured pearls dyed with $AgNO_3$ only (left) and pearls dyed using $AgNO_3$ diluted by ammonia (right).*

Results and discussion

Naturally-coloured cultured pearls

Naturally-coloured freshwater cultured pearls are usually white, orange or purple as shown in *Figure 3*. It is easy to distinguish naturally-coloured freshwater cultured pearls from black Tahiti cultured pearls (whether nucleated or non-nucleated) on colour alone. However, the lighter grey Tahiti cultured pearls may prove to be more difficult to differentiate.

The black Tahiti cultured pearl samples show very strong fluorescence under the green laser, and in the Raman spectrum (*Figure 4*) there is a broad low peak at 1605 cm^{-1} beside the typical sharp peaks at 1083 and 702 cm^{-1} of aragonite. As can be seen from the chemical analysis (*Table I*, column F-6) the Tahiti pearl contains very small quantities of minor elements, which probably would have little influence on the colour. The peak at 1605 cm^{-1} is relatively low and comparatively wide, indicating that it may

Figure 3: *Naturally-coloured Chinese freshwater cultured pearls.*

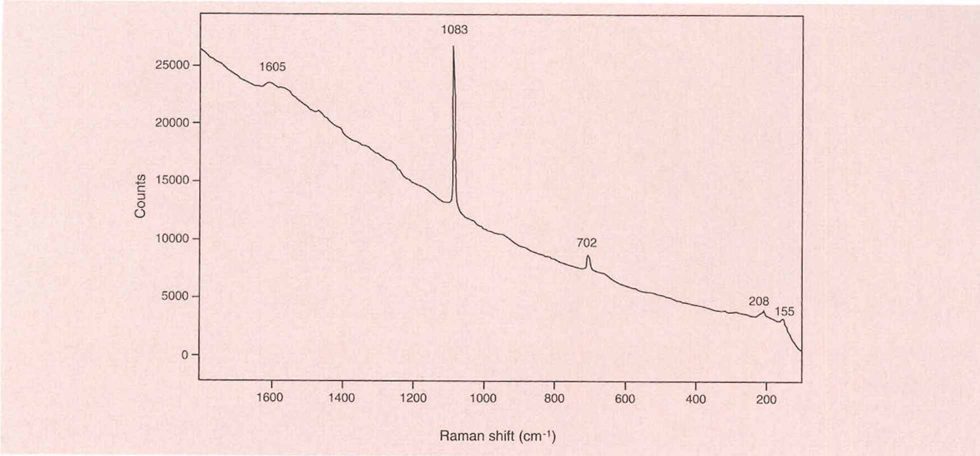


Figure 4: *Raman spectrum of Tahiti cultured pearl.*

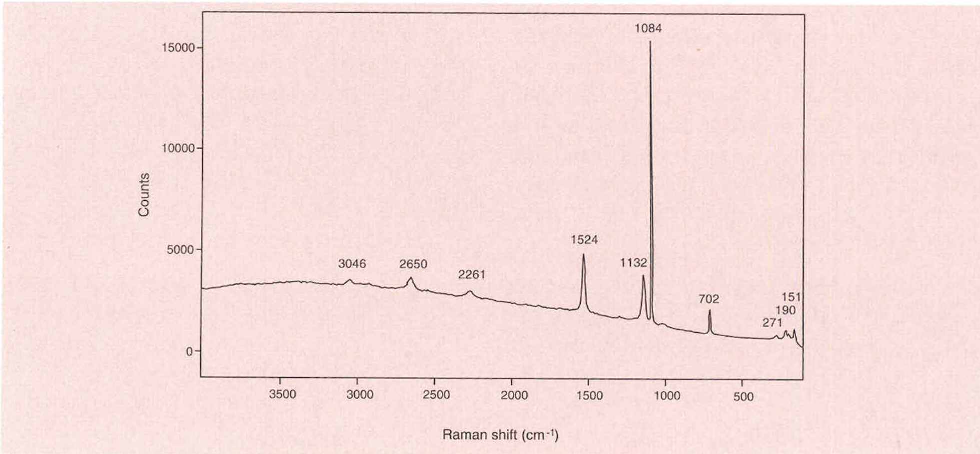


Figure 5: *Raman spectrum of naturally-coloured orange freshwater cultured pearl.*

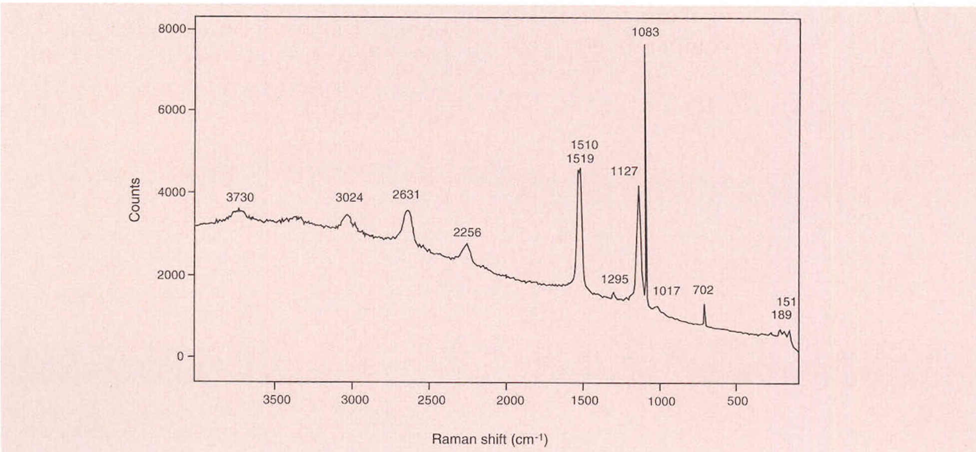


Figure 6: *Raman spectrum of naturally-coloured purple freshwater cultured pearl.*

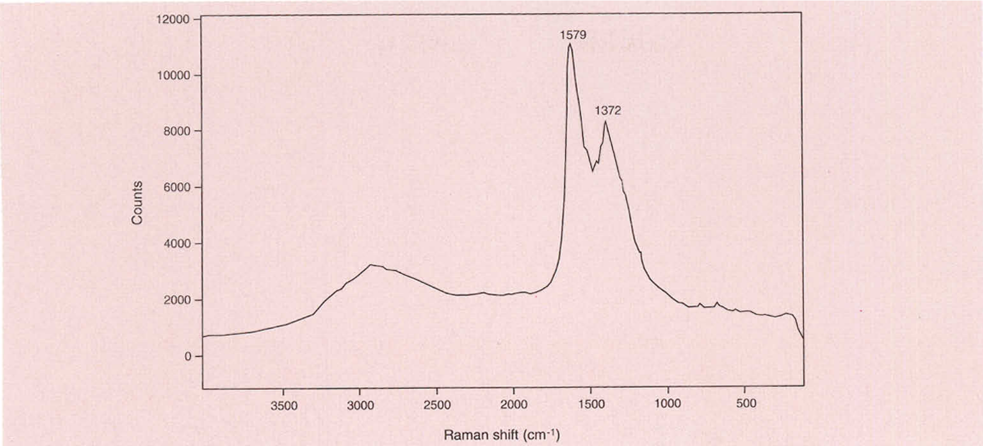


Figure 7: *Raman spectrum of freshwater cultured pearl dyed black by silver nitrate.*

be caused by a substance of low crystalline structure, which would include organic materials. It has been suggested by other researchers (e.g. see[(2)]) that pigments such as porphyrin seem to be the cause of colour in Tahiti cultured pearls.

For naturally-coloured orange freshwater cultured pearls, the Raman spectrum *(Figure 5)* is very different to that seen in Tahiti cultured pearls. In addition to the sharp and strong peaks of aragonite at 1084 and 702 cm^{-1}, there are sharp peaks at 1524 and 1132 cm^{-1} and also some weak peaks at 2650 and 2261 cm^{-1}. The sharp peaks indicate that the impurities are in the crystal structure. The chemical analyses for the orange freshwater cultured pearls reveal iron (*Table I*, F-2) being present in a comparatively high enough concentration to be a possible contributory cause of the orange colour. Further research is needed to establish if this is the cause of colour.

The naturally-coloured purple freshwater cultured pearls show a complicated Raman spectrum, with sharp peaks at 1127, 1510 and 1519 cm^{-1}, and broad peaks at 2256, 2631 and 3024 cm^{-1} (*Figure 6*). The chemical analyses reveal that contents of Mn, Si, Al and Fe are relatively high (*Table I*, F-3). Once again whether any of these minor elements contribute to the colour will require further research.

Dyed pearls

Many freshwater and saltwater cultured pearls are dyed various colours. The dyed black cultured pearls often show very good iridescence. The iridescent peacock green and purple colours associated with the highly valued natural-coloured black Tahiti cultured pearls can also be seen in the so-called 'lasered' freshwater cultured pearls. The colour distribution in both types is quite even. The 'lasered' freshwater cultured pearls are actually dyed – the process involves immersion for about one year in a new organic dye.

All the dyed cultured pearl samples show very different Raman spectra to the naturally-coloured cultured pearl samples. The three black cultured pearls dyed by silver nitrate methods produced differing colour saturations, but similar Raman spectra. The absorption peaks of aragonite are commonly present but, compared with Raman spectra of undyed cultured pearls, what was also found were peaks relating to carbon as seen in the likes of jet[(3)] (*Figure 7*). This may indicate that non-crystalline carbon is a degradation product of the organic matrix originally present in the pearl. It can be surmised that the black colour induced in pearls by dyeing with silver nitrate may be caused by the deposition within the layers of the pearl not only of silver oxide, but also of non-

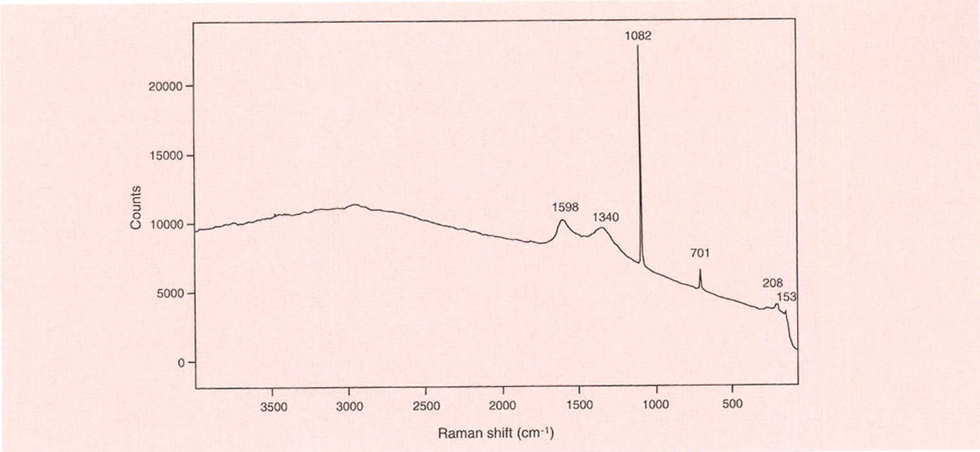


Figure 8: Raman spectrum of freshwater cultured pearl dyed dark purple ('lasered').

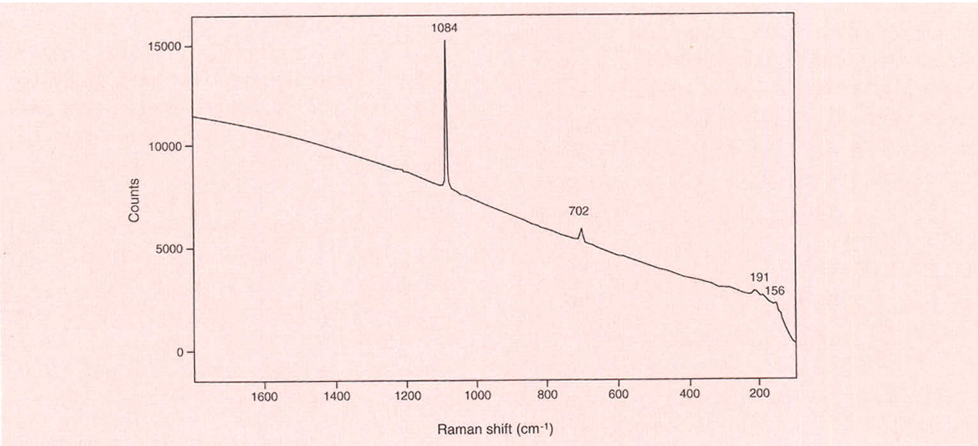


Figure 9: Raman spectrum of a white freshwater cultured pearl turned black by irradiation.

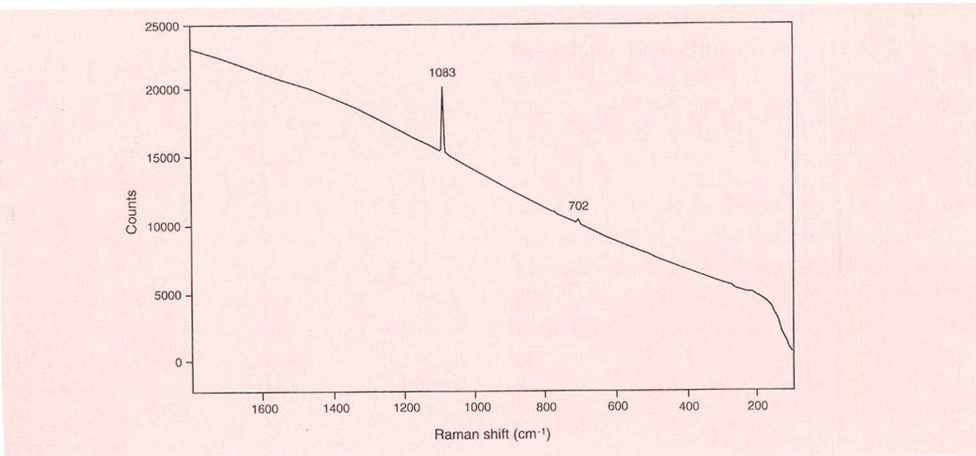


Figure 10: Raman spectrum of an orange freshwater cultured pearl turned black by irradiation.

crystalline carbon as a reduction product of organic substances. Two different 'lasered'-pearls that were also tested gave similar carbon peaks in their Raman spectra, one of which is shown in *Figure 8*. The two broad peaks at 1340 and 1598 cm^{-1} are caused by carotene which is a pigment commonly used to dye coral.

Irradiated pearls

Irradiation was carried out under contract; the authors used a TRI-CARB 2250CA Liquid Scintillation Analyzer to confirm that any residual radioactivity was at or close to background level.

It was found that irradiation effectively changed the colour of freshwater cultured pearls. The resulting irradiated colours were often a dark peacock green, dark purple or bronze (as shown in *Figure 1*). The colour produced by irradiation is considered to be stable because it does not fade after exposure to ultraviolet light for 240 hours. The Raman spectra of six pearls were obtained before and after irradiation. White freshwater cultured pearls may change to silver grey, bronze or dark purple, depending on the power of the irradiation. However, no change in Raman spectra occurs after irradiation (*Figure 9*).

On irradiation some orange and purple freshwater cultured pearls changed to dark peacock green, and others to dark purple or bronze. No additional peaks were present in the Raman spectra after irradiation; however the aragonite peak heights had decreased (*Figure 10*).

The fluorescence under the argon-ion laser of all the irradiated freshwater cultured pearls is far stronger than for those that were not irradiated; this and the Raman spectrum could imply that irradiation produces a new fluorescent centre, and destroys the organic substance in pearls.

Conclusions

Raman spectroscopy can be useful in distinguishing naturally-coloured from dyed cultured pearls.

Naturally-coloured Tahiti cultured pearls show a typical broad peak at 1605 cm^{-1}. Naturally-coloured orange or purple freshwater cultured pearls always show sharp peaks at around 1127 and 1524 cm^{-1} and broad peaks in the range between 2256 and 3730 cm^{-1}. Some dark-coloured cultured pearls dyed with organic substances show typical broad peaks at around 1340 and 1598 cm^{-1}. Silver nitrate-dyed cultured pearls may not show the typical peaks of aragonite, but only the broad peaks at 1571, 1594 and 2918 cm^{-1}. The Raman spectrum of an irradiated dark-coloured cultured pearl will only show the structural aragonite peaks. Therefore, apart from general fluorescence observations, the technique is not useful in detecting irradiation treatment.

References

1. Li Liping, Yan Weixuan, Lin Xinpei and Wuxiang, 2000. Identification of dyed pearls and irradiated pearls. *The Journal of Gems and Gemmology*, **2**(3), 1-3 [in Chinese]
2. S.J. Kennedy, S. Akamatsu and Y. Iwahashi, 1994. The Hope Pearl. *J. Gemm.*, **24**(4), 235-9
3. J.B. Nelson and K.P.J. Williams, 1995. Gemmological research with the aid of a visual light microprobe using Raman and other light scattering effects. Symposium of International Gemmological Conference, Thailand, 21-25 October 1995

Some new unusual cat's-eyes and star stones

Jaroslav Hyršl

Heverova 222, CZ-280 00 Kolin, Czech Republic

ABSTRACT: Several unusual star and cat's-eye stones are described. Pale blue topaz from Brazil shows chatoyancy caused by flat hollow channels. Four-rayed star aquamarine from Brazil has one direction caused by hollow channels parallel to the *c*-axis and a second perpendicular direction is caused by planes of two-phase inclusions orientated perpendicular to the *c*-axis. A tourmaline-quartz combination from Brazil has an iridescent chatoyancy. Grey orthoclase moonstone from Sri Lanka has a unique combination of a cat's-eye and a six-rayed star, the cause of both is not clear. Sunstone from Russia has a strong cat's-eye caused by an albite-oligoclase orthoclase perthite. Four-rayed star tourmaline (bicolour elbaite) has one direction caused by hollow channels and the second by planes of 'trichites' perpendicular to the *c*-axis. Weak chatoyancy of rhodochrosite from Kazakhstan is caused by its agate-like structure. Four-rayed star rhodochrosite is caused by two directions of a perfect cleavage.

Keywords: aquamarine, chatoyancy, moonstone, rhodochrosite, stars, sunstone, topaz

Large topaz cat's-eye from Brazil

A very unusual example of a cat's-eye was purchased in Brazil by the author in summer 2000. It is an oval cabochon weighing 152.15 ct and measuring 32.94 x 24.91 x 20.25 mm. It was identified as topaz from a spot RI of about 1.62 and from a biaxial image through a conoscope between crossed polars. The stone is light blue with strong pleochroic colours – greenish-blue and almost colourless. It is inert under UV light. When illuminated with a spotlight, it shows a sharp cat's-eye and the line has bright iridescence colours (*Figure 1*).

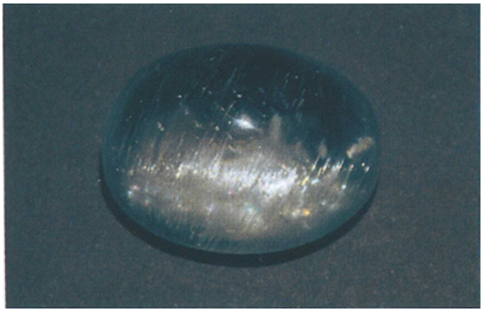


Figure 1: *Chatoyant pale blue topaz from Brazil weighing 152.15 ct. Photo by J. Hyršl.*

The cause of chatoyancy is easily visible – long colourless almost parallel needles in about one half of the volume of the stone. With a microscope, they can be identified as flat hollow channels (cf. Koivula, 1987). Channels in the studied stone contain no limonite colouring and therefore very strong iridescence colours can be seen in an oblique light. In places, three or four channels may radiate from an unidentified crystal (*Figure 2*).

 ISSN: 1355–4565

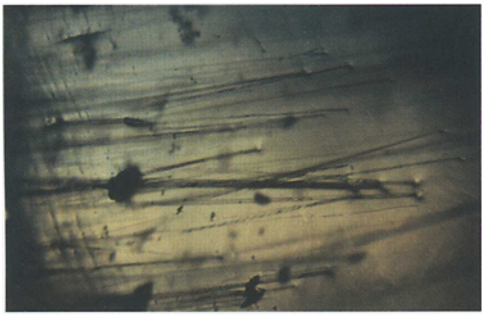


Figure 2: Iridescent flat hollow channels in a topaz cat's-eye grow in one direction from small unidentified crystals. Width 7 mm. Photo by J.Hyršl.

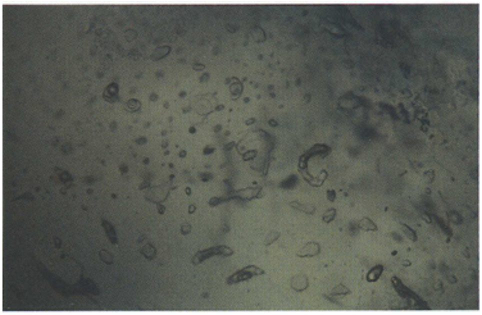


Figure 3: Six-rayed star aquamarine (27.32 ct), with a plane of inclusions perpendicular to the c-axis; some of them contain two immiscible liquids; transmitted light. Width 1.9 mm. Photo by J.Hyršl.

Hoover (1992) has described two topaz cat's-eyes, one blue of 7.98 ct from Brazil and another colourless of 12.20 ct from Sri Lanka, but this specimen is considerably larger.

Two star aquamarines from Brazil

Star beryls, including aquamarines, are very rare but have been known for a long time. They are cut perpendicularly to the *c*-axis and usually show a very weak six-rayed star. The star is caused by abundant parallel films of two-phase inclusions (*Figure 3*), which are typical for many beryls (Gübelin and Koivula, 1992; Henn and Bank, 1997), and several examples of aquamarine and yellow heliodor, and very rarely emerald, have been seen by the author in Brazil. The studied aquamarine with a six-rayed star weighs 27.32 ct, has RI (measured on a flat polished base) of 1.574 - 1.581 and a SG of 2.69. Much more surprising is a similar aquamarine of 30.91 ct, which shows a four-rayed star. Its colour and properties (RI = 1.571 - 1.579 and SG = 2.69) are very similar to the six-rayed star stone and it was cut from the same type of rough, but in a different direction. One ray direction is caused by thin films mentioned already in the six-rayed stone and this means that it is one ray of the star. The second ray direction is perpendicular to the first and is caused by hollow channels, which on their own cause chatoyancy in other aquamarines (*Figure 4*).

Quartz-tourmaline cat's-eye from Brazil

A strange stone weighing 27.58 ct was purchased in Brazil and is reliably reported to come from a pegmatite in Minas Gerais. The base is tourmaline with a transparent light green core with a dark green rim; the rim is nearly opaque and has a fibrous structure. The next phase of growth on the green tourmaline consisted of thin tourmalines and white hexagonal muscovite crystals, and then finally in the last phase all was covered by colourless rock crystal so this quartz-tourmaline stone is a sort of 'natural doublet'.

Figure 4: Four-rayed star aquamarine (30.91 ct) with hollow channels (left-right) and perpendicular small films of two-phase inclusions. Width 1.2 mm. Photo by J. Hyršl.

Figure 5: *Tourmaline and quartz (27.58 ct) with an iridescent chatoyancy, a sort of 'natural doublet'. Photo by J.Hyršl.*

Figure 6: *Chatoyant tourmaline and quartz, side view. Photo by J. Hyršl.*

After cutting into a cabochon, a sharp cat's-eye can be seen. Unusually, the eye shows bright iridescent colours which are caused by a very thin layer of air between the tourmaline and the quartz (*Figures 5 and 6*).

Moonstone with a star and cat's-eye combination from Sri Lanka

A stone described as a moonstone was purchased in Germany and probably comes from Sri Lanka, where a similar one was offered to the author in 1999. It is a brownish-grey cabochon weighing 31.42 ct with a spot RI of 1.53 and SG of 2.60. In LW UV it is inert, but in SW UV it shows red fluorescence. These properties indicate moonstone but could also be consistent with scapolite. Therefore a tiny amount of powder for X-ray diffraction analysis was scraped from the girdle; the results indicate orthoclase feldspar, which confirms its identity as a moonstone. It is slightly translucent and has a silvery schiller. In a strong light it shows an extremely unusual phenomenon – a combination of a cat's-eye and a six-rayed star, positioned beside each other (*Figure 7*). Under a microscope, thousands of tiny microcrystals can be seen. Some are black trigonal platy crystals, orientated in the same direction and could be hematite. Small black rods (ilmenite?) are parallel with the edges of the trigonal crystals. Very common are dark tiny anisotropic crystals of irregular shapes similar to snowflakes. Despite the variety, none of the inclusions is abundant enough to explain the unusual optical phenomena. The star is most probably caused by hematite (?) and ilmenite (?), and the chatoyancy could be caused by submicroscopic twin lamellae.

Sunstone cat's-eye from Russia

Chatoyant cabochons from the Vishnevye Mts. in the Urals, a famous pegmatite region about 100 km south of Ekaterinberg, were purchased in Tucson in 2001. The stones have a grey body colour but appear brown from the presence of abundant hexagonal hematite platelets up to about 1 mm in

Figure 7: *Moonstone with a combination of six-rayed star and cat's-eye, 31.42 ct. Photo by J.Hyršl.*

Figure 8: Two cabochons of sunstone cat's-eye (17.89 and 9.50 ct) from the Urals. Photo by J.Hyršl.

diameter (*Figure 8*). The hematite plates form three crystallographically oriented systems which are almost perpendicular to each other. The RI is 1.530 - 1.537 and the SG is 2.62. In LW UV the sunstone is inert, but in SW UV it shows dark red fluorescence. The cause of chatoyancy is visible with a loupe and is a 'fibrous' structure consisting of thin lamellae of intermixed feldspars (*Figure 9*). The angle between the lamellae and direction of the main cleavage is 19 degrees. According to RI and SG values, the feldspar could be orthoclase, perthite (albite – oligoclase – orthoclase intergrowths) or peristerite (albite – oligoclase intergrowths). X-ray diffraction of a powder scraping proved the stones to be perthite with more albite than orthoclase.

Star tourmaline

Although tourmaline cat's-eyes are quite common, stars are not and it was surprising to find a tourmaline - elbaite with a weak four-rayed star. The stone is an elongated cabochon weighing 11.05 ct, unfortunately without a given locality. One third is green and two thirds are pink. One direction of the star is caused by hollow channels (very common in tourmalines) and the second is caused by abundant 'trichites', most of which are oriented perpendicular to the *c*-axis.

Star and cat's-eye rhodochrosite

Cut rhodochrosite is quite common, but stones with optical phenomena have not been reported in the gemmological literature until now. Both the cat's-eye and the star rhodochrosite come from the former USSR. The cat's-eye weighs 2.27 ct, is pinkish-red, with RI (measured on a flat, polished base) of 1.570 and more than 1.80, and SG of 3.58. The weak chatoyancy is caused by a thin

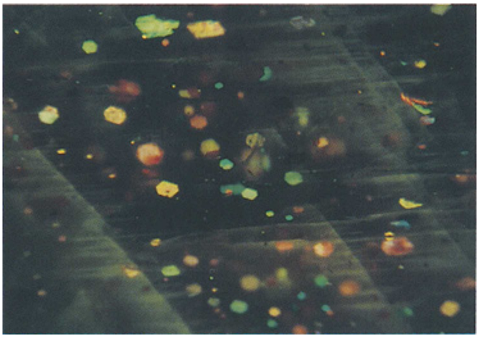


Figure 9: Hematite plates and 'fibres' in sunstone cat's-eye from the Urals. Width 4 mm. Photo by J.Hyršl.

layered 'agate-like' structure. The rough was found a few years ago in Kazakhstan and forms thick translucent crusts on matrix. Similar cat's-eyes probably could be cut from rhodochrosite from the famous Mina Capillitas in Argentina.

The star stone is a dark pinkish-red cabochon of 12.83 ct. Its RIs are 1.695 and more than 1.80 and its SG is 3.73. The well-centred four-rayed star has angles of about 74 and 106 degrees, caused by perfect cleavages in these two directions (*Figure 10*).

Figure 10: *Star rhodochrosite (12.83 ct) showing two directions of cleavage and two-phase inclusions. Width 4 mm. Photo by J.Hyršl.*

References

Gübelin, E., and Koivula, J.I., 1992. *Photoatlas of Inclusions in Gemstones*. ABC Edition, Zurich

Henn, U., and Bank, H., 1997. Beryll-Katzenaugen und Sternberylle. *Z.Dt. Gemmol. Ges.*, **46**(1), 113-17

Hoover, D.B., 1992 *Topaz*. Butterworth-Heineman, Oxford

Koivula, J.I., 1987. The rutilated topaz misnomer. *Gems & Gemology*, **23** (2), 100-3

Nephrite jade from Jordanów Slaski, Poland

Dr Douglas Nichol
Wrexham, Wales

ABSTRACT: Near Jordanów Slaski, deposits of nephrite jade are intimately associated with serpentinized ultrabasic igneous rocks of Precambrian age. The nephrite jade bodies vary from tabular to lenticular in shape and occur together with talc-chlorite schist and rodingite within the contact alteration zone between serpentinite and gabbro/diorite. Predominant colours of the nephrite jade are of green-yellow and green hue. Grain size ranges from fine- to medium-grained and rare accessory constituents of diopside, tremolite, epidote, chlorite, zoisite, pyrite, hematite and magnetite have been recorded. The nephrite jade formed as a result of sudden high-pressure effects due to movements along major faults following the emplacement of the ultramafic rocks around the Sowie Góry block. The deposits at Jordanów Slaski have provided the largest nephrite jade boulder ever recorded from Europe. The nephrite jade itself was fashioned by famous artisans through the ages and examples of hardstone carving works are preserved in museum collections around the world. Modern production is very small in scale but the development of local lapidary facilities is currently under active consideration.

Keywords: Jordanów Slaski, nephrite jade, Poland

Introduction

The nephrite jade deposits at Jordanów Slaski rank among the largest and most significant in Europe and have been worked for over one hundred years for the manufacture of costume jewellery, hardstone carvings and ornamental pieces. Following the break-up of the former Soviet Union and the easing of international travel restrictions, Polish tourism has developed rapidly and growth trends should be strongly upwards. This increasing tourism together with modern advances in lapidary equipment have fostered a renewed interest in Polish gemstone localities in general and the nephrite jade deposits at Jordanów Slaski in particular.

The nephrite jade deposits are located 31.5 km south of the city of Wroclaw in the province of Dolny Slask (Lower Silesia), southwest Poland (*Figure 1*). From the village of Jordanów Slaski access to the deposits is westwards for 2.1 km towards Sobotka (*Figure 2*).

This paper provides a review and a description of the geological setting of the nephrite jade deposits at Jordanów Slaski. It also directs attention to the exploration potential that exists in the surrounding region.

Historical background

Archaeologically, nephrite jade production in the Jordanów Slaski district appears to have commenced in Neolithic times. Indeed, various types of artefacts made of material attributed to this locality have been found scattered throughout central and

 ISSN: 1355–4565

***Figure 1:** Orientation map.*

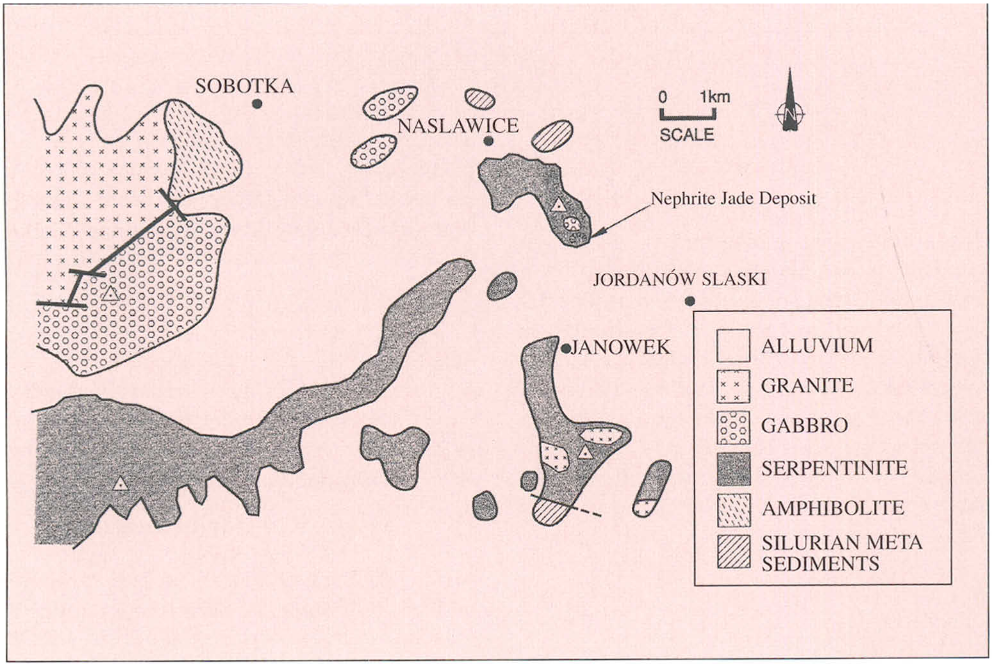


***Figure 2:** Sketch map of the regional geology of the Jordanów Slaski district.*

western Europe indicating that it was widely traded and highly prized by prehistoric man.

According to Skelton (1991) nephrite jade from south-western Poland was probably an important source of raw material for the Prague workshops of the Mannersit carvers during the 16th and 17th centuries. Also Visser (1946) contends that brief references to nephrite jade in the Jordanów Slaski district may be discerned in various 18th-century manuscripts.

However, modern discovery of the deposits at the Jordanów Slaski site is generally attributed to Hermann Traube of Wroclaw in 1884. The announcement of his findings created considerable public interest at the time and the deposits were widely heralded as the first *in situ* occurrences of nephrite jade in Europe.

Shortly after discovery, mining operations commenced and a substantial quantity of nephrite jade was produced (Traube, 1885). Subsequently mining operations were disrupted throughout the First World War but the deposits were reopened for exploitation in 1932 by Jordansmuhler Nephrit-Gesellschaft mbH and continuous production was sustained for several years (Klingner, 1943). Records are incomplete but based on the fragmentary evidence available, total production of nephrite jade from the site is estimated at approximately 1200 t.

Ruff (1963) reports that the deposits were again being worked in 1958 but production appears to have been small in scale. As far as can be determined, operations virtually ceased by 1960 although some desultory activity persists to the present day. Part of the site is currently occupied by various items of obsolete plant used for processing industrial minerals (limestone, pigment, etc.) and these tend to obstruct extractive operations.

Moreover, prior to the break-up of the former USSR, the East Sayan Mountains of Siberia were promoted as the principle nephrite-producing region for the Soviet Bloc countries and this appears to have influenced and, indeed, limited the potential for development of the deposits in Jordanów Slaski (*cf.* Prokhor, 1991).

Geological setting

The nephrite jade deposits are situated in the foreland foothills along the eastern flank of the Sudete Mountains of the north-east Bohemian Massif. They occur on the south-eastern slopes of an outlying ridge that stretches north-westwards from Jordanów Slaski. To the north-east, the site overlooks the floodplain of the River Odra.

Geologically, the crystalline basement (*Figure 2*) comprises Precambrian gneiss and amphibolite intruded by gabbro, granite and ultrabasic igneous rocks. The basement rocks form the Sowie Góry block, a major structural high and the oldest tectonic element in the region. These Precambrian rocks are unconformably overlain by metasedimentary strata of Silurian age.

Towards the end of the Precambrian, ultrabasic rocks were emplaced along deep fractures around the peripheral zone of the Sowie Góry block. They consist of serpentinized peridotite, pyroxenite and dunite, that vary from grey-green, massive serpentinites to dark green, foliated serpentinite. These ultrabasic igneous rocks underlie an area of almost 100 km^2 in the region and host economically important mineral deposits of primary chromite and nickel as well as secondary magnesite and chrysoprase (Osika, 1986).

The hilly ground around the nephrite jade deposits consists predominantly of massive serpentinite but diorite and gabbro crop out spasmodically along the southern-most lower slopes at the site. Nephrite jade occurs exclusively within the contact alteration zone along the faulted margins between serpentinite and the dioritic and gabbroic rocks.

Interestingly, a minor occurrence of nephrite jade has also been reported in a similar geological environment near Dzierzoniów, some 21 km to the south-west of Jordanów Slaski (Traube, 1887; Beutell and Heinze, 1914).

Figure 3: *View looking north of the quarry workings. Photo by Douglas Nichol.*

The host contact alteration zone is poorly exposed throughout the region. Accordingly, much of the serpentinite belt remains prospective for additional deposits of nephrite jade and further geological exploration appears warranted.

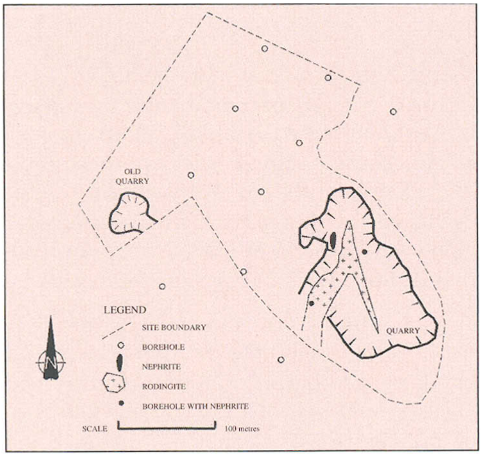


Figure 4: *Site plan (after Kozlowski, 1990).*

The deposits

The nephrite jade deposits at Jordanów Slaski occur within an old serpentinite quarry originally established for the extraction of rock aggregate for road construction purposes (*Figure* 3). The quarry area measures approximately 200 m long and 100 m wide by up to 10 m deep and the nephrite jade workings occupy the north-western corner of the principal quarry (*Figure* 4).

The bedrock is poorly exposed. However, the contact alteration zone between serpentinite and diorite crops out on the floor of the quarry. It is irregular in form, dips steeply, ranges up to 25 m wide and contains massive and sheared serpentinite, talc-chlorite schist, nephrite jade and rodingite (Gawel, 1957). Rock relations are illustrated in *Figure 5*.

The nephrite jade bodies are typically small, lensoid to tabular in shape and, although irregular in structure, generally appear to be concordant with neighbouring

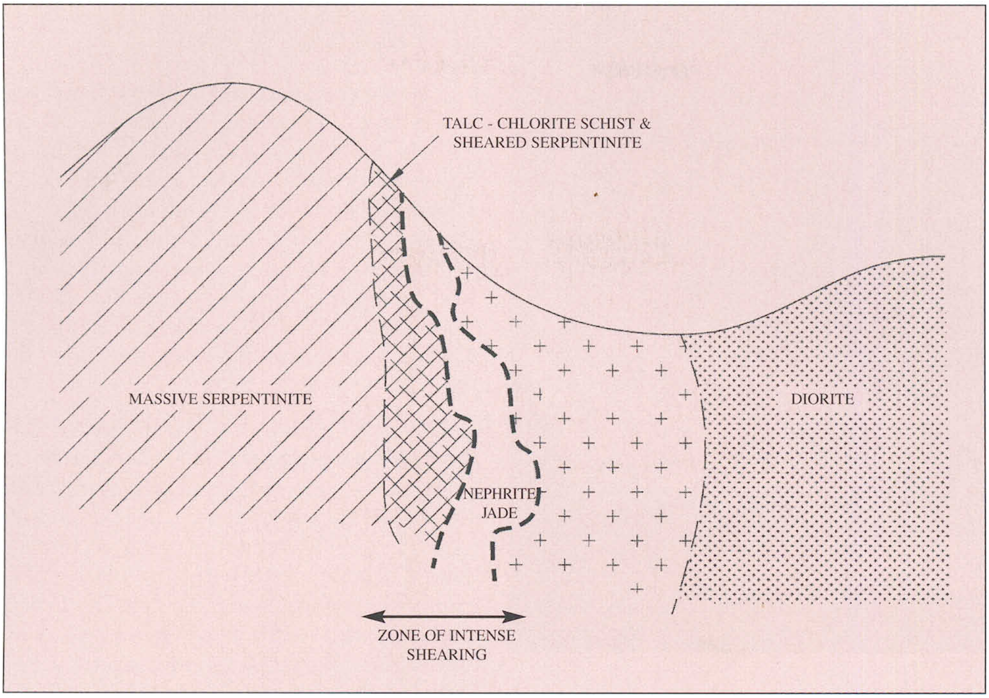


Figure 5: *Cross section illustrating rock relations at the Jordanów Slaski quarry (not to scale).*

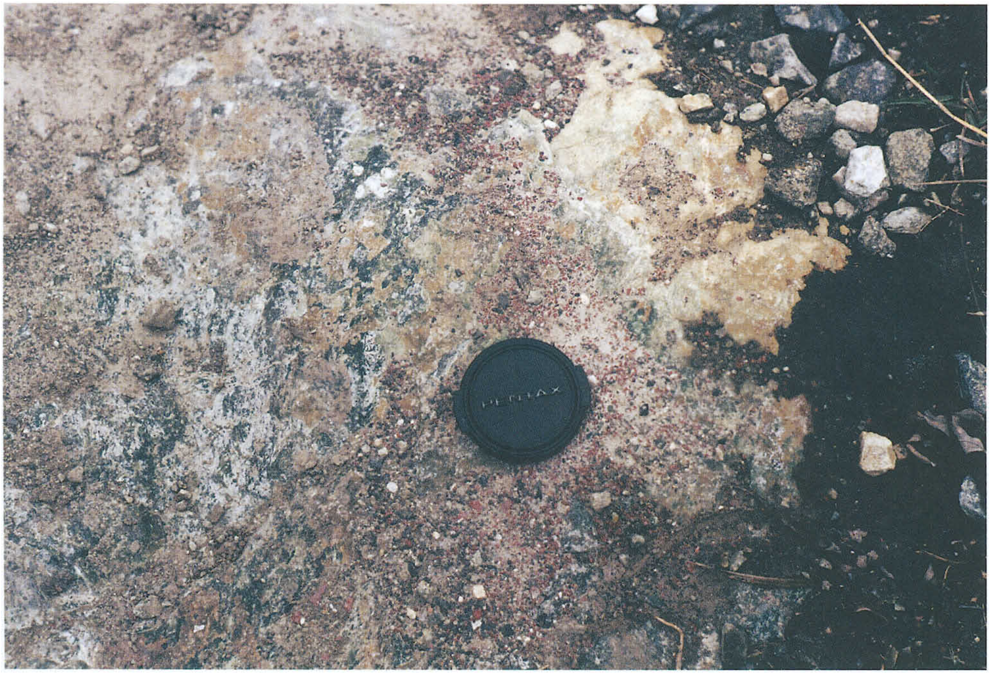


Figure 6: *Outcrop of nephrite jade exposed on the quarry floor at Jordanów Slaski. Photo by Douglas Nichol.*

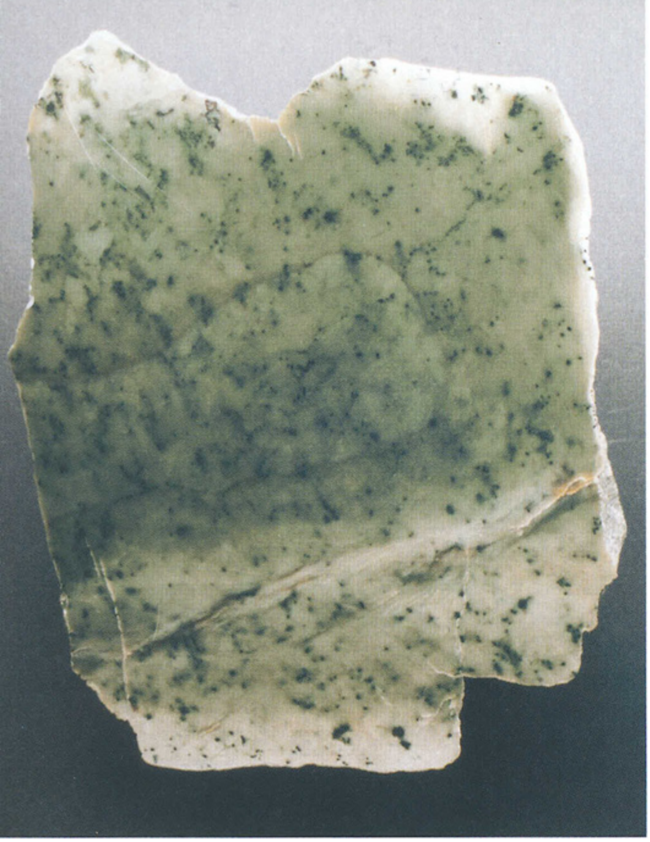


Figure 7: A typical specimen of nephrite jade from Jordanów Slaski. Size approximately 200 mm high. It appears on public display at the Muzeum Mineralogicznego, Uniwersytetu Wroclawskiego, Wroclaw. (Photo by Antoni Stryjewski).

rock formations (*Figure 6*). Size ranges up to 5 m long by 0.4 m wide though most bodies are much smaller. The larger pods give rise to rounded nodules or boulders with a distinctive white surface weathering rind. Sinuous veinlets of nephrite jade ranging from 2 to 150 mm wide seem to penetrate the adjoining serpentinite mass. However, practically all of the usable nephrite jade is obtained from dense elongate patches within the larger pods.

Using the Munsell notation (Rock-Colour Chart Committee, 1980), the nephrite jade ranges from light greenish-grey (5G 8/1) and moderate yellowish-green (10GY 6/4) through greyish-green (10GY 5/2 and 10G 4/2) and dark yellowish-green (10GY 4/4) to dusky green (5G 3/2), dusky yellowish-green (10GY 4/2) and greenish-black (5GY 2/1) but is predominantly dark yellowish-green (10GY 4/4).

Textures range from fine-grained, microfibrous and interfelted to coarse-grained. Certain specimens are veined, mottled or banded, or contain specks, streaks and flecks of minor mineral constituents (*Figure 7*). Accessory minerals include diopside, tremolite, epidote, chlorite, zoisite, pyrite, hematite and magnetite. Typically, specific gravity approaches 2.95 and hardness is about 6.5. Previous chemical analyses are listed in *Table I*.

The talc-chlorite schist and foliated serpentinite are extremely friable and similar in appearance with dark green colour and well-developed foliation. They occur in discontinuous lenses. The rodingite is a distinctive hard leucocratic rock with a highly variable composition and is generally believed to be a metasomatic or metamorphic product developed during serpentinization of the parental ultramafic rock. According to Sachs (1902) and Kolesnik (1970), the rodingite at Jordanów Slaski formed by metasomatic alteration of gabbro and its common mineral constituents include albite, hornblende, garnet, epidote, zoisite, quartz, prehnite and biotite.

A programme of exploration drilling at the quarry has indicated continuity of nephrite jade mineralization beneath the quarry floor (Kozlowski, 1990). However, understanding of the extent of recoverable reserves of nephrite jade at the site remains poor.

Nephrite formation

The nephrite jade lodes at Jordanów Slaski appear intimately associated with serpentinized ultrabasic igneous rocks. Based on the field relationship between the nephrite bodies and the serpentinite and the association of rodingites within the alteration zone, the deposits are classed as ortho-nephrite in type (Nichol, 2000). The nephrite jade appears to have formed as a reaction product by late stage dynamothermal meta-

Sample No. Analysis (Wt.%)	1	2	3	4	5	6	7	8
SiO_2	57.26	56.93	53.21	57.58	56.39	52.58	56.74	54.44
TiO_2	-	-	-	0.10	-	0.12	-	-
Al_2O_3	1.40	1.01	1.16	1.35	1.63	6.74	0.93	5.92
Fe_2O_3	4.22	4.99	2.40	4.17	5.42	4.48	4.39	6.28
Cr_2O_3	-	-	-	-	-	-	0.13	-
MnO	0.74	0.71	0.80	0.15	0.26	-	0.06	0.22
NiO					0.13	-	0.09	-
MgO	19.96	19.21	20.81	20.65	24.63	21.02	21.75	16.79
CaO	13.19	14.54	14.08	13.10	7.92	9.84	13.09	7.51
Na_2O	-	-	-	0.12	-	0.54	0.22	4.64
K_2O	-	-	-	-	-	0.28	-	0.28
Loss on ignition	2.53	1.93	1.81	2.61	4.07	3.47	2.42	4.12
Total	99.30	99.32	94.27	99.83	100.45	99.07	99.82	100.20

Sample Nos 1, 2 and 3 after Traube (1885)
Sample No. 4 after Heflik (1968)
Sample Nos 5, 6, 7 and 8 after Anonymous (1906)

Figure 8: *Bowl fashioned from nephrite jade. It appears on public display at the Muzeum Mineralogicznego, Uniwersystetu Wroclawskiego, Wroclaw. Photo by Douglas Nichol.*

morphism related to the movement of serpentinites against country rocks with higher silica contents. The following chemical reaction applies:-

$$5Mg_3[Si_2O_5](OH)_4 + 14SiO_2 + 6\ CaO = 3Ca_2Mg_5Si_8O_{22}(OH)_2 + 7H_2O$$

serpentine silica tremolite

Tectonic modification of tremolite by dynamic metamorphism recrystallized coarse-grained tremolite to the fine-grained, interfelted microstructure of nephrite. This tectonic modification is essentially mechanical and involves a sudden release in confining pressures within tremolite bodies that are saturated with water under high partial pressure. According to Dorling and Zussman (1985), the finest grain sizes are attained at the lowest possible recrystallization temperature for the shortest possible time for full crystallization. As such, the process of recrystallization was probably rapid.

Mining and processing

Extraction of nephrite jade from the quarry at Jordanów Slaski was essentially carried out in conjunction with serpentinite mining. Once the individual nephrite jade bodies were exposed they were selectively mined using hand-held tools to prize the crude blocks from the working face and to knap them into various manageable sizes.

The nephrite jade from Jordanów Slaski varies from high quality, monomineralic material suitable for gem cutting to low quality stone with inclusions suitable for ornamental work and hard-stone carving. The proportion of high quality material appears generally less then 10 per cent.

Historically, most of the crude nephrite jade blocks mined at Jordanów Slaski were exported to Idar-Oberstein, the German centre for trading hardstone and precious stones. Here, the nephrite jade was fashioned mainly as ornamental bowls, rings, beads, bracelets and carvings (*Figure 8*). As far as can be determined, finished products were mainly sold under controlled conditions and generally restricted to the German marketplace (Petar, 1936).

At the present time, the factory within the village at Jordanów Slaski that cuts and polishes stone, deals almost exclusively with serpentinite. Only roughly hewn specimens of nephrite jade are extracted to supply the local souvenir trade. Establishment of a modern lapidary factory to process the local nephrite jade is under active consideration and would complement the recent developments in tourism.

Collections

The most important suite of specimens of nephrite jade from Jordanów Slaski is housed in the American Museum of Natural History (AMNH), New York, USA. The suite comprises part of the Heber R. Bishop collection of jade and each item is described in the elaborate catalogue of the collection (Anonymous, 1906). Undoubtedly, the most famous piece is a remarkable block extracted from the quarry at Jordanów Slaski in 1899 and polished on one side by Tiffany & Co. (Sofianides and Harlow, 1990, p. 138). It originally weighed some 2.14 t and is claimed to be the largest single specimen of nephrite jade ever recorded from Europe (Kunz, 1903; 1904; 1907). The block appears on permanent exhibition in the Guggenheim Hall of Minerals at AMNH (*Figure 9*).

Items fashioned from Jordanów Slaski nephrite jade are also found in numerous museum collections throughout the world. Interestingly, nephrite jade was used extensively by Fabergé for hardstone pieces and although many of its chief works incorporate material of certain Russian origin, nephrite jades of other provenances such as Jordanów Slaski were employed for small hardstone carvings of animal

Figure 9: The largest boulder of nephrite jade ever recorded from Europe weighs 2.14 tonnes and was collected in 1899 at the Jordanów Slaski quarry. It was donated to the Metropolitan Museum of Art, New York, and now appears on public display at the American Museum of Natural History, New York. Photo Neg No 5232, Courtesy American Museum of Natural History Library.

figures and ornamental bowls that were produced at Idar-Oberstein (*e.g.* Habsburg-Lothringen and Solodkoff, 1979).

Conclusions

At Jordanów Slaski in Poland, nephrite jade has formed within the contact alteration zone between serpentinite and diorite. As well as nephrite jade, the alteration zone also contains talc-chlorite schist, sheared serpentinite and leucocratic rodingite.

The material is categorized as an ortho-nephrite jade (Nichol, 2000) and occurs in tabular to lensoid orebodies. Colour is predominantly dark yellowish-green (10GY 4/4) and texture ranges from fine- to medium-grained.

Mainly in Idar-Oberstein, an extensive range of ornaments, hardstone carvings and jewellery items has been produced from Jordanów Slaski nephrite jade using conventional lapidary equipment. In addition, museums throughout the world contain representative collections of both the raw nephrite jade and intricately carved specimens of the material from Poland. A programme of further exploration may yield new discoveries of nephrite jade in the Jordanów Slaski district.

Acknowledgments

I thank Antoni Stryjewski, Muzeum Mineralogiczne, Uniwersytetu Wroclawskiego, Wroclaw for helpful guidance during my visit to Poland.

References

Anonymous, 1906. *The Bishop Collection - Investigations and studies in Jade* (2 volumes). The De Vinne Press, New York

Beutell, N., and Heinze, R., 1914. Nephrit von Reichenstein in Schlesien, ein Ubergangsprodukt von Salit zum Serpentin. *Zentralblatt für Mineralogie, Geologie und Palaeontologie*, 553-60

Dorling, M., and Zussman, J., 1985. An investigation of nephrite jade by electron microscopy. *Mineralogical Magazine*, **49**, 31-6

Gawel, A., 1957. Nefryt z Jordanowa na Dolnym Slasku. *Przeglad Geologiczny*, **5**(7), 299-303

Habsburg-Lothringen, G. von, and Solodkoff, A. von, 1979. *Fabergé; Court Jeweler to the Tsars*. Tabard Press, New York

Heflik, W., 1968. [Mineralogy and genesis of nephrite from Jordanow, Lower Silesia.] *Zapiski Vsesoyuznogu Mineralogicheskogo Obshchestva*, **97**, 96-9

Klingner, F-E., 1943. Der Nephrit von Jordansmuhl, - ein schlesischer Schmuckstein. *Natur und Volk*, BD 73, Heft 7/8, (Frankfurt), 172-9

Kolesnik, Yu. N., 1970. Nephrites of Siberia. *International Geology Review*, Book Section, **12**, 107 pp

Kozlowski, S., 1990. Precious, ornamental and decorative stones. *In:* R. Osika (Ed.), *Geology of Poland, Volume VI, Mineral Deposits*. Publishing House, Wyndawnictwa, Geologiczne, Warsaw, 298-305

Kunz, G.F., 1903. *Heber Reginald Bishop and his jade collection*. The New Era Publishing Company, Lancaster, Pa

Kunz, G.F., 1904. Precious stones. *In:* D.T. Day, *Mineral Resources of the United States. Calendar year 1903*. Department of the Interior, United States Geological Survey. Government Printing Office, Washington, 928-35

Kunz, G.F., 1907. The printed catalogue of the Heber R. Bishop collection of jade. *Tenth International Geological Congress (Mexico, 1906), Compte Rendu*, 253-70

Nichol, D., 2000. Two contrasting nephrite jade types. *Journal of Gemmology*, **27**, 193-200

Osika, R., 1986. Poland. *In:* F.W. Dunning and A.M. Evans (Eds). *Mineral deposits of Europe. Volume 3: Central Europe*. The Institution of Mining and Metallurgy and the Mineralogical Society, London, 55-97

Petar, A.V., 1936. *Jade*. U.S Bureau of Mines Information Circular, **6844** (January 1936)

Prokhor, S.A., 1991. The genesis of nephrite and emplacement of the nephrite-bearing ultramafic complexes of East Sayan. *International Geology Review*, **33**, 290-300

Rock-Colour Chart Committee, 1980. *Rock-Colour Chart*. Geological Society of America, New York

Ruff, E., 1963. The Jade Story; Part 21; Jade of Europe (2). *Lapidary Journal*, June 1963, 354-65

Sachs, A. Von, 1902. Der Weiss-stein des Jordansmuhler Nephritvorkommen. *Zentralblatt für Mineralogie, Geologie und Palaeontologie*, 385-96

Skelton, R., 1991. Mannerist jade-carving during the 16th and 17th centuries. *In:* R. Keverne (Ed.). *Jade*. Anness Publishing Limited, London, 262-63

Sofianides, A.S., and Harlow, G.E., 1990. *Gems and crystals from the American Museum of Natural History*. Simon & Schuster Books, New York, 208 pp

Traube, H., 1885. Uber den Nephrit von Jordansmuhl in Schlesien. *Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie*, (II Band), 91-4

Traube, H., 1887. Ueber einen neuen Fund von anstehendem Nephrit bei Reichenstein in Schlesien. *Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie* (II Band), 275-78

Visser, J.M., 1946. Nephrite and chrysoprase of Silezia. *The Mineralogist*, **14**(9), 460-4

Synthetic moissanite from Russia

Dr Lore Kiefert[1], Dr Karl Schmetzer[2] and Professor Henry A. Hänni[1]

1. *SSEF Swiss Gemmological Institute, Falknerstrasse 9, CH-4001 Basel, Switzerland*
2. *Taubenweg 16, D-85238 Petershausen, Germany*

ABSTRACT: Five faceted yellow, green, bluish-green and bluish-brown synthetic moissanites of Russian production are described. Polytypism is characterized by Raman spectroscopy. Gemmological properties as well as chemical and spectroscopic properties in the UV-visible range are given. The samples were found to be of 6H- as well as 4H-SiC single crystals, and the variable coloration is caused by various amounts of nitrogen in the lattice of the synthetic moissanites. The criteria already described for the distinction of colourless American synthetic moissanites from diamonds in general also apply for a microscope characterization of Russian samples, especially to distinguish them from coloured diamonds.

Keywords: colour origin, diamond imitation, polytype, Russia, spectroscopy, synthetic moissanite

Introduction

Silicon carbide – moissanite – has been used since the last decades of the 19th century for technical purposes (Knippenberg, 1963). The growth of large crystals of synthetic moissanite by a sublimation technique from the vapour phase was first described by Lely (1955), but the crystals grown by this so-called Lely technique consist of a mixture of simultaneously grown hexagonal (H), rhombohedral (R) and cubic (C) polytypes (Knippenberg, 1963; Kawamura, 1965; Verma and Krishna, 1966). This disadvantage for the technical usage of the crystals is overcome by the use of oriented seeds of selected polytype (Tairov and Tsvetkov, 1978; 1981). By seeded growth of silicon carbide by sublimation from the vapour phase, it is possible to grow large single crystals consisting of only one silicon carbide polytype, e.g. 6H-SiC, 4H-SiC. This method is described in the literature as the modified Lely technique (see, e.g., Yoo *et al.*, 1991; Tairov, 1996; Tsvetkov *et al.*, 1996; Maltsev *et al.*, 1996; Ohsato *et al.*, 1999; Müller *et al.*, 2000; Yakimova *et al.*, 2000).

The modified Lely technique is also applied for the production of colourless synthetic moissanite crystals used as diamond substitutes (Davis *et al.*, 1989, 1995; Nassau *et al.*, 1997; Nassau, 1999). The colourless synthetic moissanites grown in the United States for jewellery purposes by Cree Inc., Durham, North Carolina and distributed by Charles & Colvard (formally C3 Inc.), Morrisville, North Carolina, consist of single crystals of one of the known hexagonal silicon carbide polytypes, namely 6H-SiC (Nassau *et al.*, 1997; Nassau, 1999), but the growth of other polytypes and/or differently coloured moissanites for gem purposes is also possible (Hunter and Verbiest, 1998a; 1998b; Schmetzer, 2000). By the addition of pairs of charge-compensating trace elements such as

 ISSN: 1355–4565

nitrogen and aluminium, completely colourless crystals can be produced (Carter *et al.*, 1998). Most recently, diamond-coated moissanite was described (Nassau *et al.*, 1999; Hammer and Schmetzer, 2000) and aluminium nitride is also mentioned as a possible new diamond substitute (Hunter, 2000).

Due to its gemmological properties, synthetic moissanite, 6H-SiC, is an ideal diamond imitation, with refractive indices of 2.648 and 2.691 and a hardness of 9 $^{1}/_{4}$ on the Mohs scale (Nassau *et al.*, 1997). Although strongly anisotropic, the thermal conductivities of synthetic moissanites are so close to those of diamonds that the commonly applied thermal probes react to synthetic moissanites as if they were diamonds (Chalain and Krzemnicki, 1999).

Since the introduction of moissanite as a diamond substitute in 1997, the material has been distributed widely and has appeared worldwide in gemmological laboratories as a diamond imitation, in some instances, even set in antique jewellery!

Synthetic moissanites for gem purposes are also produced in small quantities in St.Petersburg, Russia (Balitsky, 2000a; 2000b), and already the first samples of this material have been seen in the gem trade (Longère, 2000; McClure and Moses, 2000). Recently, faceted synthetic moissanites of Russian production weighing more than 100 ct have been submitted to gemmological laboratories as natural diamonds (Lasnier, 2001). By courtesy of Mrs B. Schaeffer, a gemmologist from Detmold, Germany, the authors were able to study five samples of the Russian production. Gemmological, microscopic, chemical and spectroscopic properties of these five faceted gemstones are presented in this paper.

Materials and methods

The research material consisted of five brilliant-cut synthetic moissanites, which range in colour from yellow, green (two), bluish-green to bluish-brown (*Table I, Figure 1*). The stones weigh between 0.381 and 0.601 ct. According to the supplier all samples were grown in St. Petersburg using, at least basically, the method described by Tairov and Tsvetkov (1978, 1981).

Table I: *Gemmological properties of Russian synthetic moissanite.*

Sample No.	*Weight (ct)*	*Polytype*	*Colour*	*SG*	*Relative reflectivity**	*Orientation of tube inclusionswith respect to the table facet*	*Pleochroism***
1	0.442	6H	yellow	3.250	118	about 45°	extremely weak
2	0.562	6H	green	3.211	122	parallel	weak: yellowish green/green
3	0.601	6H	green	3.231	121	parallel	weak: yellowish green/green
4	0.381	6H	bluish-green	3.201	120	no tubes observed	moderate: yellowish green/blue-green
5	0.542	4H	bluish-brown	3.207	120	about 5°	distinct: greenish blue/brown

* based on 100 for diamond
** as seen with a dichroscope

For the determination of moissanite polytypes Raman spectra were recorded in the 100-1800 cm-1 range using a Renishaw Raman System 1000 spectrometer equipped with a CCD Peltier detector and an argon ion laser (514.5 nm) with a power of 25 mW.

***Figure 1**: Faceted synthetic moissanites grown in St. Petersburg, Russia, by sublimation from the vapour phase. The samples range from 0.38 to 0.60 ct in weight and measure from 4.60 to 5.70 mm in diameter. Photo: © L.Kiefert, SSEF.*

We measured the relative reflectivity of the samples with a Presidio Duotester, where the value 100 was calibrated as the reflectivity of diamond. Specific gravity was determined hydrostatically. Internal features of all samples were examined using a standard gemmological microscope in conjunction with brightfield, darkfield, and oblique fibre-optic illumination. Photomicrographs were taken with a Wild M8/MPS55 stereozoom microscope. Different types of inclusions were examined by micro Raman spectroscopy using the facility at the SSEF Swiss Gemmological Institute.

Qualitative chemical analyses were performed by energy dispersive X-ray fluorescence (EDXRF) using a Tracor Spectrace 5000 instrument. For the examination of colour and colour causes we recorded UV-visible range spectra of all samples using a Varian Cary 500 spectrophotometer in the 300-800 nm range.

Determination of moissanite polytypes with Raman spectroscopy

Various techniques, e.g. X-ray crystallography, can be applied for the determination of silicon carbide polytypes. The examination of the Raman spectrum is one of the non-destructive methods which can be performed on cut gemstones without special preparation of the samples. Using a micro Raman spectroscopy facility, which is now available for routine investigations in some of the major gemmological laboratories, it is also possible to examine the samples with respect to homogeneity in different areas.

We performed Raman spectra on different facets and at different points on the larger tables of all samples including different orientations of the faceted gemstones to the incident beam. Although the spectra obtained, especially the intensities of the main peaks in the 760 to 800 and the 960 to 970 cm-1 area, were found to be strongly variable and related to the orientation of the samples (*Figures 2 and 3*), we could not determine any inhomogeneity within the five samples. In other words, the samples were found to be single crystals without any admixtures of different polytypes.

In all samples, the strongest Raman peaks above 700 cm-1 were found at similar wave numbers. The spectra of four samples consisted of strong lines at 767, 786 and 965 cm-1, sometimes with an additional line at 795 cm-1 (not shown in *Figure 2*). Weak lines above 1000 cm-1 were also present. The spectra of the bluish-brown moissanite consisted of three strong lines at 778, 794 and 969 cm-1, again with two weak lines above 1000 cm-1 (*Figure 3*). The Raman lines with weaker intensities below 700 cm-1, again were found to be different for the sample with bluish-brown colour (*Figure 4*). The main Raman lines for the first four samples in this range were determined at about 147, 238, and 504 cm-1, with one weaker line observed sometimes at 263 cm-1. The remaining sample, on the other hand, revealed lines with maxima at about 201, 263, and 609 cm-1, with an additional peak of weak intensity at 636 cm-1.

These data are consistent with numerous references describing Raman data of specific silicon carbide polytypes (e.g. Feldman *et al.*, 1968a; 1968b; Colwell and Klein, 1972; Harima *et al.*, 1995; Harima and Nakashima, 1996; Nakashima and Harima, 1997; Burton *et al.*, 1998; 1999) and indicate that four of our five samples belong to the 6H-SiC polytype, whereas the remaining faceted moissanite

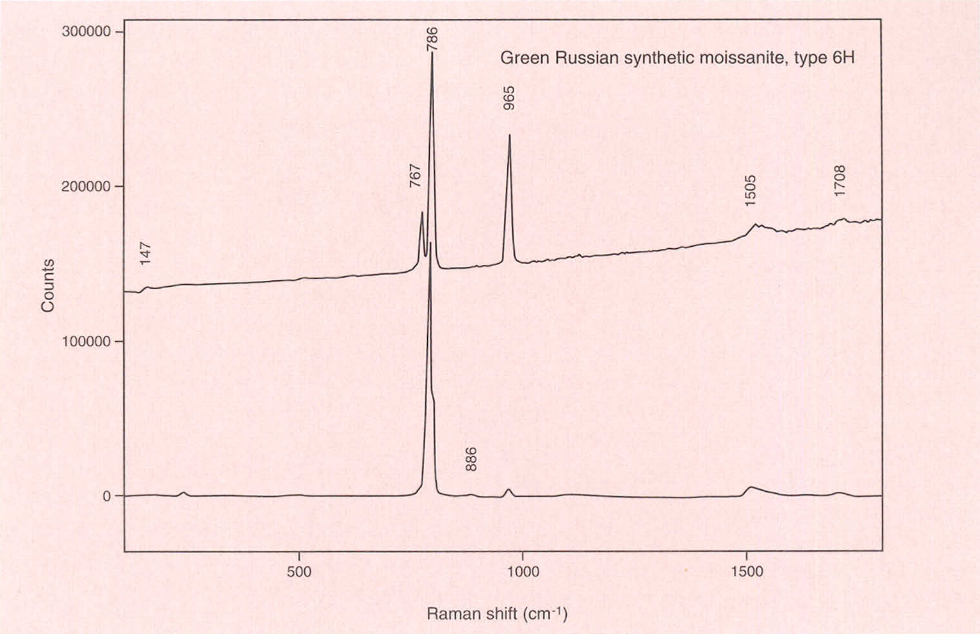


***Figure 2**: Raman spectra of synthetic moissanite (6H-SiC) in different orientations of the crystal with respect to the incident beam reveal a strong intensity variation of Raman lines.*

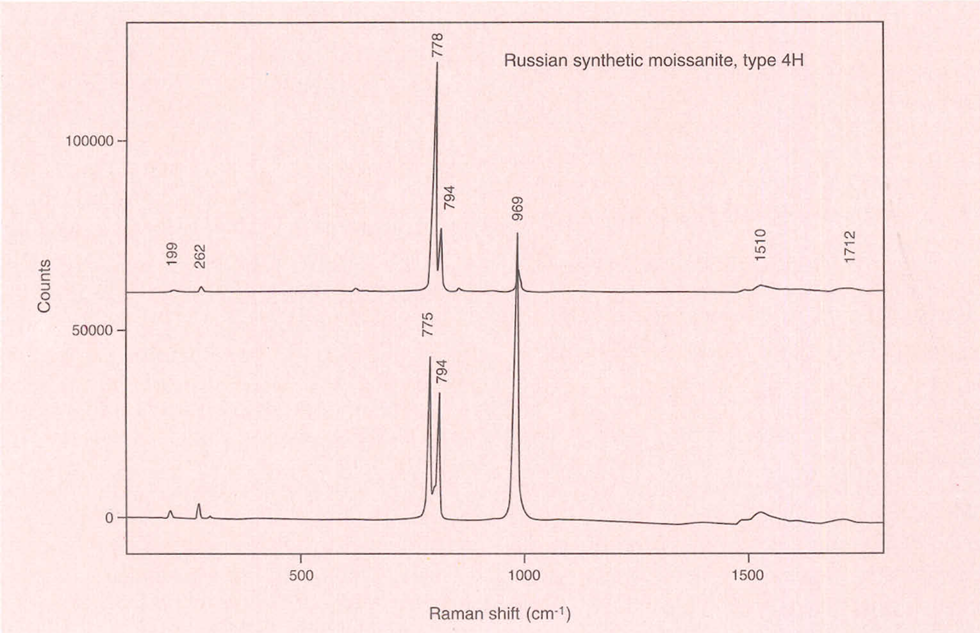


***Figure 3**: Raman spectra of synthetic moissanite (4H-SiC) in different orientations of the crystal with respect to the incident beam reveal a strong intensity variation of Raman lines.*

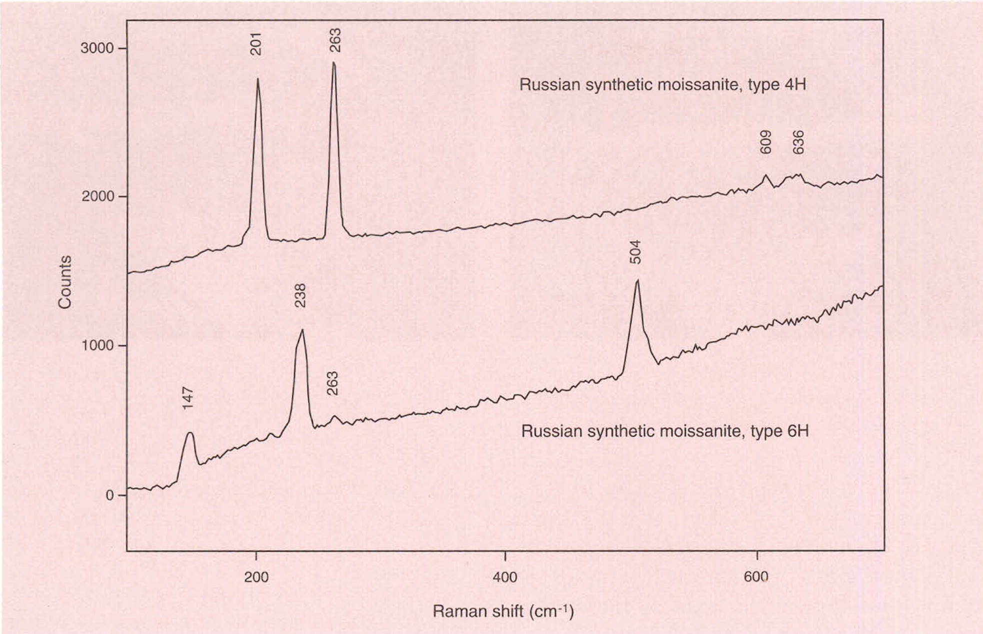


***Figure 4**: Raman spectra of different synthetic moissanite polytypes; the lines below 700 cm⁻¹ are useful for a distinction of 6H-SiC and 4H-SiC silicon carbide polytypes.*

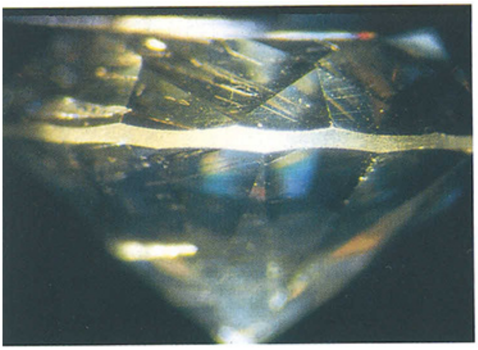
was found to be 4H-SiC (*Table I*). The colourless material produced in the USA for jewellery purposes and released to the trade has been described so far as the 6H polytype of moissanite (Nassau *et al.*, 1997; Nassau, 1999).

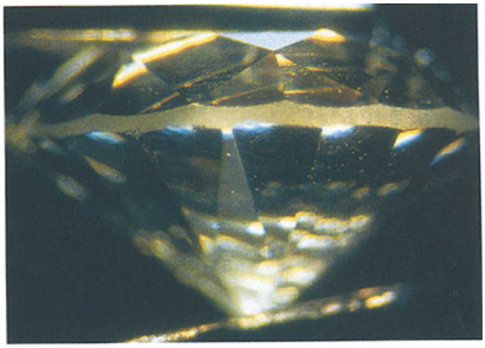
Gemmological properties

The gemmological properties of the five examined samples are listed in *Table I*. Refractive indices of synthetic moissanite were not determined. They are given as 2.648 to 2.691 in the literature (Nassau *et al.*, 1997) and are therefore higher than the range of commercially available refractometers. The relative reflectivity with an average value of 120 is distinctively higher than that of a diamond. The specific gravity of the samples ranges from 3.20 to 3.25, which is consistent with the samples grown in the USA as described by Nassau *et al.* (1997).

With the naked eye, only one of the samples which was determined as 4H-SiC revealed different colours (blue and brown) in various directions of view. Using a dichroscope, the different colours observed were greenish-blue and brown (*Figures 5 and 6*). In the other four stones no variation of colour was observed in different orientations of the sample with the naked eye. By use of a dichroscope, a variable pleochroism from extremely weak (yellow sample) to weak (green stones) or moderate (bluish-green moissanite) could be observed (*Table I*). None of the synthetic moissanites had its *c*-axis orientated perpendicular to the table facet, i.e. no optically uniaxial interference figure was observable in a view perpendicular to the table facet. The five Russian samples were inert under short-wave and long-wave ultraviolet light.

The material grown by Cree Inc. in the USA currently on the market is cut in a direction with the table facet more or less perpendicular to the *c*-axis. This material has a colour range from near colourless, through





***Figures 5 and 6**: Pleochroism of bluish-brown synthetic moissanite which was determined as 4H-SiC by Raman spectroscopy. Figure 5 blue direction, Figure 6 brown direction. Sample is 5.40 mm in diameter. Photos: © H.A Hänni, SSEF.*

slightly yellow or greyish-yellow to light brownish-yellow, grey and slightly green (Nassau *et al.*, 1997), although the commercial production of Cree Inc. focused on colourless and nearly colourless material in the first years. Near-colourless and grey samples were not encountered in the material of the present Russian production available to the authors. Pale green, bluish-green and grey colours have recently been encountered in faceted stones from the commercial American production submitted to the market (Sluis, 2001).

Microscopic characteristics

The Russian stones show the typical doubling of facet edges (*Figure 7*) as described

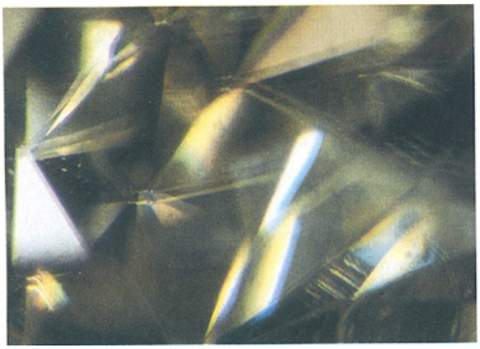


***Figure 7**: Doubling of facet junctions in Russian synthetic moissanites. This is one of the most concise diagnostic features which is easily determined using a hand-lens or the microscope. Magnified 40 x. Photo: © H.A Hänni, SSEF.*

elsewhere for moissanites grown in the USA (Nassau *et al.*, 1997; Chalain and Krzemnicki, 1999; Chalain, 2000; Shigley *et al.*, 2000).

The presence of elongated tubes, so-called micropipes, is a typical property of sublimation-grown 6H-SiC and 4H-SiC synthetic moissanites using a modified Lely technique (Takanaka *et al.*, 1996; Ohsato *et al.*, 1999; Müller *et al.*, 2000). One stone of our five synthetic moissanites is virtually inclusion-free (sample 4). Four of the five analysed stones contain elongated thin tubes or irregular cavities (*Figures 8 and 9*). In comparison to the Cree stones encountered in the SSEF Swiss Gemmological Institute as diamond imitations and described in the literature, most tubes appear thicker and are orientated parallel or slightly inclined to the table facet (samples 2, 3 and 5) as well as inclined at an angle of 45° to the table (sample 1). The Cree stones generally have thinner tubes that are orientated more or less perpendicular to the table, i.e. parallel to the *c*-axis. This orientation of tubes in American stones is responsible for an image which gives the impression that they are radiating around the centre of the stone (Chalain, 2000). This difference in appearance in stones from the two producers is caused by the different orientation of the optic axis within the faceted stones.

Small crystals or bubbles are common in four of the five stones (*Figures 8 and 9*). One stone (sample 2) shows growth lines that are orientated perpendicular to the tubes

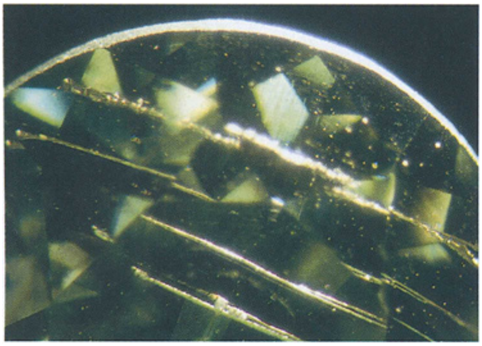


Figure 8: Elongate tubes or irregular cavities in Russian synthetic moissanites; irregular bubbles and/or small crystals are also present; growth planes perpendicular to the tubes are also seen. Magnified 40 x. Photo: © H.A. Hänni, SSEF.

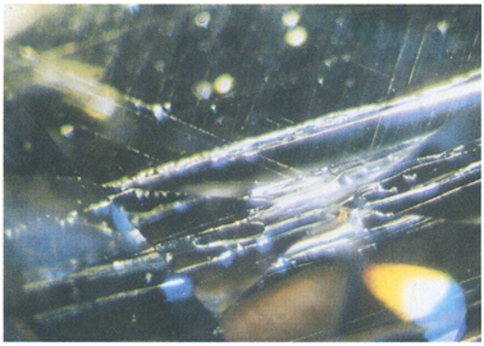


Figure 9: Elongate tubes or irregular cavities in Russian synthetic moissanites; irregular bubbles and/or small crystals are also present. Magnified 40 x. Photo: © H.A.Hänni, SSEF.

(*Figure 8*), and one of the synthetic moissanites (sample 1) contains a highly reflective hexagonal crystal or negative crystal with a hollow tube extending from it (*Figure 10*). Similar defects were described by Takanaka *et al.* (1996) in synthetic 6H-SiC.

Analysis of elongated tubes, small crystals or bubbles, as well as the hexagonal crystal mentioned above, with micro Raman spectroscopy revealed only the common spectra of the host moissanite polytypes. Consequently, all encountered inclusions are likely to be either cavities or inclusions of moissanite crystals, possible in an orientation different from that of the host. However, it is also possible that these inclusions are phases that give only weak or no Raman signals. Although thick tubes, hexagonal crystals, or growth structures are not commonly observed in the synthetic moissanites from Cree, all these features were observed by Groenenboom (2000) in samples grown in the USA. They are, therefore, neither exclusively found in, nor characteristic of synthetic moissanite of Russian production.

Chemical properties

According to Lely & Kröger (1958), hexagonal silicon carbide crystals owe their colour to impurities of N or P (green), or A1 or B (blue). Nitrogen and aluminium are the commonly used dopants for the growth of silicon carbide gem materials in different colours (Hunter and Verbiest, 1998a; 1998b).

The X-ray fluorescence spectrometer used can detect elements with atomic numbers above 11 (Na). Semi-quantitative chemical analysis of the five stones under investigation revealed, besides Si, no other element. Hence, no P or Al was detectable in our samples. This implies that these elements, if present, can only exist in traces below the detection limit of the instrument. The presence of B and especially N, on the other hand, cannot be discerned with the X-ray fluorescence facility applied.

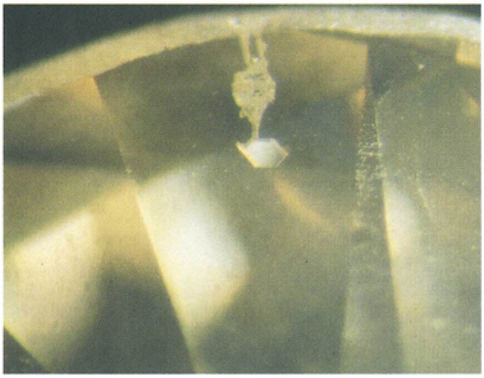


Figure 10: Tiny moissanite crystal or negative crystal with an elongate tube extending from this inclusion in yellow synthetic moissanite from Russia. Magnified 30 x. Photo: © H.A. Hänni, SSEF.

Spectroscopic properties in the visible and UV range

As a consequence of intense internal reflections due to the high refractive indices of moissanites, and of oblique orientations of the optic axis of the faceted samples, we were unable to orient the Russian moissanites properly to the incident beam of the spectrophotometer to obtain conventional polarized spectra parallel and perpendicular to the *c*-axis.

Absorption spectroscopy for yellow and green synthetic moissanites from Russia (samples 1, 2 and 3) revealed a slightly increasing absorption starting at about 600 nm towards the violet range and an absorption edge at about 410 nm (*Figure 11*). The two green samples showed an additional weak absorption band with a maximum at about 635 nm. In the bluish-green sample, both the absorption in the blue to violet range and the absorption band at 635 nm are distinctly increased in intensity, and a weak shoulder at 435 nm is also present (see again *Figure 11*).

Comparing these spectroscopic properties with published data of 6H-SiC (Lely and Kröger, 1958; Violina *et al.*, 1964; Biedermann, 1965; Ellis and Moss, 1965; Sugiyama *et al.*, 1996; Stiasny and Helbig, 1997; Lambrecht *et al*, 1998; Limpijumnong *et al.*, 1999), all absorption features are consistent with those of nitrogen-doped synthetic moissanite. Nitrogen is the most common trace element in synthetic moissanites, originating at least partly from atmospheric air. In order to achieve colourless synthetic moissanites, great efforts are undertaken to grow almost nitrogen-free samples or to reduce the influence of nitrogen by charge compensating trace elements such as aluminium.

Spectra similar to those of our Russian samples 1 to 4 have already been published by Lely and Kröger (1958) for synthetic moissanites grown under different nitrogen-bearing argon atmospheres. The spectrum of our yellow sample 1 is consistent with that of a sample grown at 0.01% N_2, the spectra of the green samples 2 and 3 are consistent with the published spectrum of a sample grown at 0.1% N_2, and the spectrum of the bluish-green sample 4 is similar to that of a synthetic moissanite grown at 10% N_2. Consequently the colour of yellow, green and bluish- green synthetic moissanites is probably due to various concentrations of nitrogen in these 6H-SiC crystals.

For the evaluation of the strong blue and brown pleochroism of sample 5, non-polarized spectra were recorded in those directions which showed these different colours (*Figure 12*). Both spectra revealed an absorption edge in the UV at about 370 nm. The spectrum in the blue-green direction revealed two strong absorption maxima at 566 nm (with a shoulder at 649 nm) and at 465 nm, and the spectrum taken in the brown direction consisted of two distinct absorption maxima at 553 nm and at 458 nm.

A shift of the absorption edge from the violet range in 6H-SiC to the ultraviolet in 4H-SiC is consistent with literature data (Choyke and Patrick, 1961; de Oliveira *et al.*, 1996). The spectra of the Russian sample 5 taken in different orientations are also consistent with reference data for nitrogen-doped synthetic 4H-SiC (Biedermann, 1965; Lambrecht *et al.*, 1998; Limpijumnong *et al.*, 1999). Comparing these literature references and the polarized absorption spectra pictured in these papers with our spectra it may be interpreted that the spectrum taken in the blue direction consists of superimposed polarized spectra with components parallel and perpendicular to *c*, and the spectrum taken in the brown direction represents a polarized spectrum perpendicular to *c*. Thus, the colour and pleochroism of blue to brown synthetic moissanite is probably caused by traces of nitrogen in 4H-SiC.

Conclusions

Hexagonal silicon carbide single crystals of 6H or 4H polytype have been grown in St. Petersburg, Russia, using the modified Lely

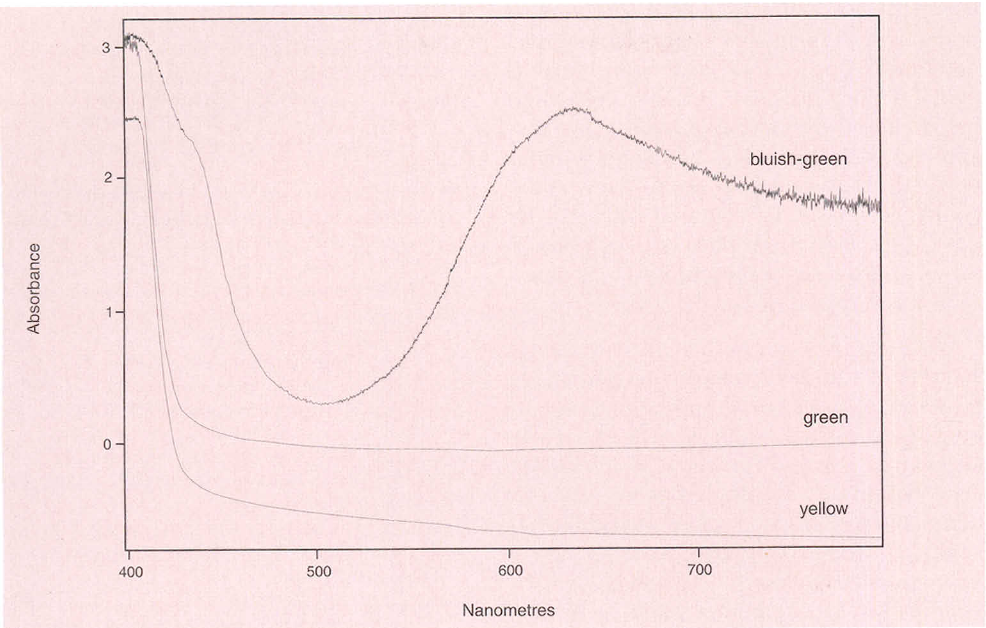


Figure 11: *Absorption spectra of yellow [bottom], green [middle] and bluish-green [top] synthetic moissanites (6H-SiC) doped with different amounts of nitrogen.*

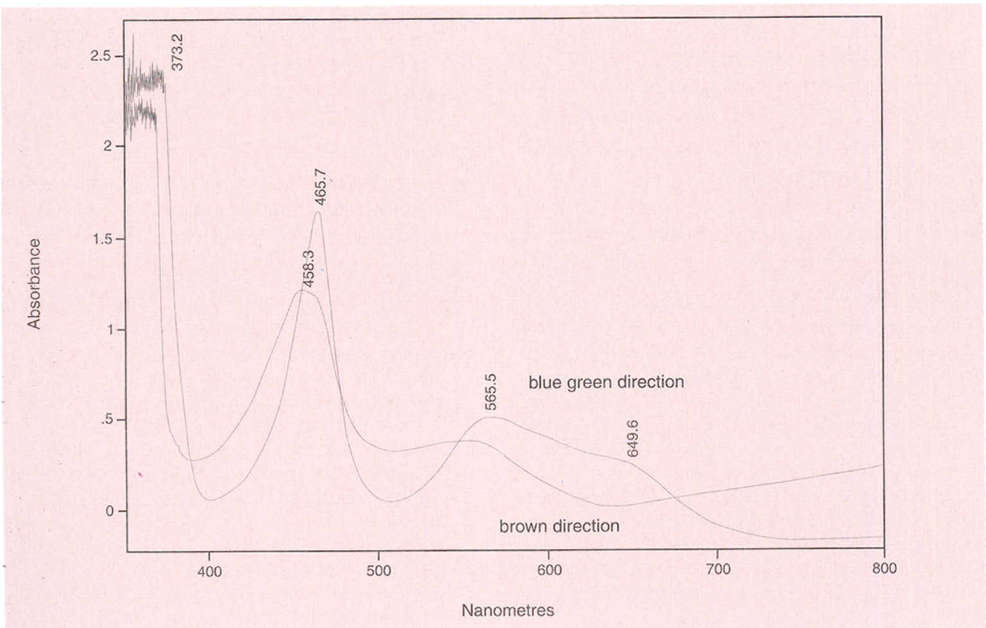


Figure 12: *Absorption spectra of bluish-brown synthetic moissanite (4H-SiC) doped with traces of nitrogen recorded in the directions of the blue-green coloration and the brown coloration.*

technique by sublimation from the vapour phase. Faceted gemstones with yellow, green and bluish-green colour were determined as synthetic 6H-SiC, the variable coloration being caused by various amounts of nitrogen. As with colourless or near-colourless synthetic moissanite, these Russian stones could be mistaken for coloured diamonds by the inexperienced jeweller. A bluish-brown sample with distinct pleochroism was determined as nitrogen-doped 4H-SiC.

The physical properties of moissanite samples of both polytypes are in the range of those of colourless or almost colourless 6H-SiC grown in the USA for jewellery purposes. Doubling of facet junctions is commonly observed in all samples. In most synthetic moissanites, elongated tubes or somewhat irregular cavities may also be observed by microscopic examination. However, the orientation of these characteristic inclusions tends to be sub-parallel to the table facet in contrast to a near perpendicular orientation in American synthetic moissanite material seen normally on the market.

Acknowledgement

The authors are grateful to Mrs B. Schaeffer of Detmold, Germany, who kindly submitted the five synthetic moissanites of Russian production described in this paper.

References

Balitsky, V.S., 2000a. Present Russian synthetic and enhanced gemstones. *Austral. Gemmol.*, **20**(11), 458-66.

Balitsky, V.S., 2000b. Pers. comm.

Biedermann, E., 1965. The optical absorption bands and their anisotropy in the various modifications of SiC. *Solid State Communications*, **3**, 343-6

Burton, J.C., Sun, L., Long, F.H., Feng, Z.C., and Ferguson, I.T., 1999. First- and second-order Raman scattering from semi-insulating 4H-SiC. *Physical Review B*, **59**(11), 7282-4

Burton, J.C., Sun, L., Pophristic, M., Lukacs, S.J., Long, F.H., Feng, Z.C., and Ferguson, I.T., 1998. Spatial characterization of doped SiC wafers by Raman spectroscopy. *J. Appl. Phys.*, **84**(11), 6268-73

Carter, C.H., Tsvetkov, V.F., and Glass, R.C., 1998. Growth of colorless silicon carbide crystals. US Patent 5, 718, 760, February 17, 1998

Chalain, J.P., 2000. Update on Moissanite Identification. *J. Gemmol. Ass. Hong Kong*, **21**, 12-15

Chalain, J-P., and Krzemnicki, M.S., 1999. Synthetischer Moissanit und Diamant: Sichere Unterscheidung mit Hilfe des Reflektometers. *Gemmologie. Z. Dt. Gemmol. Ges.*, **48**(2), 77-84

Choyke, W.J., and Patrick, L., 1961. Exciton and Interband Absorption in SiC. Proc. *Int. Conf. Semicond. Phys., Prague 1960*, Academic Press, New York (1961), pp. 432-4

Colwell, P.J., and Klein, M.V., 1972. Raman Scattering from Electronic Excitations in n-Type Silicon Carbide. *Physical Review B*, **6**(2) 498-515

Davis, R.F., Carter, C.H. Jr., and Hunter, C.E., 1989. Sublimation of silicon carbide to produce large, device quality single crystals of silicon carbide. US Patent Re. 4, 866, 005, September 12, 1989

Davis, R.F., Carter, C.H. Jr, and Hunter, C.E., 1995. Sublimation of silicon carbide to produce large, device quality single crystals of silicon carbide. US Patent Re. 34,861, February 14, 1995

Ellis, B., and Moss, T.S., 1965. Anisotropy of absorption due to free electrons in 6H silicon carbide. *Solid State Communications*, **3**, 109-11

Feldman, D.W., Parker, J.H. Jr., Choyke, W.J., and Patrick, L., 1968a. Raman Scattering in 6H SiC. *Physical Review*, **170**(3), 698-704

Feldman, D.W., Parker, J.H. Jr., Choyke, W.J., and Patrick, L., 1968b. Phonon Dispersion Curves by Raman Scattering in SiC, Polytypes 3C, 4H, 6H, 15R, and 21R. *Physical Review*, **173**(3), 787-93

Groenenboom, P., 2000. Pers. comm.

Hammer, V.M.F., and Schmetzer, K., 2000. Synthetischer Moissanit. Die Bestimmung bleibt eine Herausforderung. *Goldschmiede Zeitung*, **98**(12), 108-9

Harima, H., and Nakashima, S., 1996. Fano-interference effect of Raman scattering in doped SiC. *Inst. Phys. Conf. Ser.* **142,** Chapter 2, 365-8

Harima, H., Nakashima, S., and Uemura, T., 1995. Raman scattering from anisotropic LO-phonon-plasmon-coupled mode in n-type 4H- and 6H-SiC. *J. Appl. Phys.* **78**(3), 1996-2005

Hunter, C.E., 2000. Simulated diamond gemstones formed of aluminium nitride and aluminium nitride:silicon carbide alloys. US Patent 6,048, 813, April 11, 2000

Hunter, C.E., and Verbiest, D., 1998a. Silicon carbide gemstones. US Patent 5,723, 391, March 3, 1998

Hunter, C.E., and Verbiest, D., 1998b. Silicon carbide gemstones. US Patent 5,762,896, June 9, 1998

Kawamura, T., 1965. Silicon carbide crystals grown in nitrogen atmosphere. *Mineral. Journal*, **4**(5), 333-55

Knippenberg, W.F., 1963. Growth phenomena in silicon carbide. *Philips Research Reports*, **18**(3), 161-274

Lambrecht, W.R.L., Limpijumnong, S., Rahkeev, S.N., and Segall, B., 1998. Band Structure Interpretation of the Optical Transitions between Low-Lying Conduction Bands in n-Type Doped SiC Polytypes. *Materials Science Forum*, 264-8, 271-4

Lasnier, B., 2001. Pers. comm.

Lely, J.A., 1955. Darstellung von Einkristallen von Siliciumcarbid und Beherrschung von Art und Menge der eingebauten Verunreinigungen. *Ber. Dt. Keram. Ges.*, **32**(8) 229-50

Lely, J.A., and Kröger, F.A., 1958. Optical Properties of Pure and Doped SiC Semicond. Phosphors., *Proc. Intern. Colloq., Garmisch-Partenkirchen 1956*, publ. Interscience, New York (1958), pp. 514-24

Limpijumnong, S., Lambrecht, W.R.L., Rashkeev, S.N., and Segall, B., 1999. Optical-absorption bands in the 1-3 eV range in n-type SiC polytypes. *Physical Review B*, **59**(20), 12890-9

Longère, F., 2000. Synthetic Moissanite. *Can. Gemmol.*, **21**(1), 20-4

McClure, S.F., and Moses, T., 2000. Synthetic Moissanite: a black diamond substitute. *Gems & Gemology*, **36**(3), 256-7

Maltsev, A.A., Maksimov, A. Yu., and Yushin, N.K., 1996. 4H-SiC single crystal ingots grown on 6H-SiC and 15R-SiC seeds. *Inst. Phys. Conf. Ser.* **142**, Chapter 1, 41-44

Müller, St. G., Glass, R.C., Hobgood, H.M., Tsvetkov, V.F., Brady, M., Henshall, D., Jenny, J.R., Malta, D., and Carter, C.H. Jr., 2000. The status of SiC bulk growth from an industrial point of view. *Journal of Crystal Growth*, **211**, 325-32

Nakashima, S., and Harima, H., 1997. Raman Investigation of SiC Polytypes. *Physica Status Solidi* (a) **162**, 39-64

Nassau, K., 1999. Moissanite: a new synthetic gemstone material. *J. Gemm.*, **26**(7) 425-38

Nassau, K., Coleman, T.G., and Hunter, C.E., 1999. Gemstones formed of silicon carbide with diamond coating. US Patent 5,882,786, March 16, 1999

Nassau, K., McClure, S.F., Elen, S., and Shigley, J.E., 1997. Synthetic moissanite: a new diamond substitute. *Gems & Gemology*, **33**(4), 260-75

Ohsato, H., Kato, T., Okuda, T., and Razeghi, M., 1999. Internal stress around micropipes in 6H-SiC substrates. *Proc. SPIE-Int. Soc. Opt. Eng.* **3629**, 393-9

de Oliveira, A.C., Freitas, J.A. Jr., and Moore, W.J., 1996. Photoacoustic studies of SiC polytypes. *Inst. Phys. Conf. Ser.* **142**, Chapter 2, 341-4

Schmetzer, K., 2000. Moissanit und verwandte Materialien. *Goldschmiede Zeitung*, **98**(10) 103

Shigley, J.E., Koivula, J.I., York, P., and Flora, D., 2000. A guide for the separation of 'colorless' diamond, cubic zirconia and synthetic moissanite. *The Loupe*, **9**(3), 8-10

Sluis, J.J., 2000. Pers. Comm.

Stiasny, Th., and Helbig, R., 1997 Thermoluminescence and related electronic processes of 4H/6H-SiC. *Physica Status Solidi* (a) **162**, 239-49

Sugiyama, N., Okamoto, A., and Tani, T., 1996. Growth orientation dependence of dopant incorporation in bulk SiC single crystals. *Inst. Phys. Conf. Ser.* **142**, Chapter 3, 489-92

Tairov, Yu.M., 1996. Crystal growth of bulk SiC. *Inst. Phys. Conf. Ser.* **142,** Chapter 1, 11-15

Tairov, Yu. M., and Tsvetkov, V.F., 1978. Investigation of growth processes of ingots of silicon carbide single crystals. *Journal of Crystal Growth*, **43**, 209-12

Tairov, Yu. M., and Tsvetkov, V.F., 1981. General principles of growing large-size single crystals of various silicon carbide polytypes. *Journal of Crystal Growth*, **52**, 146-50

Takanaka, N., Nishino, S., and Saraie, J., 1996. Sublimation growth of 6H-SiC bulk. *Inst. Phys. Conf. Ser.* **142**, Chapter 1, 49-52

Tsvetkov, V.F., Allen, S.T., Kong, H.S., and Carter, C.H. Jr., 1996. Recent progress in SiC crystal growth. *Inst. Phys. Conf. Ser.*, **142,** Chapter 1, 17-22.

Verma, A.R., and Krishna, P., 1966. *Polymorphism and polytypism in crystals. 5. Silicon carbide and other polytypic substances*. John Wiley & Sons, New York, London, Sydney, pp. 92-135

Violina, G.N., Liang-hsiu, Y., and Kholuyanov, G.F., 1964. Optical absorption and electrical properties of n-type α-SiC. Soviet Physics - *Solid State*, **5**(12), 2500-05

Yakimova, R., Syväjärvi, M., Iakimov, T., Jacobsson, H., Raback, R., Vehanen, A., and Janzén, E., 2000. Polytype stability in seeded sublimation growth of 4H-SiC boules. *Journal of Crystal Growth*, **217**, 255-62

Yoo, W.S., Yamashita, A., Kimoto, T., and Matsunami, H., 1991. Bulk crystal growth of 6H-SiC on polytype-controlled substrates through vapor phase and characterization. *Journal of Crystal Growth*, **115**, 733-9

Notes from the Laboratory

Stephen Kennedy B.Sc., FGA, DGA

Gem Testing Laboratory of Great Britain, 27 Greville Street, London EC1N 8TN

ABSTRACT: A spate of ruby and emerald rough imitations are considered. The cutting of 'prize' emeralds to order is questioned. The authenticity of an archaeological intaglio is unresolved. More on 'power' bracelets. Zachery-type treated turquoise and diffused corundums are encountered. Bangladesh pearl fishing information. The problems of lax pearl terminology presented.

The fraudulent practice of circulating imitations of rough emerald, ruby, sapphire, and diamond are well known. Recently, there has been a spate of larger specimens being passed off as ruby and emerald. One of the ten specimens, weighing 40 grams, was found to be green artificial glass (*Figure 1*). A matrix of 'earthy' material is glued onto the surface to make the specimen appear more authentic.

The remaining specimens were all determined to be artificially coloured composite stones, consisting of pieces of colourless (or near-colourless) quartz. The quartz components are glued together and it is the designated dyed colour of the glue which gives the specimen its perceived body colour. The 'earthy' matrix glued onto the surface once again adds 'authenticity' but in these specimens it also covers over the joins between the quartz sections. Enough of the transparent seemingly high quality areas of the stones are revealed at the surface to persuade an unwitting purchaser that there are lucrative profits to be made. However the size of these 'windows' will not allow the casual untrained observer to see any internal clues to the true identity of the stone. The four ruby imitations were an orangish-red colour and ranged in weights from 50.3 grams to 96.6 grams (*Figure 1*). The colour would be considered somewhat artificial to anyone acquainted with handling natural ruby.

Figure 1: *Green artificial glass imitating a piece of emerald rough, which weighs 40 grams, and an artificially coloured quartz composite imitating ruby rough, weighing 96.6 grams.*

The rough green specimens varied in weight from a lowly 29.7 grams to an astounding 0.82 kilograms (*Figure 2*). At some stage, the latter specimen had been polished down one side. This action revealed the join between the quartz pieces, allowed a closer view of the internal joins and, with

 ISSN: 1355–4565

Figure 2: An artificially coloured quartz composite stone, weighing 0.82 kilograms.

Figure 3: The advertisement accompanying a rough piece of emerald, which was the 'winning' prize from a scratch card competition.

the use of a pen torch or fibre optic light, enabled an observer to clearly differentiate between the colourless quartz and the green coloured adhesive.

These composites are produced for fraudulent intent and normally form part of an elaborate scam drawing in potential buyers to part with their money. The clients involved in submitting the composites had obviously realised that something was amiss and hopefully were able to curtail their financial losses. One wonders how many transactions have occurred where purchasers have become wise after the event.

You've won this genuine emerald

So goes the advertisement attached to a rough piece of what is claimed to be an emerald (*Figure* 3). The stone and advertisement are the free gift sent out to the winners of a scratch card. In revealing 'winning' boxes on the scratch card they are instructed to telephone through their details on a premium rate telephone line. The advertisement then encourages the 'winner' to send off his piece of emerald to have it cut and mounted in a 'Lucky Horseshoe Pendant'.

The Laboratory has been shown five of these rough emerald pieces, one of which was submitted by a local authority trading standards body. Two of them were green in colour - one opaque, which was submitted by the trading standards body, and the other translucent. Both can be described as emeralds. The trading standards authority was informed that the pendant may have been imported with an emerald (assuming it is) already mounted. It was suggested that by chemical analysis as well as microscopic examination an attempt could be made to establish whether the faceted stone was cut from the stated piece of rough. Unfortunately the authority did not take it any further.

Subsequent pieces of rough that have been seen would have fallen foul of trade descriptions in that the bulk of the stone seems to be a mica schist with only grains of emerald in it. Trading standards have been informed of this.

Roman intaglio?

An oval black intaglio, measuring approximately 12 x 10 x 3 mm, was submitted with the request to establish its identity and age. The intaglio, a holiday purchase in Turkey, had been sold as a Roman artefact. It was established that the material was a dark purple artificial glass and that the depicted image of a 'Roman-like' bust of a man was a moulding. It was suggested that the client show it to an expert at the British Museum. It was interesting to learn that the Romans were able to produce moulded intaglios. The expert was unable to prove its age one way or another but his instincts were that it was a modern reproduction. The lack of wear to the stone would support his instincts. Apparently original Roman artefacts are being found in Turkey, which makes the sale of reproductions to unsuspecting tourists that much easier!

Poor man's onyx, etc

Amongst a number of low priced 'power' bracelets being tested was one assumed to be onyx. However instead of the expected smooth cryptocrystalline structure there was a granular texture (*Figure 4*). On contacting the company, who had submitted the sample, we were informed that their Far East supplier had located this material since onyx bead bracelets had not been within the price range sought by the company! Chemical analysis proved the material to be quartz. The composition of the black specks visible, which contribute to the natural black colour of the material, were not determined. The result given for the beads was black quartzite.

Figure 4: *The granular texture of black quartzite.*

In another onyx bracelet six 'black' (actually dark purple when viewed with a fibre-optic light) artificial glass beads were discovered. Another surprise was to find that someone had considered treated blue topaz to be too expensive or hard to find and had used dyed quartz instead. In testing other 'power' bracelets the most common false descriptions relate to turquoise and jade. The 'turquoise' bracelets tend to be various types of man-made imitations. The carbonate-based imitations will effervesce with a drop of dilute hydrochloric acid. In others, the admixture of dye is visible under magnification. The 'jade' bracelets are generally other materials altogether – yellow calcite, green aventurine quartz, dyed chalcedony and dyed quartzite. The prices of these bracelets mitigate against nephrite, jadeite or turquoise being used. A number of importers in describing the likes of imitation turquoise have resorted to the practice of using the French word 'faux' (literal translation – false, although in French it has a wider and in this context more relevant meaning) in smaller less prominent type in front of the word 'turquoise'. This practice falls foul of the International Jewellery Confederation (CIBJO) guidelines, which state:

"An imitation....shall be described by the name of the natural material it imitates, immediately preceded by the word 'imitation', which shall appear, in the event of a written presentation, with equal emphasis and prominence, with characters of the same size and colour as those of the name itself" (Gemstones – Terminology and Classification, 2001).

Treated turquoise

A pair of turquoise earrings were chemically analysed to establish whether they been treated by a Zachery-like process (Fritsch, E., *et al.*, 1999). There was no specific feature that caused suspicion. The fine quality of the turquoise would make you cautious since the value would be relatively high. The analysis by EDXRF (EDAX Eagle II) revealed an appreciable potassium content. The result given on the report was given as Treated Turquoise. This was the first Zachery-like treated turquoise submitted to the Laboratory for commercial testing.

Obvious diffusion treatment

The admonition to always check your sapphires for diffusion treatment normally entails the immersion of the stone in di-iodomethane or the diffusion of the light when viewing the stone on a microscope (a piece of tissue paper under the stone will often suffice). None of this was required to see the superficial colour diffusion penetrating the surface of the cabochon stone in *Figure 5*, which was in the process of being faceted.

After treatment and repolishing, diffused red corundum normally displays a patchier colour than the equivalent diffused blue corundum. This reflects the greater technical problems in diffusing the much larger chromium atoms into the corundum than in diffusing the iron and titanium into corundum, which is used to obtain the more widely available blue diffused corundum. One of our members brought in some low quality diffused red samples, where the resulting patchiness is very evident (*Figure 6*) to the extent that some of the centres of the facets lack any colour at all (*Figure 7*).

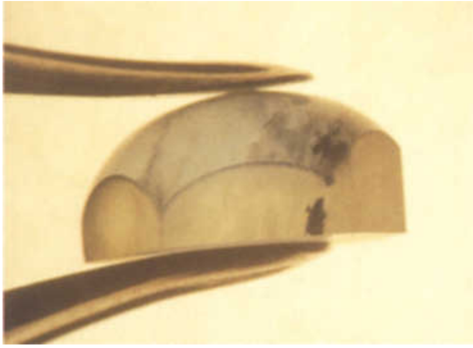


Figure 5: *The superficial colour diffusion penetrating into a cabochon, which was in the process of being faceted.*

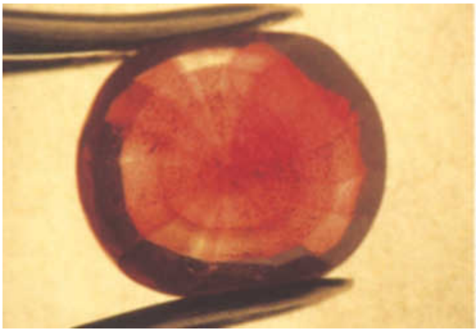


Figure 6: *A diffused red corundum showing the typical patchy colour distribution.*

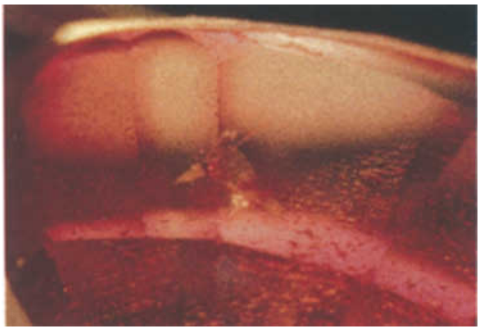


Figure 7: *The lack of colour evident on some facets of a diffused red corundum.*

Bangladeshi pearls

A white 'pearl' and a purplish grey/black 'pearl' described as originating from Bangladesh were submitted for identification. The white, irregular shaped, drilled 'pearl' was believed to be from coastal water bivalves and the black one from a River Meghna mussel. The client submitting these pearls regularly visits Bangladesh on business and was given to understand that they are natural pearls. The white 'pearl' was one from a necklace bought at a village bazaar south of Chittagong. The related pearl-bearing bivalves are fished in that area and another area 25 km from Dhaka. The client sent further samples of 'pearls' that he had personally retrieved or had seen being retrieved (*Figure 8*). In the laboratory we must ignore all provenance claims and give our objective opinion. In these circum-

Figure 8: *Bangladeshi 'pearls' - the 'pearls' on the right were identified as non-nucleated cultured pearls (© Pertti Tilus).*

stances we had to inform the client that we would report these pearls as being non-nucleated cultured pearls.

Pearl fishing in Bangladesh is known but the question is whether natural pearls exist in any numbers. Over the years, the Laboratory has received enquiries from the government and from a leading local jeweller on the development of their pearl trade. However the enquiries were not followed up. It would be interesting to hear more about the pearl situation in Bangladesh.

Freshwater pearls

It is common for non-nucleated cultured pearls to simply be labelled as freshwater pearls. In following CIBJO guidelines the jewellery trade is encouraged to call them freshwater cultured pearls. The lax practice of describing non-nucleated cultured pearls as freshwater pearls has been taken to its logical conclusion by a mail order firm, who have headlined their advertisement 'Stunning natural freshwater pearls'. This advertisement is also being brought to the attention of our trading standard authorities.

Acknowledgements

Trevor Tyler for their co-operation over the intaglio, David Davis for the loan of the red diffused corundum, and Pertti Tilus of Finbax Ltd for his picture and information on Bangladesh Pearl Fishing. Also Norman Harding, who sent in one of the rough emeralds involved with the scratch cards.

References

Fritsch, E., McClure, S.F., Ostrooumov, M., Andres, Y., Moses, T.M., Koivula, J.I., and Kammerling, R.C., 1999. The identification of zachery-treated turquoise. *Gems & Gemology*, **35**(1), 4-16

Gemstones – Terminology and Classification, 2001. *The Gemstone Book of the International Jewellery Confederation (CIBJO)*

Abstracts

Diamonds | Instruments and Techniques

Gems and Minerals | Synthetics and Simulants

Diamonds

Luminescences sous excitation visible des diamants noirs irradiés.

P.-Y. Boillat, F. Notari and C. Grobon. *Revue de Gemmologie*, 141/142, 2001, 37-9.

Most irradiated black diamonds examined under light at ± 420 nm show strong luminescence at facet junctions: examples are shown. M.O'D.

Diamants de type IIa et traitement HPHT: identification.

J.-P. Chalain, E. Fritsch and H. A. Hänni. *Revue de Gemmologie*, 141/142, 2001, 50-53.

Type IIa brown diamonds have been treated by high pressure/high temperature methods with colourless specimens resulting. Gem testing details are supplied. M.O'D.

Petrology of the Abloviak aillikite dykes, New Québec: evidence for a Cambrian diamondiferous alkaline province in north-eastern North America.

S. Digonnet, N. Goulet, J. Bourne, R. Stevenson and D. Archibald. *Canadian Journal of Earth Sciences*, **37**(4), 517-33, 2000.

A dozen ultramafic lamprophyre dykes occur in the E part of Ungava Bay, Quebec. They consist of macrocrysts of olivine and phlogopite with rims of tetra-ferriphlogopite, included in a matrix of fine-grained phlogopite, olivine, spinel, perovskite, rutile, diamond, apatite and interstitial carbonate. Rock and mineral chemistry and an Sm-Nd isotopic signature indicate that these rocks are carbonated ultramafic lamprophyre dykes. Chemical zoning of the micas and the presence in two of the dykes of andradite (TiO_2 7.54 and 11.42 wt.%) suggest a complex sequence of crystallization; an Ar isotope correlation analysis indicates an age of ~550 m.y. The dykes were emplaced in tension gashes in the Tasiuyak gneiss during reactivation of major Palaeoproterozoic structures associated with the opening of the Iapetus Ocean. The age, geochemical characteristics, isotopic evidence and geological environment are all analogous to similar dykes in SW Greenland. Their pre-drift geographical proximity, prior to the opening of the Labrador Sea, is taken to suggest that they are related to a common magmatic event which constitutes a diamondiferous alkaline province in NE North America. R.A.H.

Morphology of diamonds as a possible indicator of their genesis.

M.D. Evdokimov, M.Y. Ladygina and A.R. Nesterov. *Neues Jahrbuch für Mineralogie; Abhandlungen*, **176**(2), 2001, 153-77.

The hypothesis ascribing the formation of rounded diamonds to the processes of crystal growth is reviewed before a presentation of 34 SEM photographs of 18 representative diamonds, many from the Yakutian deposits. Growth and dissolution forms each have distinct morphological features. The crystallization of diamonds in eclogites led to plane-faced crystals. Melting at asthenospheric levels caused corrosion of diamond xenocrysts derived from the eclogite substrate. As the kimberlite magma became saturated in carbon, dissolution processes gave cyclic changes in growth and corrosion episodes responsible for the curved-face forms such as octahedroids and dodecahedroids. External sources (e.g. jets of juvenile methane) could supply enough C to trigger nucleation of a new generation of plane-faced octahedral crystals. Diamonds of the most complex morphology (including sceptre and skeletal forms) result from a combination of corrosion and rapid growth during the explosive emplacement of kimberlite magmas. The possibility of metastable crystallization of diamond directly from a juvenile gas should not be ruled out. R.A.H.

Les diamants de type I traités à HPHT: Novatek, General Electric, russes et suédois.

E. Fritsch. *Revue de Gemmologie*, 141/142, 2001, 54-8.

Brown type Ia diamonds treated by high pressure/high temperature methods may change to green. The process devised by Novatek is the only one to have been published: specimens are treated between 2000 and 2100°C and at approximately 60 kbars in the graphite stability field, using prismatic presses which are illustrated. Unusually saturated colour enhanced by fluorescence, high-pressure annealing signs, including discoidal fractures, graphite and etching, strong green luminescence under UV or visible light seen only in

Abstractors

J. Flinders	J.F.	M. O'Donoghue	M.O'D.	E. Stern	E.S.
R.A. Howie	R.A.H.	P.G. Read	P.G.R.	I. Sunagawa	I.S.

For further information on many of the topics referred to, consult *Mineralogical Abstracts*

 ISSN: 1355–4565

yellow-grained areas and very rare in natural diamonds (caused by the development of the H3 centre during treatment), and the presence of the H2 absorption line at 985 nm and below, absent from natural diamonds, are all indications of treatment. M.O'D.

[Discovery of diamonds in south-western Uzbekistan.] (Russian with English abstract)

A.V. Golovko, N.E. Yakovenko and N.A. Akhmedov. *Proc. Russian Min. Soc.*, **129**(1), 2000, 61-4.

Diamonds have been found in SW Uzbekistan in unusual diamond-bearing rocks: lamprophyres and shonkinite-porphyries forming dykes and pipes. These rocks contain xenoliths both of the host rocks and some rock types from greater depths: ultrabasites and eclogitized gabbro. The xenoliths also contain chromspinelids, chromdiopside, Cr-bearing olivine and moissanite. Data are given on the morphology of the diamond crystals, their XRD pattern and their TEM images. The diamondiferous xenoliths are related to the non-kimberlite type of rocks - lamprophyres of camptonite-monchiquite composition and/or shonkinite-porphyries. R.A.H.

Gemmologische Kurzinformationen. Eine neue Lichtquelle von kurzwelligem UV-Licht für den SSEF IIa Diamond Spotter™ zum Nachweis des Diamanttyps IIa.

H.A. Hänni. *Gemmologie. Z. Dt. Gemmol. Ges.*, **50** (1), 2001, 57-8, 1 graph, 1 photograph.

Most GE POL treated diamonds are type IIa and are transparent to short-wave UV radiation (SWUV); this test can be applied for preselection of possible HPHT treated IIa diamonds. The SWUV light source can be used with the SSEF IIa Diamond Spotter and is now produced under the name of 'SSEF IIa Diamond Illuminator'. E.S.

Superdeep diamonds from the Juina area, Mato Grosso State, Brazil.

F.V. Kaminsky, O.D. Zakharchenko, R. Davies, W. L. Griffin, G.K. Khachatryan-Blinova and A.A. Shiryaev. *Contributions to Mineralogy and Petrology*, **140**(6), 2001, 734-53.

Alluvial diamonds from the Juina area in W Brazil have been characterized in terms of their morphology, syngenetic mineral inclusions, carbon isotopes and nitrogen contents. Like other Brazilian diamonds, they show a predominance of rounded dodecahedral crystals; however, their mineral inclusions are unique. The inclusion paragenesis of Juina diamonds are dominated by ultra-high-*P* ('superdeep') phases differing from those found elsewhere. Ferropericlase is the dominant inclusion; it coexists with ilmenite, Cr-Ti spinel, a phase with the major element composition of olivine, and SiO_2. CaSi-perovskite inclusions coexist with titanite, ëolivineí and native Ni. MgSi-perovskite coexists with TAPP (tetragonal almandine-pyrope phase). Neither Cr-pyrope nor Mg-chromite occur. The spinel inclusions are low in Cr and Mg, and high in Ti (Cr_2O_3 <36.5 wt.% and TiO_2 > 10 wt.%). Most ilmenite inclusions have low MgO and some have very high (<11.5 wt.%) MnO. This suite of inclusions is consistent with derivation of most of the diamonds from depths near 670 km, and adds ilmenite and relatively low-Cr, high-Ti spinel to the known phases of the superdeep paragenesis. These diamonds have a narrow range of $\delta^{13}C$ (-7.8 to -2.5‰), low nitrogen contents and a predominant aggregated B centre. These observations have practical consequences for diamond exploration. R.A.H.

Diamond from the Guaniamo area, Venezuela.

F.V. Kaminsky, O.D. Zakharchenko, W.L. Griffin, D.M. DeR. Channer and G.K. Khachatryan-Blinova. *Canadian Mineralogist*, **38**(6), 2000, 1347-70.

More than 5000 diamond crystals (or fragments) from kimberlite sills and placer deposits in the Guaniamo area of W Bolivar State, Venezuela, have been characterized by morphology, internal structure, $\delta^{13}C$ values, syngenetic mineral inclusions, and the abundance and aggregation state of N. Some 50% of the crystals are resorbed dodecahedral forms; octahedral are the next most common form. The diamonds are generally colourless but a high percentage show radiation-induced pigmentation. About 20% are type II, the remainder belonging to the transitional IaAB type, with B>A. Ninety-three mineral inclusions were extracted from 77 crystals; EPMA and LAM-ICP-MS techniques were used to establish their trace element compositions and the *P–T* conditions of diamond crystallization. In all, 86% of the diamonds contain eclogitic inclusions, the remainder indicating peridotitic paragenesis. The $\delta^{13}C$ of 108 diamonds range from -3.2 to -28.7‰, but most stones have $\delta^{13}C$< -10‰. The authors consider that the diamonds in the placer deposits were derived mostly from the Guaniamo kimberlite sills. *P–T* estimates that most originated near the base of the lithosphere (*T*1200–1300°C) in a zone which may contain a substantial proportion of eclogite formed by subduction of crustal material. Parallels are drawn with the Australian Argyle deposit. R.A.H.

Evidence for crystals from the lower mantle: baddeleyite megacrysts of the Mbuji Mayi kimberlite.

L. Kerschhofer, U. Shärer and A. Deutsch. *Earth & Planetary Science Letters*, **179**(2), 2000, 219-25.

Results of a TEM study on previously dated, cm-sized baddeleyite xenocrysts (ZrO_2) from the Mbuji Mayi kimberlite are presented. Crystallographic analysis of their microstructures shows they transformed to their present monoclinic phase from a cubic parent phase. The high-T stability field of the cubic parent phase implies a lower mantle origin. This is further evidence that the idea of transfer of solid material across the 670 km mantle discontinuity is valid, and agrees with previous phase-petrology investigations of tiny ferro-periclase inclusions in diamonds for which a lower mantle origin has always been proposed. However, unlike the ferro-periclase inclusions, baddeleyites also record chronological information, and hence might provide new data on mantle dynamics' history. J.F.

Gemmologie Aktuell.

C.C. MILISENDA. *Gemmologie. Z. Dt. Gemmol. Ges.*, **50** (1), 2001, 1-4, 6 photographs.

A 'fancy-white' pear-shaped modified brilliant-cut diamond of 0.71 ct was translucent with a milky white colour due to a high concentration of sub-microscopic inclusions of an unknown nature that scatter the incident light. Colour flashes can produce an appearance similar to white opal. Possession of magnetism can often be used to separate natural from synthetic diamonds, but a natural cubic, black diamond of 2.02 ct was found to be magnetic probably due to magnetite inclusions. The body colour was brownish, but it appeared black due to many graphite inclusions; irradiated 'black' diamonds usually have a greenish-black body colour. E.S.

Gem Trade Lab notes.

T.M. MOSES, S.F. MCCLURE AND M.L. JOHNSON (EDS). *Gems & Gemology*, **37**(1), 2001, 56-63.

Items noted include a strongly colour-zoned diamond showing pseudo-dichroism. R.A.H.

Industrial diamond: applications, economics and a view to the future.

C. OWERS, *Industrial Diamond Review*, **60**(3), 2000, 176-81.

Diamond has extreme properties in the mechanical, thermal, optical, chemical and electronic fields and it is the combination of these properties which gives diamond its industrial importance. The world superabrasive tooling market is estimated to be worth almost $4 billion. Applications are continuing to be developed, but in addition to the quantifiable effects include less noise for less time, less dust, dry grinding rather than wet and more neutral waste. R.A.H.

Discovery and mining of the Argyle diamond deposit, Australia.

J.E. SHIGLEY, J. CHAPMAN AND R.K. ELLISON. *Gems & Gemology*, **37**(1), 2001, 26-41.

The Argyle mine in north-western Australia was established in 1983 and almost immediately became the world's largest source of diamonds. In its peak year (1994) it produced >42 million carat of rough diamonds, representing 40% of the world's production. A large proportion of these diamonds are small (mean size <1 ct) brown to yellow stones, with some near-colourless and colourless rough diamonds. The type 1a brownish and yellowish cut stones are marketed as 'champagne' and 'cognac' diamonds. The Argyle mine is also noted for the production of a very limited amount of rare pink diamonds (sold in auction at >US $ 100 000 per ct). The ore grade is 3 ct/tonne of olivine lamproite host rock; secondary alluvial deposits are also worked. R.A.H

Diamonds and their mineral inclusions, and what they tell us: a detailed 'pull-apart' of a diamondiferous eclogite.

L.A. TAYLOR *et al.* [9 others]. *International Geology Review*, **42**, 2000, 959-83.

Three-dimensional high resolution X-ray computed tomography of an eclogite xenolith from Yakutia has proved able to image diamonds and their textural relationships with coexisting minerals. Thirty specimens >.1 mm were found in an eclogite from Udachnaya, Russia: the diamonds appeared to be associated with zones of secondary alteration of clinopyroxene, the presence of secondary minerals suggested that the diamonds formed after the eclogite in conjuction with metasomatic inputs of C-rich fluids. Inclusions studied showed variations in major and trace-element chemistry within and between specimens and do not correspond to the minerals in the eclogite. M.O'D.

Gems and Minerals

The Rist and Ellis tracts.

D.L. BROWN AND W.E. WILSON. *Mineralogical Record*, **32**, 2001, 129-40.

North Carolina is virtually the only significant emerald producing state in the United States, the Hiddenite area (which also produces Cr-green spodumene) having yielded crystals of fair to good gem quality since the first discovery in 1875. The Rist and Ellis properties are in Alexander County and close to the small town of Hiddenite. The bedrock geology in which the emerald-bearing veins occur consists of Precambrian quartz-mica schists and gneisses in which sets of steeply-dipping fractures are penetrated by late-stage pegmatitic fluids with associated quartz and quartz-mica veins. These veins contain emerald-bearing vugs and pockets. Details of the emeralds are given: crystals are almost always etched and range from pale-green to blue-green. Some contain a colourless core while Cr-rich portions show a rich blood-red through the Chelsea filter. Amethyst, smoky quartz and gem-quality dark red rutile crystals also occur in the area, as well as hiddenite spodumene and fine jet-black crystals of tourmaline. Dark green tourmaline is also reported. M.O'D.

Tourmaline and aquamarine deposits from Brazil.

J. CESAR-MENDES, H. JORT-EVANGELISTA AND R. WEGNER. *Australian Gemmologist*, **21**(1), 2001, 3-6, 3 illus. in black-and-white.

Brazil is one of the world's largest producers of aquamarine and gem-quality tourmaline. These gemstones are found in granitic pegmatites and in the states of Minas Gerais, Bahia, Espirito Santo, Ceara, Paraiba and Rio Grande do Norte. Although aquamarines and tourmalines had been known for around 300 years, the Brazilian deposits only started to be exploited during this last century. The authors discuss in detail the very different mineralogical compositions of these various pegmatite deposits. P.G.R.

Jadeite in Japan.

K. CHIHARA. *Journal of the Gemmological Society of Japan*, **20**(1-4), 1999, 5-21, 18 figs., 7 tables.

Archaeological, geological, petrological and mineralogical description of jadeite in Japan, principally in the Himekawa and Itoigawa regions, Niigata Prefecture, are given. I.S.

Identification du traitement thermique à haute température des corindons par spectrométrie infra-rouge.

C. DAVID AND E. FRITSCH. *Revue de Gemmologie*, 141-142, 2001, 27-31.

The detection of high-temperature treatment of ruby and blue sapphire, mostly of high-quality specimens has up to now relied upon the identification of inclusions and growth fractures with the microscope. IR spectrometry was first used to examine sapphires from Rock Creek, Montana when absorption at 3309 cm^{-1} [3021 nm] was found in heated stones, the absorption being the most prominent of a group of 5, caused by an OH-dipole linked to Fe and Ti atoms in the corundum lattice. A Fourier transform IR spectrometer was used in the present study in which specimens from 20 different localities were examined: tests (shown in graph form) were found to be effective for metamorphic sapphires when the absence or smallness of a peak at 3309 cm^{-1} indicates that the specimen has not been treated. In treated specimens the peak is significant. Sapphires of volcanic origin cannot be tested by this method. Specific absorptions of alumina hydrates (diaspore, boehmite) are seen only in sapphires which have not undergone HT treatment. The tests are also found useful for heated/unheated Mong Hsu rubies on the basis of the 3309 cm^{-1} signal. M.O'D.

The geology, mineralogy and rare element geochemistry of the gem deposits of Sri Lanka.

C.B. DISSANAYAKE, R. CHANDRAJITH AND H.J. TOBSCHALL. *Bulletin of the Geological Society of Finland*, **72**(1-2), 2000, 5-20.

Nearly all the gem-bearing formations of Sri Lanka are located in the central high-grade terrain of the Highland complex. They include sedimentary, igneous and metamorphic rocks, but sedimentary deposits are the most abundant; the gemstones include corundum, chrysoberyl, beryl, spinel, topaz, zircon, tourmaline garnet and sphene. The trace elements in sediments from the three main gem fields were determined; some of the host sedimentary rocks are considerably enriched in certain elements compared to their average crustal abundances. The Walawe Gorge sediments are anomalously enriched in the high-field-strength and associated elements, particularly Zr, Hf, W and Ti. This is attributed to the presence of accessory zircon, monazite and rutile in the heavy minerals, which may amount to <50 wt.%. The geochemical enrichment of some trace elements is taken to indicate that highly differentiated granites and associated pegmatites provided the source material for these sedimentary rocks. R.A.H

Minerals of the Brumado magnesite deposits, Serra das Eguas, Bahia, Brazil.

A. FALSTER, W.B. SIMMONS, K.L. WEBBER, J.W. NIZAMOFF, C.P. BARBOSA AND R.V. GAINES. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical record*, **31**, 2000, 177-83.

A mineral assemblage associated with the magnesite deposits at Brumado, Serra das Eguas, Bahia, Brazil, includes uvite and dravite ranging from black to green to red to fine yellow, orange, pink or purple crystals of topaz up to several centimetres in length, aquamarine and emerald. M.O'D.

Cuprian elbaite from the Bocheiron Zinho pegmatite, Paraíba, Brazil.

A.U. FALSTER, W.B. SIMMONS, J.W. NIZAMOFF AND K.L. WEBBER. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

Elbaite of vivid blue to green colour and showing prominent colour zoning with either pink cores and deep blue rims or blue cores with several outer zones of purple, green, blue or grey ['Paraíba tourmaline'] was found during 1988 from Mina da Batalha, Sao Jose da Batalha, Paraíba, Brazil. Analyzed specimens were found to contain up to 1.4 wt. % CuO in the blue zones, 0.2 wt. % MnO in the pale pink cores and 1.2 wt.% FeO in the deep green rims. Deep green specimens found in the footwall of the pegmatite held up to 3.0 wt.% FeO and many contained thin, platy inclusions of native copper. Causes of the coloration are briefly reviewed. M.O'D.

Ornamental variety of pink marble with apatite found near Eppawala, Sri Lanka.

M.D.P.L. FRANCIS AND P.G.R. DHARMARATNE. *Australian Gemmologist*, **21**(2), 2001, 91-4, 4 illus. in colour, 2 maps.

Because Sri Lanka is a major source of transparent to translucent gemstones, little attention has been paid to the many varieties of ornamental stones that also occur on the island. A deposit of one such ornamental rock, a variety of pink marble with apatite, is located at Galmaduwa 5 km south-east of Eppawala. In spite of its impurities (embedded apatite crystals), the pink marble is a very attractive, easily worked and inexpensive carving material. P.G.R

Origine de la couleur dans les gemmes.

E. FRITSCH AND G.R. ROSSMAN. *Revue de Gemmologie*, 141/142, 2001, 65-74.

Describes the various methods by which gemstones are coloured. Body-colour, phenomenal colour and play of colour are included. M.O'D.

Le traitement des perles.

J.-P. GAUTHIER. *Revue de Gemmologie*, 141/142, 2001, 42-5.

The various methods used to alter the colour of pearls are reviewed and their identification briefly noted. M.O'D.

Prehnite from La Combe de la Selle, Saint Christophe-en-Oisans, Isère, France.

L. GAUTRON AND N. MEISSER. *Mineralogical Record*, **32**, 2001, 223-32.

Fine large crystals of prehnite capable of being fashioned are reported from a classic alpine cleft deposit at La Combe de la Selle, Isère, in the French Alps – the famous axinite deposit of Bourg d'Oisans is not far away. The mineral was first described in 1789. Details of the local geology and mineralization are given, together with a descriptive list of associated minerals. Prehnite occurs as isolated and intergrown green translucent to partially transparent crystals up to 5 cm on an amphibolitic matrix. M.O'D

Descriptive mineralogy of inclusions in some faceted gem topaz from Brazil.

B. GELLER. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

In a study of seven faceted topaz specimens from unidentified sites in Brazil the following minerals were identified: ilmenorutile, limonite, muscovite, rutile, struverite, tourmaline, zinnwaldite and three unknown phases. Optical and scanning electron microscopy and x-ray fluorescence were used in the investigation. The Virgem de Lapa region was ruled out as a site for the specimens as no recognizable lepidolite was identified.

M.O'D.

Dal 'negorsk, Primorskiy Kray, Russia. (Famous mineral localities.)

R. GRANT AND W.E. WILSON. *Mineralogical Record*, **32**, 2001, 3-30.

The Dal'negorsk area in the east of Russia produces many fine minerals, some with ornamental application. These include exceptional calcite, danburite, found only in the Danburitiy mine and formung crystals exceptionally reaching 40 cm (some of this material has been irradiated to produce a deep golden-orange colour), datolite in green (attributed to Cr), honey-yellow to brown (RE) as well as colourless crystals, exceptional fluorite crystals, some occurring as green octahedra and some as yellow, rarely blue and purple. Some specimens have been called 'invisible fluorite' from their clarity. M.O'D.

Canadian emeralds: the Crown showing, south-eastern Yukon.

L.A. GROAT, T.S. ERCIT, D.D. MARSHALL, R.A. GAULT, M.A. WISE, W. WENGZYNOWSKI AND W.D. EATON. *Newsletter of the Mineralogical Association of Canada*, **63**, 2000, 1 and 12-13.

Numerous emerald-bearing float trains were discovered in a 900 x 400 m area on the Goal Net property, 600 m E of a granitic pluton in the Finlayson Lake district of SE Yukon. Washing and hand-sorting of ~ 6 m^3 of material yielded 6 kg of emeralds. The emeralds occur where quartz veins cut mica-rich layers in a chlorite-mica schist; they range in size from <1 mm to 4 cm in length. EPMA on 25 crystals gave average values of Cr 3209, V 171 ppm (some have Sc ≤ 499 ppm). Some of the smaller crystals (0.25 ct) and parts of larger crystals are of gem quality with excellent clarity and colour. R.A.H.

Jade: occurrence and metasomatic origin.

G.E. HARLOW AND S.S. SORENSON. *Australian Gemmologist*, **21**(1), 2001, 7-11, 2 maps.

The term jade refers to two extremely tough rocks; nephrite with a felted microcrystalline habit and jadeite/jadeitite with micro- to macro-crystalline textures. Nephrite is the more common and less valuable of the two jade types with important deposits in Canada, China, Russia, South Australia and New Zealand. Jadeite/jadeitite is much less common and only occurs as bodies in subduction-related serpentinite along major fault zones in Northern Myanmar, Guatemala, Russia and Kazakhstan, also in Japan. Recent investigations show that the jades share some common geological characteristics, and both result from and record important earth processes. P.G.R.

The gemstone occurrences of Madagascar.

U. HENN AND C. MILISENDA. *Australian Gemmologist*, **21**(2), 2001, 76-82, 8 illus. in colour, 2 tables.

For centuries Madagascar has been well known for its wealth of gemstones. By the beginning of the 20th century the island was supplying the world with commercial quantities of gems including beryl, tourmaline, various quartzes, spodumene, amazonite, labradorite and garnet. More recently, commercially important occurrences of blue and pink sapphires have also been discovered. This paper details the geology of the island's occurrences, and tabulates the gems in order of chemistry and of location. P.G.R.

Scottish gem lab news.

A. HODGKINSON. *Australian Gemmologist*, **21**(2), 2001, 83-7, 12 illus. in colour.

The author describes the use of the Hanneman tanzanite filter in the separation of tanzanites from their two look-alikes, synthetic forsterites and glass imitation tanzanites. When illuminated by incandescent light, tanzanites showed pinkish when viewed through the filter, unlike the synthetic forsterites. However, the glass imitations also showed pinkish, and to differentiate these from tanzanite, two polaroid strips, orientated so that their vibration directions are at right-angles, are added alongside the main filter. Any questionable gems which appear pink through the main filter are then scanned through the paired polaroid filters. The glass imitations remain the same blue colour, while the tanzanites display their diagnostic pleochroic colours. The author also describes and illustrates how visual optics can be used to separate tanzanite from these two simulants, and how visual optics and the Hanneman-Hodgkinson refractometer were used to identify a suspect pink synthetic perovskite as an orthorhombic yttrium aluminate. P.G.R.

New gemmological study of large garnets of supposedly Czech origin.

J. Hyrsl. *Gemmologie. Z. Dt. Gemmol. Ges.*, **50**(1), 2001, 37-42, 2 photographs, bibl.

Supposedly the largest Bohemian pyrope garnet is in the Green Vaults in Dresden and set in the Order of the Golden Fleece, which was made in Prague by Diessbach in 1749. The RI of this stone is 1.78, with a typical almandine spectrum. This specimen measures 34 x 27.4 x 9 mm and has a form of a reversed saucer with an actual thickness of about 3.5 mm. In an ancient inventory the weight was given as 46.75 ct (47.9 metric ct). The largest supposed Bohemian pyrope is in a Czech museum and weighs 13.21 ct; it has an RI of 1.79, an almandine spectrum and zircon inclusions. Examining other Bohemian garnet jewellery in the National Museum in Prague, the author found the pyropes to be usually smaller than 4 mm and found only rare examples up to 6.5 mm. E.S.

Minas Gerais – past and present.

A.R. Kampf. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

Describes the discovery and exploitation of some of the gem-bearing pegmatites in the Brazilian state of Minas Gerais and more recently of some of the metamorphic deposits which have produced alexandrite, emerald and other species. M.O'D.

The identification of gems in Japan.

H. Komatsu. *Journal of Gemmological Society of Japan*, **20**(1-4), 1999, 111-25, 5 figs., 13 photos.

The macroscopic structure of pearl, the microscopic structure of the nacreous layer, origin of colour and lustre, and the shape of pearls are explained first. Appropriate methods to investigate these properties are pointed out. Following these explanations, methods to differentiate imitation pearls, nucleated and non-nucleated pearls, physically treated pearls, chemically treated pearls, thickly coloured pearls by treatment, and to identify mother oysters are explained. Basic procedures for distinguishing pearls are summarized in five steps; visual observation, microscopic observation, observation by light transmission method, by soft X-ray, and by precision analytical apparatus. I.S.

Gem News International.

B.M. Laurs (Ed.). *Gems & Gemology*, **37**(1), 2001, 64-78.

Mention is made of the first production of emeralds from Piteiras, Minas Gerais, Brazil; an 8.25 ct precision-cut block of iolite to demonstrate pleochroism; semi-transparent to translucent, greenish-yellow prehnite from Australia; and yellow-green faceted vesuvianite from California. R.A.H.

[SEM study of jadeite jade.] (Chinese with English abstract)

X.-w. Liu. *Yanshi Kuangwu. (Journal of Mineralogy & Petrology)*, **21**(1), 2001, 5-7.

The mineral composition, grain size and microstructural features of the green part of a specimen of jadeite were studied by SEM imaging, and the variation of scattering and intensity of colour were correlated with the grain size. SEM images of the cleavage planes show they are not smooth, but characterized by linear and sawtooth cleavage steps. R.A.H.

Gem pegmatites of the Ural Mountains, Russia.

P. Lyckberg and V. Ye Zagorsky. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

The northern section of the central Ural Mountains of Russia includes notable miarolitic pegmatites carrying beryl, topaz and tourmaline in the western endo and exocontact of the Mursinka-Adui intrusions and the desilicated pegmatites surrounded by emerald-alexandrite-phenakite mineralization. Fine blue topaz with smoky quartz and albite is found at the Mokrusha, Golodnij, Tyazhitnitza, Staraja Mylnitsa, Starzewa Jama and Kazionnitsa mines. Gem-bearing pegmatites NW of Mursinka are enclosed in a serpentine and contain miaroles with coloured tourmaline: pegmatites to the W and SW contain green and yellow beryl and yellow or light blue topaz. The Sarapulka and Shaitanka pegmatites are thin veins with rubellite and rhodizite in the W and green and blue aquamarine in the E. Large amounts of emerald, alexandrite and phenakite have been produced since 1830 from the Takovaja district schists. Specimens recently discovered include combinations of phenakite/emerald and alexandrite/emerald. The southern Ural region centred on Miass in the Ilmen Mountains produced clear topaz crystals up to 3-4 kg and uncommon green beryl associated in miarolitic pegmatites with amazonite. M.O'D.

Laboratoire Français de Gemmologie: principaux examens pratiqués pour identifier le traitement thermique des saphirs.

P. Maitrallet and H. Garcia. *Revue de Gemmologie*, 141/142, 2001, 14-17.

Describes the examination of sapphires at the Paris Laboratoire Français de Gemmologie and the methods used to detect specimens whose colour has been affected by heat treatment. The authors make the point that traditional gemmological tests enable quite effective diagnosis to be made in many cases though examples cited show the usefulness of UV/visible spectroscopy. M.O'D.

Les corindons diffusés.

L. Massi and E. Fritsch. *Revue de Gemmologie*, 141/142, 2001, 18-26.

Details of tests carried out on 11 polished blue sapphires diffused with Fe and Ti, two blue sapphires diffused with cobalt and six red to orange sapphires diffused with Cr are given. The easiest method of detection was magnification using diffused lighting while specimens were immersed in di-iodomethane, when uneven colour distribution was apparent with concentration near facet junctions and at the edges. Absorptions at 3310 and 3232 cm^{-1} and related to (OH) groups were found in the blue treated specimens: the peaks were not detected in the stones before treatment nor in the treated red stones. Their presence is ascribed to the reducing, H-containing atmosphere used. A red luminescence detected in the Co-diffused red stones was found to arise from Cr rather than Co. SEM examination of residues at the surface of treated stones shows the presence of molten alumina but also zones rich in Na, Al and K among other elements. Iridium and carbon (graphite) traces were presumed to be from crucible material. M.O'D.

Gemmologie Aktuell.

C.C. Milisenda. *Gemmologie. Z. Dt. Gemmol. Ges.,* **50** (1), 2001, 1-4, 6 photographs.

Yellow and green sapphires from Malawi were examined. E.S.

Demantoide aus Pakistan.

C.C. Milisenda, U. Henn and J. Henn. *Gemmologie. Z. Dt. Gemmol. Ges.,* **50** (1), 2001, 51-6, 1 map, 1 table, 1 graph, 7 photographs, bibl.

Fifty samples of garnet came from a peridot mine in the Pakistan part of Kashmir. They were yellowish-green to emerald-green faceted stones, weighing between 1.04 and 11.38 ct. SG ranged from 3.77 to 3.85. chemical analysis showed relatively pure andradites with 0.25 wt. % of Cr_2O_3. The acicular, fibrous and felt-like mineral inclusions were shown to be chrysotile. E.S.

Composition and colour of uvite-dravite tourmaline from Brumado, Bahia, Brazil.

P.J. Modreski, E.E. Foord and C.P. Barbosa. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record,* **31**, 2000, 177-83.

Fibrous to prismatic reddish-brown dravite with up to 4-7 wt. % FeO, deep red platy to tabular crystals, identified as sodic uvite with 3 to 4% FeO, tabular green to brown discoidal crystals flattened on *c*, identified as uvite to calcic dravite and prismatic predominantly green but some colour-zoned crystals range from uvite through dravite, all from the magnesite deposits of Brumado, Bahia, Brazil, have been investigated by microprobe and other analytical methods. M.O'D.

What's new in minerals: Tucson Show 2001.

T. Moore. *Mineralogical Record,* **32**, 2001, 245-57.

Among gem and ornamental specimens on display at the 2001 Tucson Show were fine green fluorite crystals from the Homestake (former gold mine site) in Oatman County, Arizona, where they occur as simple octahedra up to 4 cm. Purple fluorite crystals from the Sweet Home mine, Alma, Colorado, were also shown. Very large crystals of elbaite from a recently-struck large pocket at the Pederneira mine, Minas Gerais, Brazil, were coloured pink to deep red to smoky green: some reached 10 cm. Apple-green elbaites from a pocket at the Arqueana mine in the same state were also shown. A new find of brazilianite from the Telirio mine in Minas Gerais has produced pale yellow and yellow-green crystals. Fine crystals of kunzite were on display, the source being a pegmatite province located between the towns of Jos and Ibadan, Nigeria. Some of the crystals reached 10 cm and showed pronounced surface etching with pink/purple pleochroism. M.O'D.

Inklusen-Bernsteine: Informationsträger vergangener Erdepochen.

H.J. Müllenmeister. *Gemmologie. Z. Dt. Gemmol. Ges.,* **50** (1), 2001, 5-36, 85 photographs, bibl.

Beautiful photographs of fauna and flora of more than 25 million years ago preserved in amber. The inclusions which vary from animals (or parts of animals) with vertibrae, to insects and their eggs to plant parts, are described in detail. Fake inclusions and their provenance are discussed. E.S.

Ammolite: iridescent fossilized ammonite from southern Alberta, Canada.

K.A. Mychaluk, A.A. Levinson and R.L. Hall. *Gems & Gemology,* **37**(1), 2001, 4-25.

Ammolite is a form of aragonite obtained from vivid iridescent fossilized ammonite shells from the late Cretaceous Bearpaw formation, mainly mined S of Lethbridge, Alberta. Because the iridescent layers are thin and fragile, typically coming from naturally crushed and compacted specimens, it is generally marketed as doublets or triplets; some material may be stabilized by epoxy resin. R.A.H.

La tanzanite (ß zoïsite): detection de traitement thermique.

F. Notari, P.-Y. Boillat and C. Grobon. *Revue de Gemmologie,* 141/142, 2001, 34-36.

Despite general belief it has been found possible to distinguish between heated and unheated transparent zoisite (tanzanite) by examination of the nature of the near-UV spectrum. Heated tanzanites transmit deeper into the UV; findings are shown in graph form and the technique is reported to have been 100% successful up to now. M.O'D.

Chronological table of events related to gemstones and jewellery in Japan.

H. Ohtani. *Journal of the Gemmological Society of Japan,* **20**(1-4), 1999, 175-89.

This paper presents chronological tables of events relating to finding and polishing of gemstones, jewellery making and gemmological studies in Japan, starting from the paleolithic stone age, the Jyomon, Yayoi and Kofun ages to historic ages. Japan has the oldest history in the world in use of jadeite for religious and ornamental stones, which started in the earliest period of the Jyomon age, ca. 7000 BC. The use of natural minerals for ornamental purposes stopped entirely after the end of the Kofun age, ca. AD 500. However, Japan is now the second biggest importer of gemstones, after the USA. I.S

Sogdianite and sugilite from Dara-i-Pioz massif (Tajikistan).

L. A. PAUTOV, P. V. KHVOROV, V. A. MUFTAKHOV AND A. A. AGAKHANOV. *Proceedings of the Russian Mineralogical Society*, **129**(3), 2000, 66-79.

Chemical, optical and powder XRD data are reported for a new find of sogdianite in six different associations in pegmatite of the Dara-i-Pioz massif. A new variety of sogdianite with Sn 1.97% is described. Sugilite also occurs here, and the existence is demonstrated of an isomorphous series between sugilite and sogdianite. An unnamed hexagonal phase $KLi_3Zr_2Si_{12}O_{30}$ with milarite-type structure has been discovered in pseudomorphs after eudialyte; it is uniaxial positive with ω 1.578, ε 1.582; *a* 10.325, *c* 14.325 Å; H. 6.5, *D* 2.78 g/cm^3. A relationship was established between the cation occupation of octahedral site *A* and the filling of polyhedral *B* with Na while there is constant K in site *C*; when the *A* site is completely occupied by tetravalent cations, the *B* position is vacant giving the sodium-free silicate $KLi_3Zr_2Si_{12}O_{30}$. R.A.H.

The eastern Brazilian pegmatite province.

C. PREINFALK AND G. MORTEANI. Friends of Mineralogy/Tucson Gem & Mineral Show/ Mineralogy Society of America. 21st Annual Symposium. *Mineralogy Record*, **31**, 2000, 177-83.

The province includes the whole of the state of Minas Gerais, the southern part of the state of Bahia, the western margin of Espirito Santo and the northern part of Rio de Janeiro. Exploration of the area produced green tourmaline as long ago as the early 16th century. The pegmatites are often found in Proterozoic mica-schists and amphibolites, the major pegmatite-forming event taking place between 525 and 545 million years ago. Gem species found include tourmaline, aquamarine, topaz, brazilianite, kunzite, columbite-tantalite, spodumene and pollucite. M.O'D.

The chemical composition of biotite from granitic pegmatites and from metamorphic emerald deposits in the Eastern Brazilian Pegmatite Province [EBPP].

C. PREINFALK AND G. MORTEANI. Friends of Mineralogy/Tucson Gem & Mineral Show/ Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

Two theories of the genesis of schist-type emerald deposits (by exometasomatism or by a regional and usually multi-stage reaction between already emplaced Be-rich and alkali-rich rocks) are examined with respect to the EBPP. M.O'D.

Brazilian gem provinces.

C.P. PINTO AND A.C. PEDROSA-SOARES. *Australian Gemmologist*, **21**(1), 2001, 12-16, 1 map.

Emerald, alexandrite, aquamarine, tourmaline, topaz, chrysoberyl, amethyst, opal and morganite are the main coloured gemstones mined in Brazil. The Eastern Pegmatite Province is a major source of the beryl and chrysoberyl gems and of the kunzite variety of spodumene, the Southern Gem Province (Rio Grange do Sul) is the major world producer of amethyst and agate, the Piaui Gem Province produces opals, and the Bahia and Central Gem Provinces are Brazil's major emerald sources. P.G.R.

The history of Brazilian pegmatite gem mining.

K. PROCTOR. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

Describes gem mining from the pegmatites in the NE portion of the Brazilian state of Minas Gerais. Gem crystals were first found by gold prospectors over 400 years ago. M.O'D.

The development and present geologic environment of the most important gem crystals and mines of Minas Gerais, Brazil.

K. PROCTOR. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

Describes how the uplifting of pegmatite bodies and erosion of their cover has led to the discovery of many varieties of gem quality minerals. M.O'D.

The famous tourmaline, aquamarine and kunzite mines of Minas Gerais and their greatest gem crystals.

K. PROCTOR. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

The primary deposits of Cruzeiro, Jonas, Xanda, Limoeiro, Golconda, Medina and Corrego do Urucum and the secondary deposits of Barra de Salinhas, Ouro Fino, Santa Rosa, Morro Redondo, Frade and the Pioneer mine in the Tres Barros area near Marambaia produce some of the world's finest tourmaline, aquamarine and kunzite. M.O'D.

Uber das Salz der Erde und vom Gold aus Ophir-Mineralogisches aus der Bibel.

H. ROESER. *Aufschluss*, **52**, 2001, 129-67.

Four primary classes of references to minerals in the Bible are: minerals in the manufacture of tools, of jewellery, of religious artefacts and for popular use. Naming conventions are discussed and in spite of nomenclature problems it is still possible to establish which species is meant in a particular context. Gold and salt have a particular significance in the Bible. A table giving names and compositions of the minerals cited refers to the book, chapter and verse and there is an extensive bibliography. M.O'D.

Glass-filled rubies ou rubis rebouches.

K. SCARRATT. *Revue de Gemmologie*, 141/142, 2001, 11-13.

Summary with appended questions and answers on glass-filled rubies with special reference to material from Mong Hsu. M.O'D.

Emerald deposits – a review.

D. SCHWARTZ AND G. GIULIANI. *Australian Gemmologist*, **21**, (1), 2001, 17-23, 1 map.

Emerald is scarce because the juxtaposition of Cr/V and Be in nature is rare in that it requires exceptional geological and geochemical conditions. Sources of chromium and vanadium are mafic-ultramafic igneous rocks found in suture zones and volcano-sedimentary series, as well as in sedimentary formations such as black shales. Sources of beryllium are pegmatitic and A1/Si-rich magmas, black shales and metamorphic rocks. The review describes the conditions which make it possible for emerald mineralisation to occur in worldwide green beryl deposits. P.G.R.

Gem tourmaline chemistry and paragenesis.

W.B. SIMMONS, K.L. WEBBER, A.U. FALSTER AND J.W. NIZAMOFF. *Australian Gemmologist*, **21**(1), 2001, 24-9, 12 illus., 1 map.

Tourmaline is a well-known and widely mined variety that is recovered from highly fractionated granitic pegmatites worldwide. The wide range of colours, good durability and reasonably ample supply make this mineral one of the most important gemstones. The study examines the colour and chemistry of gem tourmaline from pegmatites in Russia (Transbaikalia), Madagascar, North America and northern Brazil. P.G.R.

Quartz crystals twinned after Brazil and Japan laws – origin of their morphological and textural characteristics.

I. SUNAGAWA. *Journal of The Gemmological Society of Japan*, **20**(1-4), 2000, 23-36, 12 figs.

Brazil twins are formed by joining polymerized particles of 10 nm size with right-hand and left-hand quartz structures and develop as polysynthetic twin lamellae. A large number of Brazil twin lamellae co-operate to form Brewster fringes, which are observed in natural amethysts. Brazil twin is a growth twin formed when natural quartz crystals grow under low temperature conditions, in the presence of impurity ions. But, even under high temperature synthetic conditions, generation of a Brazil twin can be triggered by a strain field associated with inclusions of impurity components, mainly ferric iron oxide or hydroxide, and with dislocations therefrom. Japanese twins are formed during the nucleation stage by joining two quartz individuals of the same structure on their well developed rhombohedral faces. At this stage, quartz crystals take a hexagonal bipyramidal habit with no prism faces developed. Dislocations concentrate in the twin junction plane, and act as preferable sites for step generation, resulting in an 'apparent' or 'pseudo' re-entrant corner effect, so far as rhombohedral faces meet at twin junction. A more flattened habit and larger size of Japanese twins compared with the co-existing single crystals, and the morphological evolution as growth proceeds can be explained in terms of the 'apparent' re-entrant corner effect and the difference in effectiveness of dislocations as active growth sources between rhombohedral and prism faces. V- and fan-shapes of Japanese twins represent the upper half of a Y-shape, and not of and X-shape, indicating that they belong to a contact twin. Freely developed Japanese twins show a Y-shape. I.S.

Origin of gem corundums from basaltic fields.

F.L. SUTHERLAND AND D. SCHWARTZ. *Australian Gemmologist*, **21**(1), 2001, pp.30-3, 2 illus., 2 tables.

Gem corundums, both sapphire and ruby, are eroded from particular basaltic eruptives. They are recorded in six continental regions, within fifteen countries and involve over forty main basalt fields. These fields discharge both magmatic and metamorphic origin corundums from underlying sources. Several fields with bimodal origins are now known. 'Magmatic' sapphire suites exhibit more consistent trace element variations that 'metamorphic' sapphire-ruby suites, which encompass a diversity of metamorphic origins. P.G.R.

The geology of Australian opal deposits.

I.J. TOWNSEND. *Australian Gemmologist*, **21**(1), 2001, 34-7, 1 map.

The many variations of opal depend on a number of factors. Firstly, the climate must provide alternating wet and dry periods, creating a rising or more importantly a falling water table which concentrates any silica in solution. The silica itself is formed either by volcanic activity or by deep weathering of Cretaceous clay sediments producing both silica and white kaolin. Each local opal field or occurrence must have contained voids or porosity of some sort to provide a site for opal deposition. Silica spheres, once formed, are deposited in a regular array in these voids from a receding water table to produce precious opal. P.G.R

Recent mineral occurrences from north-eastern Brazil.

R. WEGNER. Friends of Mineralogy/Tucson Gem & Mineral Show/Mineralogical Society of America. 21st Annual Symposium. *Mineralogical Record*, **31**, 2000, 177-83.

Gem-quality minerals recently found in the states of Paraiba and Rio Grande do Norte, NE Brazil include apatite with distinct colour zoning from yellow cores to blue or green rims from the Alto Feio pegmatite, Paraiba:

perfectly crystallized cognac-coloured herderite crystals up to 12 cm from the Alto des Flechas pegmatite near Pedra Lavada, Paraiba (this pegmatite has produced fine golden beryl in the past) and amethyst sceptre crystals with milky quartz bases from the area of Santana de Mangeiras, Paraiba. M.O'D.

Gallery review: the R S McLaughlin Mineral Hall, Royal Ontario Museum.

J S WHITE. *Mineralogical Record*, **32**, 147-151, 2001.

Review of the newly-arranged Treasures of the Earth portion of the new Dynamic Earth display at the Royal Ontario Museum, Toronto. Treasures of the Earth comprises the mineral and gem exhibits. Following some recent display history and a description of the collections which are excellent in themselves, notes on presentation find, as well as a number of positive points, serious inadequacies in labelling both in quantity and content, as well as in the general arrangement of some of the specimens. Some ancillary services do not work too well and there were no booklets available in one of the rooms although they were advertised. It should be possible to rectify some if not all of the shortcomings (including poor commentaries from guides) with minimum effort and expense. M.O'D.

The minerals of Russia.

Annual FM-TGMS-MSA Mineralogical Symposium, 22nd, 2001, Tucson, 2001. *Mineralogical Record*, **32**, 2001, 39-47.

Papers on various aspects of Russian minerals are abstracted. Those concerning gem and ornamental species include: Famous mineral localities and mineral collecting in the former Soviet Union: Nomenclature of quartz colour variations - pink and rose: Gem pegmatite and greisen deposits of Russia during the twentieth century: Gem pegmatites of Ukraine, Kazakhstan and Tajikistan: Gem beryl and topaz of Sherlovaya Gora, Transbaikal, Russia. M.O'D.

What's new in minerals.

[Various authors.] *Mineralogical Record*, **32**, 2001, 53-64.

The mineral shows covered this time are Springfield and Denver: notable examples of Colorado gem minerals available include rhodochrosite from the Sweet Home and Sunnyside mines, aquamarine from Mount Antero, zircon as sharp lustrous brown crystals in matrix from St Peter's Dome. At the same show were a few gem-quality brownish-green elbaite crystals, their characteristic oily lustre indicating their origin from the Gillette quarry, Haddam Neck, Connecticut. Deep yellow-green sphene crystals were available from the classic locality of Capelinha, Minas Gerais, Brazil (such specimens have been rare for a number of years). Some dealers at Springfield were showing pale translucent pink elbaite said to be from the Mogok district of Burma: a most unusual transparent pale smoky-brown phlogopite from the same area was on show.

At the Denver show crystals of brazilianite were available – they were pale to medium-intense greenish-yellow, some on a matrix of albite. The location was the Telirio mine, Linopolis, Minas Gerais. Raspberry-red elbaite was on view from Nigeria 'near Oyo City' and fine deep blue aquamarine with schorl on feldspar was being sold – the location Bergsig 274, Erongo mountains, Namibia. Afghanistan has produced deep orange danburite from 'somewhere in Nuristan' [but see Grant and Wilson above for irradiated danburite]. M.O'D.

Instruments and Techniques

Dispersion, birefringence, and the critical angle refractometer.

W.W. HANNEMAN. *Australian Gemmologist*, **21**(2), 2001, 88-90, 3 illus.

The author first outlines the basic determinative value of the critical angle refractometer in measuring the RI and, more importantly, the DR of a gemstone. Concurrently, the gem's optical character and optic sign are easily determined on the same instrument, and these four properties provide sufficient information to identify the majority of gem materials within the RI range of 1.4 to 1.80. In discussing the practical value of a proposed method for measuring the dispersion of a gemstone on the standard refractometer, a plot of dispersion values against RI over the range of 1.4 to 1.81, produces a cluster of points which the author claims to be of limited determinative value. P.G.R.

The present status of application of instrumental methods of gem identification – examples of identifications using EDS, X-radiography, FT-IR.

M. HAYASHI. *Journal of Gemmological Society of Japan*, **20**(1-4), 1999, 99-110, 22 figs., 4 tables.

Several examples are given to demonstrate how EDS, soft X-ray transmission, FT-IR spectroscopy can be applied to gem identification. These include identification of flux inclusions in Kashan ruby by EPMA, XRF, EDXRF analyses of natural, GE and Sumitomo synthetic diamonds, of natural, synthetic, and heat-enhanced sapphire, X-radiographic investigation of Koss, Yehuda-treated diamond, emerald, jadeite, FT-IR investigation of natural of natural and synthetic alexandrite, natural and resin-impregnated jadeites. I.S.

Quantification and visualization of diamond brilliancy.

K. INOUE. *Journal of Gemmological Society of Japan*, **20**(1-4), 1999, 153-67, 11 figs, 13 photos., tables.

The degree of brilliance is quantified by evaluating intensity of light reflected in stones. A computer algorithm was applied to calculate ray trajectories in three dimensional space for the case of a round brilliant diamond. The principles to calculate the intensity in light reflected in three dimensional models of a round brilliant diamond are explained first. Computer analyses are applied to a lumpy stone, an ideally cut stone, and three cut stones with proportions commonly encountered in the market. How the degree of brilliance changes depending on the proportions is demonstrated. I.S.

Re-examination of optimum cutting angles between main facets of gemstones based on geometrical optics

A. KATO. *Journal of Gemmological Society of Japan*, **20**(1-4), 1999, 127-43, 21 figs., 2 tables.

This is a summarized English translation of Kato's paper in Japanese published in the same Journal, **9**(1), 3-17, 1982, with supplementary comment and selective bibliography on diamond cutting by W. Funnel. I.S.

A method for computation of gem faceting.

M. KATO. *Journal of Gemmological Society of Japan*, **20**(1-4), 1999, 144-51, 6 figs.

Mathematical formulae based on solid geometry are derived to calculate the best faceting design of any gemstone. The formulae are applied to calculate appropriate cutting angles and edge proportions, and the results are illustrated using the orthogonal projection. I.S

Cathodoluminescence method and its applications to gemmology.

T. MIYATA, H. KITAWAKI AND M. KITAMURA. *Journal of Gemmological Society of Japan*, **20**(1-4), 1999, 63-78, 28 figs, 8 tables.

Observations on growth banding revealed by cathodoluminescence (CL) images of diamonds have demonstrated that (1) growth morphology of natural diamonds consists of flat {111} faces with or without curved {100} faces, whereas that of synthetic diamonds consists of flat {111} and {100} faces, and (2) each diamond has its characteristic pattern of growth banding. These characteristics can be used as diagnostic features to be used in discriminating natural from synthetic diamonds, as well as fingerprinting an individual stone. CL observations on 10 pieces of synthetic emerald, which were identified beforehand by ordinary gemmological tests and NIR spectroscopy, have demonstrated that flux-grown emeralds show straight parallel growth banding or 'aurora-like' bright spots, whereas hydrothermally-grown emeralds show 'comet-like' spots arranged in certain directions or show a unique rhombic pattern. It is therefore anticipated that natural and synthetic emeralds and flux- and hydrothermally-grown synthetic emeralds can be distinguished by CL observations. I.S.

A new method to identify a cut gemstone.

C. RINAUDO, B. CAPELLE AND R. NAVONE. *Gemmologie. Z. Dt. Gemmol. Ges.*, **50** (1), 2001, 43-50, 1 table, 2 sketches, 8 photographs, bibl.

X-ray transmission topography allows fingerprinting of a cut gemstone which enables recognition after a re-cut. When a white beam of a synchrotron is applied, a few seconds are sufficient to record the topography on a plate film placed behind the stone. The features shown are quite distinctive on each individual stone. E.S.

Laser tomography; a new powerful method to identify natural, synthetic and treated stones – case study of corundum.

J. SHIDA. *Journal of Gemmological Society of Japan*, **20** (1-4), 1999, 79-98, 30 figs, 1 table.

Laser tomography is a non-destructive method to visualize light scattering centres of sub-micron size and associated luminescence in nearly perfect transparent single crystals. The method was designed by Moriya and Ogawa (1983), and can visualize distribution of laser scattering centres in transparent crystals by scanning laser beams and recording the image on photographic film. The method was applied to many gem quality samples of natural, synthetic and heat-enhanced corundum. It was possible to obtain information relating to distribution of impurities, growth sectors, dislocations in these crystals, both rough and cut stones. Flux-grown, hydrothermally grown, and melt-phase grown (Verneuil, CZ, FZ) synthetic rubies, overgrowth rubies, and heat-enhanced rubies show respectively different characteristic laser tomographs. Also sapphire from Kashmir exhibits different tomographs from those of other localities. Heat-enhanced sapphires give diagnostically different features from non-enhanced sapphires. It was demonstrated that laser beam tomography is a powerful new method in gem identification. I.S.

La tracabilité des émeraudes: une avancée décisive obtenue par microscopie infrarouge.

A. CHEILLETZ, P. DE DONATO AND O. BARRÈS. *Revue de Gemmologie*, 141/142, 2001, 181-3.

Microscopy in the IR region with Fourier transforms has been found useful in the determination of the nature and locality information of emerald. Examples and background are discussed. M.O'D.

Synthetics and Simulants

Growth of high pressure synthetic diamonds.

H. KANDA. *Journal of the Gemmological Society of Japan*, **20**(1-4), 1999, 37-46, 6 figs.

HPHT synthesis of large size, gem-quality diamonds, and colour control of synthetic diamonds are summarized. HPHT growth technique has been highly improved to produce 30 ct diamonds of type II. Yellow, blue, green and brown coloured diamonds have also been obtained. The colour depends on composition of the alloy used as solvent and on the growth temperature. The colours are changed by annealing. I.S

Gemmologie Aktuell.

C.C. MILISENDA. *Gemmologie. Z. Dt. Gemmol. Ges.*, **50** (1), 2001, 1-4, 6 photographs.

Samples of hydrothermally grown synthetic corundum from Russia were blue, red, purplish-blue, bluish-green and yellow. A transparent eye-clean faceted stone was offered as sapphire but was shown to be CZ. E.S.

Gem Trade Lab notes.

T.M. MOSES, S.F. MCCLURE AND M.L. JOHNSON (EDS). *Gems & Gemology*, **37**(1), 2001, 56-63.

Items noted include a 3 ct synthetic apatite (with appreciable Nd) showing a colour change from purple-pink in incandescent light to violet-blue in fluorescent light and a bangle of quartzite dyed three colours to imitate jadeite. R.A.H.

Quartz α SiO_2: discrimination des améthystes et des citrines naturelles et synthétiques.

F. NOTARI, P-Y. BOILLAT AND C. GROBON. *Revue de gemmologie*, 141/142, 75-80, 2001.

While IR methods will distinguish amethyst and citrine grown on flat seeds they cannot be used when growth takes place upon a crystal of natural habit. Use of the microscope to interpret interference patterns remains the best method of detection: techniques are described and illustrated. M.O'D.

Hydrothermal synthetic red beryl from the Institute of Crystallography, Moscow.

J.E. SHIGLEY, S.F. MCCLURE, J.E. COLE, J.I. KOIVULA, T. LU, S. ELEN AND L.N. DEMIANETS. *Gems & Gemology*, **37**(1), 2001, 42-55.

Hydrothermal red beryl has been synthesized for use in jewellery by the Institute of Crystallography and Encom Ltd., both in Moscow. Diagnostic features include a tabular crystal morphology, chevron-like and sub-parallel or slightly wavy internal growth zoning, sharp absorption bands at ~ 530, 545, 560, 570 and 590 nm due to Co^{2+}, water-related absorption bands between 4200 and 3200 cm^{-1} in the IR spectrum, and the presence of Co and Ni peaks in EDXRF spectra. These red beryls have ε (purplish-red) 1.569-1.573, ω (orange-red to orange-brown) 1.576-1.580; SG 2.67-2.70; electron microprobe analyses are given for three samples. R.A.H.

Disclosure – gemstones and synthetics.

TAY THYE SUN. *Australian Gemmologist*, **21**(2), 2001, 67-75, 15 illus. in colour.

The worldwide gemstone and jewellery industries are becoming increasingly aware of the importance of appropriate disclosure of the true nature of synthetics, value-enhanced gemstones and imitations to purchasers of these materials. In this paper the author discusses the relevance of such disclosure to the economic survival of the gemstone and jewellery business, and as an example of modern gemstone treatment focuses on A-, B-, C- and B+C- jade. Although advanced instrumentation, such as FTIR spectroscopy, is generally considered essential for positive identification of these materials, practical advice is offered on some basic observations which can be used to recognize these treated jadeite jades. P.G.R.

Formation and quality of pearls.

K. WADA. *Journal of the Gemmological Society of Japan*, **20**(1-4), 1999, 47-62, 23 figs.

Based on optical and electron microscopic observations on microtextures of iridescent and non-iridescent pearls (natural and cultivated pearls formed by the family *Pteriidae*, Conch Pearl formed by sea-water gastropod *Strombus gigas*, Calm pearl produced by the calm and the short necked calm, etc.), the kind and quality of pearls are classified into several types depending on the microtextures, components and formation. The quantities of cultured pearls are systematically analyzed based on the surface and body colour, thickness of nacreous layer, flaws, shape and size. The biological function and regulation applied to control the pearl quality are discussed to help the evolution of technological studies in controlling the quality of cultured pearls. I.S.

Russian colourless synthetic diamond.

J.C.C. YUAN. *Australian Gemmologist*, **20**(12), 2000, 529-33, 13 illus., 1 table.

Since January 1999, Russian-made gem-quality colourless to near colourless synthetic diamonds have been available on the US market at prices more than double that of natural diamond. These type IIa diamonds have identifying metallic inclusions, are magnetic and display SWUV luminescence and phosphorescence which differs from that of natural diamonds. Images from the De Beers DiamondView instrument are also diagnostic for these synthetic diamonds. It is believed that as the 'split sphere' synthesis technology used in Russian factories (or in factories licensed to use this technology outside Russia) becomes more productive and cost effective, the colourless synthetic diamond will eventually be in a position to compete against the natural diamond. P.G.R.

Characterization of a new Chinese hydrothermally grown emerald.

C. ZHENQIANG, Z. JILANG, C. KEQIN, Z. CHANGLONG AND Z. WEINING. *Australian Gemmologist*, **21**(2), 2001, 62-6, 3 illus. (two in colour), 2 tables.

Five sample emerald crystals of a new hydrothermal type synthesised by the Gemological Institute of Guangxi in the People's Republic of China were evaluated in this report for their gemmological, chemical and spectroscopic characteristics. Common diagnostic features of the new synthetic included a strong reaction under the Chelsea colour filter, a moderate red LW UV fluorescence and a much lower chlorine and higher alkali element content. P.G.R.

Ammolite 2. A guide for gemmologists, jewellers and lapidaries.

D. Barnson, 2000. The author, P O Box 179, Selkirk, Manitoba, Canada. pp 116, illus. in colour, softcover. ISBN 0 9688580 0 7. Price on application.

Ammolite has gained in popularity from its first appearance in the late 1970s. In 1981 it was recognised as a gemstone by CIBJO and the various names originally proposed for it have now, fortunately, been subsumed into ammolite. This second extensive and well-illustrated text gives a history of its discovery and of the realisation that it has considerable gem potential. Various types and localities are described and there are useful notes on fashioning what can prove to be quite a difficult material which does, however, easily lend itself to use in composites, as in opal. There are short notes on identification (though ammolite, once seen, is very distinctive), high-quality pictures of the play of colour seen under magnification (the use of colour throughout the book is excellent), notes on colour grading, a glossary and a bibliography. This is a very attractive book and seems likely to become the standard work on ammolite for the foreseeable future. M.O'D.

The Mineralogical record index, volumes I-XXV, 1970-1994.

E.L. Clopton and W.E. Wilson (Eds), 1996. The Record, Tucson. pp 312, hardcover. Price on application.

Five-year author/title index to vols 26-30, 1995-1999 [Comprises pp 119-134 of vol.. 31] issued as separate pamphlet.

In 1985 the Friends of Mineralogy, an independent non-profit organization, published an index to volumes 1-14 of *The Mineralogical record* which, apart from binding problems and some awkwardness of structure, has served well up to the present. Information in the new index is divided between author/title and general/subject sections, with full bibliographic details given in the author/title section. Searching is by keyword taken from the titles, making it easy for the searcher to find the complete citation. Adoption of the new structure made re-editing of the previous 10-year index and additional material in the same form necessary. There will be no further indexes cumulative back to volume 1: the next indexing project is expected to cover volumes 26-35. For this reason the present index is strongly bound with sewn rather than glued pages.

Readers will find considerable pleasure and much useful information in just leafing through the index, whose print run is said to be small. M.O'D.

Mineralogy of Maine. Volume 2: mining history, gems and geology.

T.V. King (Ed.), 2000. Augusta, ME 04333: Maine Department of Conservation, Maine Geological Survey, Station #22. pp vi, 524, illus. in black-and-white and in colour, hardcover. US $50

This is the second volume of *Mineralogy of Maine*, the first one having been published in 1994 (reviewed in *J.Gemm.* 1996, **25**(3), 241), edited by King and the now sadly late Eugene E Foord. This is described in the present book as a greatly expanded species-localities checklist. The Maine Department of Conservation deserves the warmest thanks of all connected with the minerals and gemstones of the State for persisting with this publication, whose richness mirrors that of the minerals described. This should be the ideal for all area surveys.

In the words of the editor, this book attempts to give a wider picture of Maine's minerals. In succeeding in this aim, several authors have been called into service and tables of other contributors show how great has been the interest in one of the most important mineralized areas of the United States. The book starts with geological history, describes the five recorded meteorites and then begins on the select history of Maine mining and minerals which begins in the 17th century and continues to the present day. In the course of the account, which extends over approximately 240 pages there are many references both to geologists and others prominent within the state and to workers of world stature. In this way the reader can learn a great deal of general mineralogical history as well as the more local events and occurrences. During this section details of many important publications are also given.

The Maine Geological Survey and its work are described next, by the present State Geologist and this section is followed by an account of the gem-cutting machine devised by Loren B. Merrill and then by three sections, each with very great gem importance, describing Mount Mica in 1964 and 1965, the Newry tourmaline discovery of 1972 and extracts from a diary kept by a miner at the Dunton mine. For the reader's information, all three locations are celebrated for their tourmaline, though the state also produces fine garnet, purple apatite, morganite and beryl.

A chapter by John Marshall deals with the gemstones of Maine, photographs of which appear in the colour section immediately following. Later chapters include Maine literature for the collector, a Maine mineral locality list and Addenda to the mineralogy described in the first volume of 1994. A section of black-and-white photographs and an index complete the book

I cannot imagine this work being equalled let alone surpassed by work in any other of the world's great mineral locations. To possess such a survey for a major gem-producing area is a bonus and the book can be picked up and consulted at any time for general reading while containing everything needed for strict scientific evaluation of the minerals encountered. The price is amazingly reasonable and the standard of the production high without being exotic. The lists of references are a

 ISSN: 1355–4565

model of their kind and the photographs show the distinctive colours of Maine tourmaline. The maps in the mineral locality section are easy to read and scattered through the texts are advertisements for machines and other mining equipment from the early days. M.O'D.

Mogôk – Valley of rubies and sapphires.

T. Themelis. 2000. A & T Publishing, Los Angeles. pp 270, illus. in colour, hardcover. £79.00.

In a profusely-illustrated study the author presents the Mogôk area of Burma, beginning with notes on the pre-history and history of the country as a whole and passing on to the gradual establishment of communities and local rulers by the middle of the tenth century. Established fact is mixed with fable and the whole account presented in a readable and lively way. The reigns of the chiefs and sovereigns from 1044-1287 and the establishment of British rule in Burma began to coincide with the development of ruby mining by the nineteenth century and a number of authorities are cited: photographs of early mining scenes and of documents are very attractively inserted into the text at the appropriate places and there are also reproductions of relevant maps.

The historical account takes the reader up to 2000 when, the author tells us, up to 1200 ruby mining sites were in operation in Mogôk, which town is now introduced on page 83. There is a good deal of physical and commercial geographical and local historical detail here and chapters 3 and 4 introduce us to the people of the region with their ethnic origin, religion, customs and folk-lore recounted. The fifth chapter discusses the commercial aspect of gemstones and there is a good deal of interesting history of how the stones are traded: as in the previous chapters photographs, newspaper cuttings and text are pleasingly intermingled. The work of the Mogôk lapidaries is described in chapter 6 and notable Mogôk rubies and sapphires in the following chapter. The specimens are very well illustrated with what appear to be accurate colour rendering: named rubies and some sapphires are listed with their history and present whereabouts where known. Chapter 8 gives details of the Burmese court regalia and the final chapter deals with jewellery and jewelled artefacts made in the area and set with the local stones.

A selected bibliography includes welcome citations of East India Company documents (now held in the British Library) as well as most other relevant monographs and papers. The two important works by Harbans Lal Chhibber, *The mineral resources of Burma, 1934 (Sinkankas #1280)* and *The geology of Burma* (1934) and one by Bender, *Geology of Burma* (1983) [with a very large and scholarly bibliography] could well be added to any future edition, though the present work is not intended as a scientific study.

It is, however, an admirable introduction to a fascinating area with pleasures on every page. M.O'D.

Colour and the optical properties of materials.

R. Tilley, 2000. John Wiley & Sons Ltd, Chichester. pp xii, 335, illus. in colour, softcover. ISBN 0 471 85198 1. £24.95.

A useful and well-produced book which can be read alongside Nassau: *The physics and chemistry of color* (1983). While gemstones are covered briefly in the text, with plentiful opportunities for complexity and hard thought on the part of the reader, the book is arranged into 13 chapters in which considerations of colour in many wider contexts are provided. The first chapters cover the nature of light and colour, refraction and dispersion, crystals and light, the production of colour by reflection, colour due to scattering and to diffraction, from atoms, ions and molecules and from charge transfer and luminescence. The reader can then proceed to discussion of metals, semiconductors and insulators (this chapter includes band theory), fibre optics and data transmission, displays (cathodoluminescence is here) and finally lasers and holograms.

Chapters include problems and exercises (with answers to the numerical ones at the back) and each chapter has a very short list of references. There are some attractive colour plates and the colour of red wine is introduced in the chapter dealing with colour from molecules.The print is very easy to read and the price reasonable for a stimulating work. M.O'D.

Proceedings of the Gemmological Association and Gem Testing Laboratory of Great Britain and Notices

AWARD

At the Inter/Micro-2001 Conference and SMSI Awards Banquet held at the Knickerbocker Hotel, Chicago, on 27 June 2001, **Dr Jamie Nelson** (GA Research Diploma) received the August Köehler Medal Award of the State Microscopical Society of Illinois for 'Outstanding contributions to microscopy'. On the following day Dr Nelson presented a lecture to the conference entitled 'A Raman spectra database and its application to gemmological science' and a talk on 'The microscopy of gemstones'.

GEM-A OPEN DAYS

On 15 August at the Gem Tutorial Centre, 27 Greville Street, London EC1N 8TN, an Open Day was held which included displays and hands-on gem sessions. A report was published in the September issue of *Gem & Jewellery News*. A Gem-A open day was also held in Birmingham on 22 August.

ANNUAL GENERAL MEETING

The Annual General Meeting of Gem-A was held on Monday 25 June 2001 at 27 Greville Street, London EC1N 8TN. Jeffrey Monnickendam chaired the meeting and welcomed those present. The Annual Report and Accounts were approved.

Terry Davidson, Michael O'Donoghue and Ian Thomson were re-elected and Jean-Paul van Doren elected to the Council of Management. Dr Tony Allnutt, Sally Everitt, Brian Jackson and Peter Wates were re-elected and Sheila Burgoyne elected to the Members' Council. Amanda Good did not seek re-election. After lengthy discussion regarding the remit of the Members' Council and a possible conflict of interests, the nomination of Laurent Kellerson for election to the Members' Council was not approved. However, the establishment of a group to consider members' and educational matters was discussed. Hazlems Fenton were re-appointed auditors.

Following the Annual General Meeting, a Reunion of Members and Bring and Buy Sale were held, at which winners of the 2001 Photographic competition were announced. During the evening Gem-A, the new image for the GAGTL, was launched.

GEM DIAMOND EXAMINATION

In the Gem Diamond Examination held in June 2001, 97 candidates sat of whom 65 qualified, including six with Distinction and eight with Merit.

The **Deeks Diamond Prize** for the best candidate of the year in the Gem Diamond Examinations has been awarded to Allyson Thomas of Birmingham, West Midlands.

The Bruton Medal has not been awarded

The names of the successful candidates are listed below:

Diploma

Qualified with Distinction

Dines, Rachel S., North Dulwich, London
Kai Wang, Wuhan. P.R. China

 ISSN: 1355–4565

FORTHCOMING EVENTS

26 October	**Midlands Branch**. *Beautiful opals, Australia's national gemstone.* JOHN WHEELER
4 November	**Gem-A CONFERENCE 2001. Barbican Conference Centre, London** *Keynote speaker:* GEORGE BOSSHART, **Gübelin Gem Lab, Lucerne** Further details are given on p. 460
5 November	**London**. *Presentation of Awards and Reunions of Members*
20 November	**Scottish Branch**. *Jade.* ROSAMOND CLAYTON
21 November	**London**. *Analysis of precious stones under thick glass by Mobile Raman Microscopy (MRM) and Compositions of jade and garnets by non-destructive Raman Microscopy.* PROFESSOR DAVID SMITH
21 November	**North West Branch**. *AGM and social evening*
25 November	**South West Branch**. *Everything included.* DOUG GARROD *Pearls of Wisdom.* MARCUS MCCALLUM
30 November	**Midlands Branch**. *Wonderful emeralds.* ALAN HODGKINSON
6 December	**London**. *The literature of gemstones.* MICHAEL O'DONOGHUE
8 December	**Midlands Branch**. *Annual Dinner, 49th year*
9 January	**London**. *An orgy of organic gem materials.* E. ALAN JOBBINS
25 January	**Midlands Branch**. *Gemmology quiz and Bring & Buy*
22 February	**Midlands Branch**. *An orgy of organics.* E. ALAN JOBBINS

Midlands Branch

A day in celebration of fifty years of gemmology

A one-day conference, including celebration lunch, to be held on Sunday 24 February at Barnt Green near Birmingham

Speakers will include:

PROFESSOR DR HENRY HÄNNI

E. ALAN JOBBINS

IAN MERCER

For further information contact Gwyn Green (details below)

Contact details

(when using e-mail, please give Gem-A as the subject):

London:	Mary Burland on 020 7404 3334 e-mail: gagtl@btinternet.com
Midlands Branch:	Gwyn Green on 0121 445 5359 e-mail: gwyn.green@usa.net
North West Branch:	Deanna Brady on 0151 648 4266
Scottish Branch:	Catriona McInnes on 0131 667 2199 e-mail: cm@scotgem.demon.co.uk
South West Branch:	Bronwen Harman on 01225 482188 e-mail: bharman@harmanb.freeserve.co.uk

Gem-A WEB SITE

For up-to-the-minute informatin on Gem-A events visit our web site on www.gagtl.ac.uk

GIFTS TO THE ASSOCIATION

The Association is most grateful to the following for their gifts for research and teaching purposes:

Argos Ltd, Milton Keynes, for nine CZ-set rings.

Paul R. Cassarino, Rochester, NY, U.S.A., for a set of original GA course notes from the 1950s for the Association's archives.

Jane Kalischer, Finchley, London, for a marble carving and collection of gem-set jewellery.

Kyaw Khaing Win, Myanmar, for an aquamarine crystal from Thitseintkone mine, Myanmar.

Dian Packer, London, for three pieces of nephrite and a piece of margarite.

Preseli Bluestone Ltd, Pembrokeshire, Wales, for cabochons and rings of Preseli bluestone.

Christopher Tarratt, of George Tarratt, Stoneygate, Leicestershire, for a Tully refractometer in its original box also containing the instructions.

Thomson Gems, London, for a group of fire opals.

Osbourne-Shaw, Lisa M., London
Price, Sharron, Halesowen, West Midlands
Ruckel, Daphne, London
Speake, Malcolm, F., Ladywood, Birmingham, West Midlands

Qualified with Merit

Ankama, Silvester Kwabena, London
Frodin, Peter John, West Kirby, Merseyside
Greenfield, Dawn, Eynsford, Kent
Hackett, Helen, Market Harborough, Leicestershire
Jiahua Tian, Wuhan, P.R. China
Thiel, Miriam, Ealing, London
Yao Wang, Wuhan, P.R. China
Wu Weijuan, Beijing, P.R. China

Qualified

Alderman, Chris, Guildford, Surrey
Amarasinghe, Ashan Sudeera, Colombo, Sri Lanka
Bakri, Dalilah A., London
Barwuah, Maximus A., Clapham, London
Bordbar, Hossein Jean-Louis, London
Bourke, Mary, Enniscorthy, Co. Wexford, Ireland
Browning, Matthew, Brighton, East Sussex
Chu Xiao, Beijing, P.R. China
Daramy, Soulaiman B., London
Darby, Iain, Birmingham, West Midlands
Day, Glen, Redditch, Worcestershire
Dowling, Siobhan L., Canary Wharf, London
Farrer, Alison Mary, Stonehouse, Gloucestershire
Gan, Shaojun, Beijing, P.R. China
Ge Lin, Beijing, P.R. China
Gouros, Artemis, Coulsdon, Surrey
Hellstenius, Gabriella, Fulham, London
Hicks, Suzanne Carole, Yardley, Birmingham, West Midlands
Holdsworth, Isabel, Surbiton, Surrey
Jia Liu, Wuhan, P.R. China
Ju Ye, Beijing, P.R. China
Junwen Huang, Wuhan, P.R. China
Khurana, Ruma, Kenton, Harrow, Middlesex
Koundouraki, Evagelia, Katerini, Greece
Lawrence, Kerry, London
Li Nan, Beijing, P.R. China
Li Xiaobo, Beijing, P.R. China
Lin Xinhao, Beijing, P.R. China
Lin Yan, Beijing, P.R. China
Loe Su-Mon, Taipei, Taiwan, R.O. China
Morris, Celia J.W., Nuneaton, Warwickshire
Ndemumana, Zarina K.C., London
O'Connor, David William, Birmingham, West Midlands
Pecku, George Otu, London
Powell, Diane E, Birmingham, West Midlands
Rockman, Gary, Bromley, Kent
Rogers, Emily Irene, London
Rupo Su, Wuhan, P.R. China
Shen, Tingting, Beijing, P.R. China
Siddiqui, Farah, Golders Green, London
Sidiropoulou, Maria-Theresa, Thessaloniki, Greece
Sinnamon, Sonya, Co. Wicklow, Ireland
Smith, Alan J., Bethnal Green, London
Smith, Eloise, Stratford-upon-Avon, Warwickshire
Teramae, Ikumi, Greenford, Middlesex
Wang Xu, Beijing, P.R. China
Wen Lin, Wuhan, P.R. China
Xiaojie Zhu, Wuhan, P.R. China
Xuemei Du, Wuhan, P.R. China
Yun Jing Wen, London
Zhou Fan, Beijing, P.R. China

EXAMINATIONS IN GEMMOLOGY

In the Examination in Gemmology held worldwide in June 2001, 195 candidates sat the Diploma Examination of whom 82 qualified, including two with Distinction and nine with Merit. In the Preliminary Examination, 168 candidates sat of whom 126 qualified.

The **Anderson Bank Prize** for the best non-trade candidate of the year in the Diploma Examination has been awarded to Dong Lan, Wuhan, Hubei, P.R. China.

The **Christie's Prize for Gemmology** for the best candidate of the year in the Diploma Examination who derives his/her main income from activities essentially connected with the jewellery trade has been awarded to Ian Sipson, Trowbridge, Wiltshire.

The **Anderson Medal** for the best candidate of the year in the Preliminary Examination has been awarded to Patricia Wong Bick San, Hong Kong.

The **Preliminary Trade Prize** for the best candidate of the year who derives his/her main income from activities essentially connected with the jewellery trade has been awarded to Karen McKinley, Abington, Northampton.

The Tully Medal has not been awarded.

The names of the successful candidates are listed below:

Diploma

Qualified with Distinction

Bangert, Julie C., West Kensington, London
Sipson, Ian, Trowbridge, Wiltshire

Qualified with Merit

Bi Yu Liang, Guilin, P.R. China
Cao Yuan, Guilin, P.R. China
Huang Zhan, Guilin, P.R. China
Jung Hee An, Jeollanam-Do, Korea
Moltke, Nicholas D., Klamenborg, Denmark
Ning Liu, Wuhan, P.R. China
Warner, Rachel Fleur, Reading, Berkshire
Woo Ha Na, Jeollanam-Do, Korea
Ying Zhou, Wuhan, P.R. China

Qualified

Abu-Nassr, Mohammed-Maher, Toronto, Ontario, Canada
Al-Turki, Nohad, London
Amliwala, Panna, Solihull, West Midlands
Barber, Emily Anne, London
Biuokzadeh, Hossein, Toronto, Ontario, Canada
Bolter, Rachel Louise, Swindon, Wiltshire
Borruso, Alessandro, Harrow, Middlesex
Chater, Melanie Dawn, Northampton
Chen Mei Ling, Guilin, P.R. China
Chen Yu-Ting, London
Cruse, Toby, Eastbourne, East Sussex
Dimmick, Helen Margaret, London
Downes, Lisa, Birmingham, West Midlands
Eensaar, Karin, Tallinn, Estonia
Elder, Maureen, Vancouver, B.C., Canada
Epa, W. S. Damayanthi, Colombo, Sri Lanka
Goyal, Neha, Coimbatore, India
Gregory, Kerry Honor, Newport, Wales
Greig, Davina R., London
Ha Na Ho, Jeollanam-Do, Korea
Hassan, Fatima Chamade, London
Honda, Hiroya, Tokyo, Japan
Hoshino, Takako, Vancouver, B.C., Canada
Howard, Avrom Eric, Toronto, Ontario, Canada
Htun Ngwe Lin, Yangon, Myanmar
Jang, Shinkuk, London
Jogia, Sushila Das, Vancouver, B.C., Canada
Kakehashi, Kotaro, Nagoya, Japan
Ke Zhou, Shanghai, P.R. China
Kobayahi, Hiromi, London
Kumagai, Hiromi, Sendai City, Miyagi Pref. Japan
Kumagai, Jiro, Tokyo., Japan
Li Sang, Wuhan, P.R. China
Liao Wei-Ching, Ping Tong, Taiwain, R.O. China
Llinares, Luis, Geneva, Switzerland
Manaka, Yuji, Kashiwa Cty, Chiba pref., Japan
Mariani, Geoffry, M., Toronto, Ontario, Canada
Miyazaki, Tomohiko, Takarazuka City, Hyogo Pref., Japan
Mo Bina, Shanghai, P.R. China
Morrish, Rachel, Birmingham, West Midlands
Nakagawa, Eriko, Sapporo, Hokkaido, Japan
Ngo Minh-Si, Toronto,Ontario, Canada
Ning Haibo, Guilin, P.R. China
Ok Min Suk, Jeollanam-Do, Korea
Orimo Taeko, Maebashi City, Gunma Pref., Japan
Pace, Howard Michael, Eccleshall, Stafford
Pala, Sunil, Coventry, West Midlands
Ren Qin, Shanghai, P.R. China
Renming, Shen, Wuhan, P.R. China
Salukvadze, Iamze, Dubai, U.A.E.
Sasaki Takako, Hirakata City, Osaka, Japan
Smith, Dana, Port Perry, Ontario, Canada
Song Ping, Guilin, P.R. China
Sutton, Collette Stefania, Solihull, West Midlands
Takayama, Rie, Itabashi-ku, Tokyo, Japan
Thouvenot-Villie, Fabienne, London
Tominaga, Masami, London
Trudel-DeCelles, Maureen, Hudson, Quebec, Canada
Wong Vina, Hong Kong

Woodring, Sharrie R., New Jersey, U.S.A.
Xianlong Sun, Wuhan, P.R. China
Xie Kefei, Shanghai, P.R. China
Xuhua Gu, Wuhan, P.R. China
Yang Na, Guilin, P.R. China
Ying Liu, Wuhan, P.R. China
Yorke, Anabel, London
Yoshida, Sachiyo, Osaka City, Osaka, Japan
Zhong Lin, Guilin, P.R. China
Zhou Songsong, Shanghai, P.R. China
Zhu Haijing, Shanghai, P.R. China
Zuo Xin Mo, Guilin, P.R. China

Preliminary

Qualified

Ahde, Petra, Lahti, Finland
Anders, Cynthia Lorette, Koog Aan De Zaan, The Netherlands
Argyrou, Anastasia, Athens, Greece
Asano, Yoko, Gifu Pref., Japan
Au Kai Leung, Albert, Hong Kong
Aubert, Rebecca, London
Aung, Toe, Yangon, Myanmar
Bai, Yunlong, Guilin, P.R. China
Bennett, Martin, Sherfield English, Hampshire
Bjorklund, Niina Carita, Helsinki, Finland
Brady, John Joseph, Swadlincote, Derbyshire
Bryant, Helen, Lantau, Hong Kong
Chan May Kuen, Hong Kong
Chan Chi Kin, Hong Kong
Chan Miu Ching, Lavinia, Hong Kong
Cheng Wai Yee, Hong Kong
Cherchi, Sonia, Horgen, Switzerland
Cheung Fung Wan, Hong Kong
Cheung Pui Lai May, Hong Kong
Choi Jung-Hae, Daejon, Korea
Chow Ching Yee, Hong Kong
Chung Yee Donna, Hong Kong
Clark, Darel James, Farnham, Surrey
Clark, Alice Hald, Sandnes, Norway
Clarke, Julia, London
Conejero, Jennifer Helen, Boston, Lincolnshire
Danks, James, Geoffrey, Dudley, West Midlands
Dawson, Jane Marie, Codsall, Wolverhampton, West Midlands
Deligiannis, Marios, Athens, Greece
Duff, Sara Margaret, Banbridge, Co. Down, N. Ireland
Eastwood-Barzdo, Elizabeth Louise, Vinzel, Switzerland
El, Thida, Yangon, Myanmar
Epelboym, Marina, New York, U.S.A.
Fagelund-Gjersoe, Sandra, London
Falnes, Lene, Hafrsfjord, Norway
Firth, Richard Anthony, London
Fisher, Fiona Jane, Dublin, Ireland
Fujimoto, Akiko, Yamanashi Pref., Japan
Furze, Cindy, Cheshunt, Hertfordshire
Gandusio, SU.S.A.nna, Lugano, Switzerland
Gaskin, Hans Dominic, London
Gerenstein, Helen, Stockholm, Sweden
Grieve, Sharon, Barwell, Leicestershire
Grigoraki, Christianna, Athens, Greece
Htun Su Su, Yangon, Myanmar
Hui Chau Ming, Hong Kong
Hussain, Arshid, Birmingham, West Midlands
Ishida, Kohei, Wakayama Pref., Japan
Jappinen, Virpi, Turku, Finland
Jenakom, Pimmas, Bangkok, Thailand
Jiang Linhui, Guilin, P.R. China
Kakehashi, Kotaro, Nagoya, Japan
Kwok Nai Chiu, Hong Kong
Kwok Hei, Hong Kong
Lai Pui Sha,n Peggy, Hong Kong
Landolf-Csizmas, Zsuzsanna, Zurich, Switzerland
Lau Kam Yin, Mabel, Hong Kong
Lee Hin Chi, Hong Kong
Lee Man Wah, Hong Kong
Leung Wai Yue, Winnie, Hong Kong
Li Yikuang, Guilin, P.R. China
Li Yuet Yau, Hong Kong
Lo Ka Lok Carold, Hong Kong
Loong Suk Ming, Hong Kong
Maeland, Egil, Sandnes, Norway
Mak Sio In, Hong Kong
Mak Kin Yeung, Kenny, Hong Kong
Malinowska, Rossita, Beckenham, Kent
Marlow, Carol, Sutton Coldfield, West Midlands
Mathiesen, Lisbeth Susanne, Kobenhavn, Denmark
McKinley, Karen, Abington, Northampton
Mo Bixun, Shanghai, P.R. China
Moger, Adam, Huntingdon
Nakagawa, Miho, Hyogo Pref., Japan
Nessi, Veroniki, Athens, Greece
Ng, Wing Yee, Winnie, Hong Kong
Ng, Wai Ling, Hong Kong
O'Leary, Dominique, London
Oh, Minkyung, London
Pavaro, Thitintharee, Bangkok, Thailand
Phillips, Paul, Nuneaton, Warwickshire
Preston, Anne Victoria Rhodes, London
Randawa, Sukhwant Singh, Otford, Kent
Rantanen, Ari-Pekka, Hameenlinna, Finland
Rintanalert, Porntip, Bangkok, Thailand
Rolph, Liz, Corringham, Essex
Roy, Maryse, Montreal, Quebec, Canada
Sakkaravej, Somruedee, Nonthaburi, Thailand
Sancheti, Amishaa, Indore, India
Sanchez, Sierra Maria Fernanda, London
Sideras, Despina Nicole, Nairobi, Kenya
Sikanen, Essi Maarit, Lahti, Finland

Smith, Anna, Pinner, Middlesex
Somboon, Chaniya, Bangkok, Thailand
Sun Jiexian, Shanghai, P.R. China
Suraseth, Peerapol, Bangkok, Thailand
Takala, Ville, Lannavaara, Sweden
Tam Cheuk Kuen, Hong Kong
Tangsubkul, Hiranya, Bangkok, Thailand
Tantisiriphaiboon, Yenrudee, Bangkok, Thailand
Tennekoon, Indrani, London
Thant, Zin Mar, Yangon, Myanmar
Thiel, Miriam, London
Thouvenot-Villie, Fabienne, London
Thu Latt Myat, Yangon, Myanmar
Tong Yung, Hong Kong
Tyrrell, Siobhan Ann, London
Uberoi, Tina, London
Ullal, Vidhya, Surat, India
Valvio, Raija Leila Maria, Jyvaskyla, Finland
Visitpanich, Theeraya, Chiang Mai, Thailand
Von Schantz, Casimir, Helsinki, Finland
Waelti, Nicole, Lenk, Switzerland
Westling, Jonny, Stockholm, Sweden
Whitehouse, Keith Percival, Stafford
Williams, Cara Marie, Jefferson City, Missouri, U.S.A.
Williams, Adrienne Victoria, London
Wong Bick San, Patricia, Hong Kong
Wong Yin Yan, Sandy, Hong Kong
Wong Lai Cheng, Hong Kong
Wong Tai-Wai, Hong Kong
Wu Mingyang, Shanghai, P.R. China
Xue Fuzhen, Luton, Bedfordshire
Yokokawa, Naomi, London
Yu Chung Wah, Hong Kong
Zar Aye Tin, Yangon, Myanmar

MEMBERSHIP

Between 29 June to 11 September 2001 the Council of Management approved the election to membership of the following:

Fellowship and Diamond Membership (FGA DGA)

Li Ding, Shenyang, P.R.China. 2001
Weston, Jonathan, Brierley Hill, West Midlands. 1988, 1989
Yihua Wu, Taipei Shiann, Taiwan, R.O. China. 2000

Fellowship (FGA)

Barber, Emily Anne, London. 2001
Berkowitz, Roza, Toronto, Ontario, Canada. 1974
Collier, Rowley W., Hornchurch, Essex. 1966
Corcoran, Moya Ann Marie, London. 2001
Croucher, Nicola, London. 2001
Gregory, Kerry Honor, Newport, Wales. 2001
Moe Moe Shwe, Banhan Township, Yangon, Myanmar. 2001
Molesworth, Helen, Rotherhithe, London. 2001
Naing Naing Oo, Latha Township, Yangon, Myanmar. 2001
Pace, Howard Michael, Eccleshall, Staffordshire. 2001
Pwint Phue Lwin, Yankin Township, Yangon, Myanmar. 2001
Sidiropoulou, Marie-Theresa, Panorama, Thessaloniki, Greece. 2001
Spencer, Jonathan Peter, Staple Hill, Bristol. 1986
Tominaga, Masami, London. 2001
Wasim, Baber, Gulshan-E-Iqbal, Karachi, Pakistan. 2001

Diamond Membership (DGA)

Ankama, Silvester Kwabena, Ilford, Essex. 2001
Day, Glen, Redditch, Worcestershire. 2001
Rogers, Emily Irene, Putney, London. 2001
Tsang, Jasmine, Kennedy Town, Hong Kong. 2001
Wong Man Kuen Purdet, Fanling, N.T., Hong Kong. 2001
Wong Shuk Ching, Hong Kong. 2001

Ordinary Membership

Adebowale, Rabiu Adedokun, Isleworth, Middlesex
Akintonde, Olubunmi, Plumstead, London
Berry, Susan, London
Bertrand, Sylvia, London
Choi, Daeshik, Sutton, Surrey
Clay, Robert Mossman, Islesteds, Dumfries, Scotland
Croukamp, Anna-Luise, Edinburgh, Scotland
Cuba, Grant, San Angelo, Texas, U.S.A.
Danks, James Geoffrey, Netherton, Dudley, West Midlands
De Lasteyrie du Saillant, Valentine, London
English, Bernard, Drogheda, Ireland
Grumitt, Peter, Tadworth, Surrey
Gurevich, Lina, Golders Green, London
Hakkaku, Tomoko, Kew, Surrey
Hall, Michael, Derby, Derbyshire
Hedenskog, Elin, Camberwell, London
Hornsleth, Henriette, Copenhagen, Denmark
Huish, Irene, Liverton, Newton Abbot, Devon
Kamani, Priscilla, Arkley, Barnet, Hertfordshire
Leader, Lucille, London
Longy, Bruno P.B., London
McKinley, Karen L., Abington, Northamptonshire
Man Chun Yin Christy, Windsor, Middlesex
Martin, Jennifer M., Padworth Common, Berkshire
Middle, Geoffrey Edward, Bangkok, Thailand
Rayatchi, Ali Reza, Finchley, London

Riley, Patricia, West Didsbury, Manchester
Rossi, Paola, El Fraile, Arona, Tenerife
Ruangrung, Thitima, Brighton, East Sussex
Sanghani, Kantilal, Elstree, Hertfordshire
Scarr, Graham, Stapleford, Nottingham
Selvamani, Parvathi, London
Sillitoe, Alvin F.J., London
Singh, Jaspal, Seven Kings, Ilford, Essex
Skinner, James, Ripley, Nr. Guildford, Surrey
Stinglhamber, Renata, Fulham, London
Strinati, Maria Aparecida, Kingston upon Thames, Surrey
Thein, Myint Myint, Willesden, London
Ukrainski, Krystof J., Fleet, Hampshire
Valia, Tulsi, London
Veraria, Dev, Bexley, Kent
Wenham, Diana Lesley, North Harrow, Middlesex
Whalley, Joanna, Walthamstow, London
Williams, Gail, Whitchurch, Cardiff
Wood, Valerie, Floral Park, New York, U.S.A.
Yanagihara, Satomi, London

TRANSFERS

Ordinary Membership to Fellowship (FGA)

Al-Turki, Nohad, London
Borruso, Alessandro, Harrow, Middlesex
Yu-Ting Chen, Taichung, Taiwan, R.O. China.
Eensaar, Karin, Tallinn, Estonia
Greig, Davina R., London
Honda, Hiroya, Tokyo, Japan
Jang, Shinkuk, Cambridge, Cambridgeshire
Kakehashi, Kotaro, Jyoto-Ku, Osaka, Japan
Kobayashi, Hiromi, London
Kumagai, Hiromi, Sendai City, Miyagi Pref., Japan
Kumagai, Jiro, Chuo-ku, Tokyo, Japan
Liao Wei-Ching, Ne Pu, Ping Tong, Taiwan, R.O. China
Llinares, Luis, Geneva, Switzerland
Manaka, Yuji, Kashiwa City, Chiba Pref., Japan
Miyazaki, Tomohiko, Takarazuka City, Hyogo Pref., Japan
Nakagawa, Eriko, Sapporo, Hokkaido, Japan
Orimo, Taeko, Maebashi City, Gunma Pref., Japan
Salukvadze, Iamze, Dubai, United Arab Emirates
Sasaki, Takako, Hirakata City, Osaka, Japan
Sutton, Collette S., Solihull, West Midlands
Takayama, Rie, Itabashi-ku, Tokyo, Japan
Warner, Rachel F., Reading, Berkshire
Yoshida, Sachiyo, Osaka City, Osaka, Japan

SUBSCRIPTIONS 2002

The following are the membership subscription rates for 2002. Existing Fellows, Diamond Members and Ordinary Members will be entitled to a £5.00 discount for subscriptions paid before 31 January 2002.

	Fellows, Diamond Members and Ordinary Members	*Laboratory Members*
UK	£64.00	£250.00 plus VAT
Europe	£70.00	£250.00
Overseas	£75.00	£250.00

Ordinary Membership to Diamond Membership (DGA)

Bakri, Di, London
Barwuah, Max, London
Bordbar, Jean-Louis H., London
Daramy, Soulaiman B., Colindale, London
Gouros, Arte, Coulsdon, Surrey
Hellstenius, Gabriella, Fulham, London
Khurana, Ruma, Kenton, Harrow, Middlesex
Siddiqui, Farah, Golders Green, London
Smith, Alan J., Bethnal Green, London
Thiel, Miriam, Ealing, London
Yun Jing Wen, London

Diamond Membership to Fellowship and Diamond Membership (FGA DGA)

Bangert, Julie C., West Kensington, London
Cruse, Toby, Eastbourne , East Sussex
Moltke, Nicholas D., Klamenborg, Denmark
Pala, Sunil, Coventry, West Midlands
Fellowship to Fellowship and Diamond Membership (FGA DGA)
Bourke, Mary, Enniscorthy, County Wexford, Ireland
Dines, Rachel S., North Dulwich, London
Dowling, Siobhan L., Canary Wharf, London
Farrer, Alison M., Nympsfield, Stonehouse, Gloucestershire
Frodin, P.J., West Kirby, Wirral, Merseyside
Greenfield, Dawn M., Eynford, Kent
Hicks, Suzanne C., Yardley, Birmingham
Loe Su-Mon, Taipei, Taiwan, R.O. China
Morris, Celia J.W., Nuneaton, Warwickshire

Osborne-Shaw, Lisa M., London
Price, Sharron A., Halesowen, West Midlands
Rockman, Gary, Bromley, Kent
Sidiropoulou, Maria-Theresa, Panorama, Thessaloniki, Greece
Speake, Malcolm F., Ladywood, Birmingham
Teramae, Ikumi, Greenford, Middlesex

ISLAND OF GEMS

An exhibition of the gems and gem industry of Sri Lanka is to be held on 17 and 18 November 2001 at the Resource Centre, 356 Holloway Road, London N7 6PA. The exhibition will be divided into five units which include geology, the mining and cutting of gemstones, jewellery and education. During the exhibition there will be demonstrations of gem cutting and gem testing.

The entrance fee, which includes a souvenir brochure and a sample gemstone, is £3.00. Accompanied children under 12 years of age will be admitted free of charge.

For further details contact Don Ariyaratna on 020 8807 8252; e-mail sri@lankagems.freeserve.co.uk; website: www.lankagems.co.uk.

Guide to the preparation of typescripts for publication in *The Journal of Gemmology*

The Editor is glad to consider original articles shedding new light on subjects of gemmological interest for publication in *The Journal*. Articles are not normally accepted which have already been published elsewhere in English, and an article is accepted only on the understanding that (1) full information as to any previous publication (whether in English or another language) has been given, (2) it is not under consideration for publication elsewhere and (3) it will not be published elsewhere without the consent of the Editor.

Typescripts Two copies of all papers should be submitted on A4 paper (or USA equivalent) to the Editor. Typescripts should be double spaced with margins of at least 25 mm. They should be set out in the manner of recent issues of *The Journal* and in conformity with the information set out below. Papers may be of any length, but long papers of more than 10 000 words (unless capable of division into parts or of exceptional importance) are unlikely to be acceptable, whereas a short paper of 400–500 words may achieve early publication.

The abstract, references, notes, captions and tables should be typed double spaced on separate sheets.

Title page The title should be as brief as is consistent with clear indication of the content of the paper. It should be followed by the names (with initials) of the authors and by their addresses.

Abstract A short abstract of 50-100 words is required.

Key Words Up to six key words indicating the subject matter of the article should be supplied.

Headings In all headings only the first letter and proper names are capitalized.

A **This is a first level heading**

First level headings are in bold and are centred on a separate line.

B *This is a second level heading*

Second level headings are in italics and are flush left on a separate line.

Illustrations Either transparencies or photographs of good quality can be submitted for both coloured and black-and-white illustrations. It is recommended that authors retain copies of all illustrations because of the risk of loss or damage either during the printing process or in transit.

Diagrams must be of a professional quality and prepared in dense black ink on a good quality surface. Original illustrations will not be returned unless specifically requested.

All illustrations (maps, diagrams and pictures) are numbered consecutively with Arabic numerals and labelled Figure 1, Figure 2, etc. All illustrations are referred to as 'Figures'.

Tables Must be typed double spaced, using few horizontal rules and no vertical rules. They are numbered consecutively with Roman numerals (Table IV, etc.). Titles should be concise, but as independently informative as possible. The approximate position of the Table in the text should be marked in the margin of the typescript.

Notes and References Authors may choose one of two systems:

(1) The Harvard system in which authors' names (no initials) and dates (and specific pages, only in the case of quotations) are given in the main body of the text, (e.g. Collins, 2001, 341). References are listed alphabetically at the end of the paper under the heading References.

(2) The system in which superscript numbers are inserted in the text (e.g. ... to which Collins refers.[3]) and referred to in numerical order at the end of the paper under the heading Notes. Informational notes must be restricted to the minimum; usually the material can be incorporated in the text. If absolutely necessary both systems may be used.

References in both systems should be set out as follows, with *double spacing* for all lines.

Papers Collins, A.T., 2001. The colour of diamond and how it may be changed. *J.Gemm.*, **27**(6), 341-59

Books Balfour, I., 2000. *Famous diamonds*. 4th edn. Christie's, London. p. 200

Abbreviations for titles of periodicals are those sanctioned by the *World List of scientific periodicals* 4th edn. The place of publication should always be given when books are referred to.

Volume 27 No. 8 October 2001

The Journal of Gemmology

Contents

Cultured pearls and colour-changed cultured pearls: Raman spectra 449
Li Liping and Chen Zhonghui

Some new unusual cat's-eyes and star stones 456
J. Hyršl

Nephrite jade from Jordanów Slaski, Poland 461
D. Nichol

Synthetic moissanite from Russia 471
L. Kiefert, K. Schmetzer and H.A. Hänni

Notes from the Laboratory 483
S. Kennedy

Abstracts 488

Book Reviews 500

Proceedings of the Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 502

Cover Picture

Bangladeshi 'pearls'
© Pertti Tilus
(See 'Notes from the Laboratory' p. 483)

ISSN: 1355–4565

Designed & Produced by Harley UK

The Journal of Gemmology

Volume 27 No. 8 October 2001

Cultured pearls

Cat's-eyes and star stones

Nephrite jade

Synthetic moissanite

The Gemmological Association and Gem Testing Laboratory of Great Britain

The Journal of Gemmology

VOLUME 27
NUMBERS 1–8 2000–2001

CONTENTS

[No. 1, January 2000]

SCHMETZER, K., PERETTI, A., Characterization of a group of experimental Russian hydrothermal synthetic sapphires 1
DUROC-DANNER, J.M., A very convincing forgery 8
SIMONET, C., Geology of the Yellow Mine (Taita-Taveta District, Kenya) and other yellow tourmaline deposits in East Africa 11
CARBONIN, S., AJÒ, D., RIZZO, I., De ZUANE, F., Identification of synthetic spinels by means of photoluminescence spectroscopy 30
CAMPBELL, I.C.C., An independent gemmological examination of six De Beers synthetic diamonds 32
Abstracts 45
Book reviews 53
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 56

[No. 2, April 2000]

MATHAVAN, V., KALUBANDARA, S.T., FERNANDO, G.W.A.R., Occurrences of two new types of gem deposits in the Okkampitiya gem field, Sri Lanka 65
CHALAIN, J.-P., FRITSCH, E., HÄNNI, H.A., Identification of GE POL diamonds: a second step 73
KENNEDY, S.J., CASTRO, A.I., HARDING, R.R., Notes from the laboratory 79
COLOMBO, F., RINAUDO, C., TROSSARELLI, C., The mineralogical composition of maw-sit-sit from Myanmar 87
DEREPPE, J.M., MOREAUX, C., CHAUVAUX, B., SCHWARZ, D., Classification of emeralds by artificial neural networks 93
Abstracts 106
Book reviews 114
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 118
Letter to the Editor 124

[No. 3, July 2000]

LIND, T., HENN, U., A new find of spessartine garnets in Nigeria 129
Da COSTA, G.M., SABIONI, A.C.S., FERREIRA, C.M., Imperial topaz from Ouro Preto, Brazil: chemical character and thermal behaviour 133
KINNAIRD, J.A., JACKSON, B., Somaliland – a potential gem producer in the Mozambique Belt 139
HANNEMAN, W.W., The Hanneman Refractometer 155
PINHEIRO, M.V.B., BASILIO, M.S., KRAMBROCK, K., DANTAS, M.S.S., PANIAGO, R., ASSUNÇÃO, A.L., PEDROSA-SOARES, A.C., The cause of colour of the blue alexandrites from Malacacheta, Minas Gerais, Brazil 161
Abstracts 171
Book reviews 176
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 181

[No. 4, October 2000]

NICHOL, D., Two contrasting nephrite jade types 193
DE WEERDT, F., VAN ROYEN, J., Investigation of seven diamonds, HPHT treated by NovaDiamond 201
COWING, M., Diamond brilliance: theories, measurement and judgement 209
SCHMETZER, K., GÜBELIN, E., BERNHARDT, H-J., KIEFERT, L., Oriented inclusions in spinels from Madagascar 229
CARTIER, R.H., Critical angle vs. deviation angle vs. Brewster angle 233
Abstracts 237
Book reviews 242
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 243
Letters to the Editor 251

[No. 5, January 2001]

BANK, F., BANK, H., VILLA, E., Santa Maria aquamarine 257
HORIKAWA, Y., Identification of a new type of laser treatment (KM treatment) of diamonds 259
KENNEDY, S., Notes from the laboratory 265
HÄNNI, H.A., SHUN TIEN WU, YUAN XINGQIANG, TSAI WEN-PO, A glass imitation of blue chalcedony 275
NICHOL, D., Ornamental granite from Ailsa Craig, Scotland 286
FRANCIS, M.D.P.L., DHARMARATNE, P.G.R., The fashioning of rock crystal for spectacles in Sri Lanka 291
Abstracts 295
Book Reviews 302
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 307

[No. 6, April 2001]

OU YANG, C.M., LI JIAN, QI, Hte long sein – a new variety of chrome jadeite jade 321
HYRŠL, J., Gemstones of Peru 328
HENN, U., HYRŠL, J., MILISENDA, C. C., Gem-quality clinohumite from Tajikistan and the Taymyr region, northern Siberia 335
COLLINS, A. T., The colour of diamond and how it may be changed 41
Letters to the Editor 360
Abstracts 362
Book Reviews 370
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 372

[No. 7, July 2001]

MILISENDA, C.C., HENN, U., HENN, J., New gemstone occurrences in the south-west of Madagascar 385
KRZEMNICKI, M.S., HÄNNI, H.A., REUSSER, E., Colour-change garnets from Madagascar: comparison of colorimetric with chemical data 395
SCHWARZ, D., SCHMETZER, K., Rubies from the Vatomandry area, eastern Madagascar 409
SUNAGAWA, I., A discussion on the origin of irregular shapes of type II diamonds 417
CARTIER, R.H., Disclose, describe, dress-up, disguise, deceive ... credibility and gem descriptions 426
Abstracts 432
Book Reviews 434
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 435

[No. 8, October 2001]

LI LIPING, CHEN ZHONGHUI, Cultured pearls and colour-changed cultured pearls: Raman spectra 449
HYRŠL, J., Some new unusual cat's-eyes and star stones 456
NICHOL, D., Nephrite jade from Jordanów Slaski, Poland 461
KIEFERT, L., SCHMETZER, K., HÄNNI, H.A., Synthetic moissanite from Russia 471
KENNEDY, S., Notes from the laboratory 483
Abstracts 488
Book Reviews 500
Proceedings of The Gemmological Association and Gem Testing Laboratory of Great Britain and Notices 502

INDEX

Compiled by Robin W. Sanderson

Alphabetical arrangement is letter-by-letter.
Names of authors are printed in capitals, pages of abstracts and book reviews in italics.

Special usages:
above and *below* in cross-references indicate that the reference is to another subheading under the same heading, not a separate heading.
A number in brackets following a page number indicates that there is more than one reference to the subject on the page.

Abalone (*see* Pearls and Shell)
Abstracts: *45, 106, 171, 237, 295, 362, 432, 488*
Absorption spectra (*see* Spectroscopy, optical absorption)
Actinolite (*see* Amphibole)
Afghanistan: *300*
—'Aowien', blue diopside, *433*
—Antigorite, *48*
—Jegdalek, near Kabul, *297*
—Nuristan, *497*; Kunar, *368*
Afzal Fatima Ali, gift to GAGTL, 183
AGAKHANOV, A.A. (*see* Pautov, L.A., *et al.*)
Agate (*see also* Chalcedony): *299*
—Austria, *174*
—Brazil, Rio Grande do Sul, artisanal mining, *110*
—formation and coloration, *109*
—Germany, Idar-Oberstein, *367*; Waldhambach, Rheinland-Pfälz, *363*
—Mexico, *370*
—pseudomorphs after aragonite, *367*
Aillikite (*see* Lamprophyre)
AJÒ, D. (*see also* Carbonin, S., *et al.*)
—, CARBONIN, S., RIZZO, I., POZZA, G., Photoluminescent properties of defect spinels, *297*
AKAMATSU, S. (*see* Scarratt, K., *et al.*)
AKHMEDOV, N.A. (*see* Golovko, A.V., *et al.*)
Alabaster, S.P., donor to GAGTL, 119; 183
Albite (*see* Feldspar)
Albitite:
—Guatemala, Motagua valley, origins, *173*
Alexandrite (*see* Chrysoberyl)
Almandine (*see* Garnet)
AMABILI, M., MIGLIOLI, A., Granati: nuovo ritrovamenti ad Asbestos e Thetford, *363*
Amazonite (*see* Feldspar)
Amber:
—Baltic, cloudy wood-like texture, *298*
—burmite, *47*
—organic inclusions in, *494*
America, North (*see also* Canada, Mexico, USA)
Amethyst (*see* Quartz)
Ametrine (*see* Quartz)
Ammolite:
—Alberta, Canada, *494*
—guide for gemmologists, jewellers, lapidaries, *500*
Ammonite shells (*see* Ammolite)
Amphibole (*see also* Nephrite):
—actinolite, transparent, *432*
—chromian-eckermannite in maw-sit-sit jade, 87, 89, 90
—pargasite, Pakistan, *47*
—sodic, jade simulants, Myanmar, *48*
—tremolite (nephrite) chatoyancy, *111*
Analyses, chemical:
—alexandrite, Brazil, 164
—chromian-eckermannite in maw-sit-sit jade, 90
—biotite, eastern Brazil, *495*
—chromite in maw-sit-sit jade, 90
—clinohumite, Pamir and Siberia, 337
—enstatite inclusions in spinel, 231
—feldspar, Yellow Mine, Kenya, 18; albite in maw-sit-sit jade, 90
—garnet: colour change, Madagascar, 400; hessonite, Sri Lanka, 71; Nigerian spessartine, 130; Somaliland, 148
—jade, hte-long-sein, 326
—kosmochlor in maw-sit-sit jade, 90
—nephrite, Poland, 467
—ortho-nephrite, Canada, 198
—para-nephrite, Australia, 198
—pearls: freshwater, 450; Tahiti, 450
—pegmatites: Yellow Mine, Kenya, 19, Mangare, 19, Madagascar, 19
—ruby; Madagascar, 414; Myanmar, 414, Thailand/Cambodia, 414
—tourmaline, Kenya, 21
Andersson, A., gift to GAGTL, 183
Andradite (*see* Garnet)
ANDREE, G., ANDREE, R., Waldhambach-klassische Fundstelle für Achata im Pfälzer Wald, *363*
ANDREE, R. (*see* Andree, G., *et al.*)
ANDRES, Y (*see* Fritsch, E., *et al.*)
Angelite (*see* Anhydrite)
Anhydrite:
—Iran, faceted, *366*
—'Angelite', Peru, 332
ANN (artificial neural networks):
—95, methods, 100
—emerald classification, 93
ANON:
—, Achat: der Edelstein, aus dem Idar-Oberstein entstanden ist, *302*
—, Diamanten, *371*
—, Diamanten, München Mineralientage, *303*
—, Edel Steine aus Holz. Katalog zur Austellung im Deutschen Edelsteinmuseum Idar-Oberstein vom 3.9 bis 15.11.1999, *303*
—, Einkaufsführer 1999, *177*
—, Ekati – Canada's first commercial diamond mine, *45*
—, Mineral stories, *366*

—, The Merlin diamond mining project. Part 1: an introduction, *238*
—, Portrait der Edelsteinmetropole Idar-Oberstein, *117*
—, Professione Gemme: Anuario 2000, *371*
—, Steckbrief: Chrysoberyll, *300*
—, Turmalin 2000. Katalog zur Ausstellung im Deutschen Edelsteinmuseum Idar-Oberstein vom 19.2 bis 27.8.2000, *305*
—, Von Ammoniten und Zwillingen (catalogue of the 1999 München Mineralientage), *117*
ANOVITZ, L.M. (*see* Grew, E.S., *et al.*)
Anthracite (*see* Coal)
ANTHONY, J.W., BIDEAUX, R.A., BLADH, K.W., NICHOLS, M.C., Handbook of mineralogy. Vol. IV. Arsenates, phosphates, vanadates, *302*
Antigorite (*see* Serpentine)
Antigua, pre-Columbian gems, *367*
Aowien (*see* Pyroxene)
Apatite:
—Afghanistan, *300*
—Brazil, Paraiba, *496*
—cat's-eye, Madagascar, *363*
—purple, Erongo, Namibia, *365*
—USA, Cedar City, Utah, *300*
Aquamarine (*see also* Beryl):
—Brazil: Bahia, *491, 495(3)*; Minas Gerais, *495*; Santa Maria, 257; star-, 457; deposits, *490*
—China, Ailaoshan and Mufushan pegmatites, study of, *298*
—India, Tamil Nadu, *368*
—Madagascar, Ranohira-Sakaraha, *109*
—Namibia, Erongo Mountains, *364, 365(2), 497*
—Santa Maria, 257, gem properties, 257
—Santa Maria Africana, 257
—Somaliland, 146
—USA, Colorado, *497*
—Zambia: Kapirinkesa, *299,* Lundazi-Chama, *299*
AQUILINA, B., REED, W., Lure of the Pearl: pearl culture in Australia, *114*
ARACIC, M. (*see* Aracic, S., *et al.*)
ARACIC, S., ARACIC, M., Rediscover opals in Australia, *302*
Aragonite:
—agate pseudomorphs after , *367*
—Peru: 332; 'Victorite', 332
ARCHIBALD, D. (*see* Digonnet, S., *et al.*)
Arctic Territories, Canada, *450*
Argentina, Catamarca, stalactitic rhodochrosite, *366*
Argos Ltd, gift to GAGTL, 504
ARIT, T. (*see* Schafer, P., *et al.*)
ARIZMENDI, E. (*see* McLaurin, D., *et al.*)
Armstrong, A.H.G., donor to GAGTL, 119
ARNDT, N. (*see* Capdevila, R., *et al.*)
ARONIN, A.S. (*see* Palnichenko, A.V., *et al.*)
Artificial gems (*see* Synthetic gemstones; Simulants and Simulated gemstones)
Asia, Central, States (CIS) (*see under* Russia)
ASSUNÇÃO, A.L. (*see* Pinheiro, M.V.B., *et al.*)
Asterism (*see* Chatoyancy)
'Aurora Borealis' carved opal, *298*
Australia:
—Argyle, *171, 490*
—Bridgetown soapstone, *238*
—Broken Hill, minerals of, *176*
—Catlin Creek, *238*
—commercial gemstone resources and markets, *432*
—Eyre Peninsula, Minbrie Ranges, para-nephrite, 193, 195
—Lightning Ridge, Rainbow billabong, *117*
—Londonderry, *238*
—moonstone, *432*
—NSW: New England, gemstones, *111,* Silent Grove, Torrington, *238*; Wellington, diamond origins, *106*
—Norseman, *238*
—Northern Territory, Merlin, *171, 238*
—opals: *115, 300*; black, fossils, *117*; description of locations, *240*; geology of, *496*; moss, *238*; rediscover, *302*
—pearl culture, *114*
—Queensland, Moonstone Hill, Hughenden, *432*
—Ravensthorpe, *238*
—South Australia, Andamooka, *300*
—Tasmania, Dundas, *238*
—Victoria, Melbourne, Museum Victoria, *364*
—White Cliffs opal field, history, *49*
Austria:
—agates, *174*
—concretions including agate, *299*
—Hohen Tauern, amethyst, *50*
—lazulite deposits, *297*
—Maissau, *298*
AVERILL, S.A. (*see* Morris, T.F., *et al.*)
Axinite, ferro-, Peru, 333
AYE MYO NAING, comment on maw-sit-sit jade paper, Colombo, Rinaudo, Trossarelli, 2000 (below), 251

BABU, E.V.S.S.K. (*see* Mukherjee, A., *et al.*)
Baddeleyite megacrysts in kimberlite, *489*
BAGAI, D., Occurrences of minerals in Himachal Pradesh, *46*
BAGRYANTSEV, D.G. (*see* Chepurov, A.I., *et al.*)
BALFOUR, I., Famous diamonds (4th edn), *302*
BALITSKY, V.S., Present Russian synthetic and enhanced gemstones, *369*
—, LU, T., ROSSMAN, G.R., MAKHINA, I.B., MAR'IN, A.A., SHIGLEY, J.E., ELEN, S., DOROGOVIN, B.A., Russian synthetic ametrine, *175*
BALZER, R., Amethyst aus Brasilien, *46*
BANK, F., BANK, H., VILLA, E., Santa Maria aquamarine, 257
Bank, H., gift to GAGTL, 183, 309
BANK, H. (*see also* Bank, F., *et al.*)
—, HENN, U., MILISENDA, C.C., Gemmological news, *46, 363, 369*
—, HENN, U., MILISENDA, C.C., Gemmological notes, *297*
—, HENN, U., MILISENDA, C.C., Gemmologic Aktuell, *106, 108(2), 112(2), 432, 433*
BANKO, A., KARFUNKEL, J., Die Mineralogie und Gemmologie der Diamanten aus der Sierra do Espinhaço, Minas Gerais, Brasilien, *432*
BARBOSA, C.P. (*see* Falster, A.U., *et al.*; Modreski, P.J., *et al.*)
BARILO, S.N., BYCHOV, G.L., KURNEVICH, L.A., LEONUK, N.I., MIKHAILOV, V.P., SHIRYAEV, S.V., KOYAVA, V.T., SMIRNOVA, T.V., Controlled crystallisation of emerald from the flux melt, *175*
Barite:
—concretions, *299*
—inclusion in fluorite, *48*
BARNARD, A.S., The diamond formula, *176*
—, NovaDiamond – colour enhanced yellow and yellow-green diamonds, *432*
BARNSON, D., Ammolite 2. A guide for gemmologists, jewellers and lapidaries, *500*
BARRAULT, A. (*see* Fritsch, E., *et al.*)
BARRÈS, O. (*see* Cheilletz, A., *et al.)*
BASILIO, M.S. (*see* Pinheiro, M.V.B., *et al.*)
Bastnäsite, orange-brown, *175*
BAUR, W.H. (*see* Joswig, W., *et al.*)
BAYLISS, P., Glossary of obsolete mineral names, *176*
Beads: *114,*

—Baltic amber, wood-like texture, *298*
—Anglo-Saxon glass, *116*
—'Power', *433*
BEAD STUDY TRUST, Catalogue of the Beck Collection of beads in the Cambridge University Museum of Archaeology and Anthropology. 1 Europe, *114*
Becker, F.A., gift to GAGTL, 183
BEDOGNÈ, F., SCIESA, E., VIGNOLA, P., Il 'demantoide' della Val Malenco, *172*
BERL, R., Lazulithvorkommen in Österreich, *297*
BERNHARDT, H.-J. (*see* Schmetzer, K., *et al.*, Sunagawa, I., *et al.*)
BERNSTEIN, P., The power of gold, *434*
BERRY, S.L. (*see* Hofmeister, A.M., *et al.*)
Beryl (*see also* Aquamarine; Emerald):
—Australia, Londonderry quarry, *238*
—Brazil: Minas Gerais, *300*; Eastern Pegmatite Province, *495*
—China, Ailaoshan and Mufushan pegmatites, study of, *298*
—colour loss, *49*
—colour variation in iron-containing, *299*
—Madagascar, new source, characteristics, 393
—maxixe, *49*
—Mozambique, Alto Ligonha, *364, 367*
—Namibia, Erongo Mountains, *300*
—Pakistan cat's-eye, *298*
—Raman spectroscopy, *240*
—spectacle lenses, 292
—Somaliland, 144
—Sri Lanka, *491*
—Russia, Urals, *493*
BETTENCOURT DIAS, M., WILSON, W.E., The Alto Ligonha pegmatites, Mozambique, *363*
BHP DIAMONDS INC., The Ekati diamond mine, *53*
Biblical gems and minerals, *495*
BIDEAUX, R.A. (*see* Anthony, J.W., *et al.*)
Biggs, Margaret J., obituary, 374
BIRCH, W.D., Minerals of Broken Hill, *176*
—, HENRY, D.A., The geology collections of Museum Victoria, Melbourne, *364*
Birefringence in garnet, *109*
BLADH, K.W. (*see* Anthony, J.W., *et al.*)
BLAKEMORE, K., The retail jeweller's guide (6th edn), *370*
Blue John (*see* Fluorite)
BOEHM, E.W. (*see* Shigley, J.E., *et al.*)
BOILLAT, P.-Y. (*see also* Notari, F., *et al.*)
—, NOTARI, F., GROBON, C., Luminescences sous excitation visible des diamants noirs irradiés, *488*
Bolivia: Ayopaya, Cerro Tapo, Cerro San Cristobal, *47*
Bonanno, Kathryn L., donor to GAGTL, 119
Book Reviews: *53, 114, 176, 242, 302, 370, 434, 500*
BORCHARDT, R., TUROWSKI, S., Symmetrielehre der Kristallographie, *176*
Bordbar, Hossein, gift to GAGTL, 437
Boron, mineralogy, petrology and geochemistry, *178*
BORZDOV, Y.M. (*see* Sokol, A.G., *et al.*)
BOSSHART, G. (*see* Hughes, R.W., *et al.*; Shigley, J.E., *et al.*; Smith, C.P., *et al.*)
BOTTRILL, R.S., BROWN, G., Rare Australian gemstones – stichtite, *238*
Bouman, Henrietta A.E., donor to GAGTL, 119
BOURNE, J. (*see* Digonnet, S., *et al.*)
BOWERSOX, G.W., FOORD, E.E., LAURS, B.M., SHIGLEY, J.E., SMITH, C.P., Ruby and sapphire from Jegdalek, Afghanistan, *297*
BRACEWELL, H., Gems around Australia: Part 15, *238*
—, A new deposit of smoky quartz from the Torrington area, *238*
—, Moonstone – a rare Queensland gemstone, *432*
Branco, R.P., donor to GAGTL, 119
Brady, Deanna, 309
BRANDSTÄTTER, F. (*see* Hammer, V.M.F., *et al.*)
Brazil: 456, 457, *496*
—artisanal mining, agate and amethyst, *110*
—Bahia: *495*; aquamarine and tourmaline, *490*; Brumado, Serra das Eguas, minerals of, *491*, tourmaline compositions, *494*
—Barra de Salhinas, *495*
—Ceara, aquamarine and tourmaline, *490*
—Central Gem Province, *495*
—Corrego do Urucum, *495*
—Cruzeiro, *495*
—Eastern Brazil Pegmatite Province, *495(3)*, genesis of emerald deposits, *495*
—Espirito Santo: aquamarine and tourmaline, *490*; pegmatite province, *495(2)*
—famous mines, *495*
—Frade, *495*
—gem provinces, *495(3)*
—Golconda, *495*
—Imperial topaz, 133
—Jonas, *495*
—Limoeiro, *495*
—Mato Grosso, Juina, superdeep diamonds, *489*
—Medina, *495*
—Minas Gerais: Arqueana, *494*; Capelinha, *497*; discovery and exploitation, *493*; Diamantina, *47;* Dos Barras, *300*; Lavra Berilo Branco, *112*; Linopolis, *497*; Malacacheta, 161; Municipio de Manhuaca, Sacramento, *433*; Mutuca mine, *368*; Pederneira, *494*; pegmatite province, *495(2)*; Piteiras, first emerald production, *493*; Santa Maria, Itabira, 257; 'Sapucaia', *112;* Sierra do Espinhaço, *432;* Telirio, *494*
—Morro Rendondo, *495*
—Ouro Fino, *495*
—Ouro Preto: Capão, 133, Vermelhão, 133
—Paraiba: *366;* Alto des Flechas, *496*; Alto Feio, *496*; aquamarine and tourmaline, *490*; Bocheiron Zinho elbaite, *491*; Pedra Lavada, *496*; Santana, de Mangeiras, *496*; Sao Jose da Batalha, *491*
—pegmatite province, eastern, *495(2)*
—Piaui gem province, *495*
—Rio Grande do Nort, aquamarine and tourmaline, *490*
—Rio Grande do Sul, *46, 110, 495*
—Rio de Janiero, pegmatite province, *495(2)*
—Santa Rosa, *495*
—tourmaline: general survey, *240*, famous mines, *495; 496*
—Tres Barros, Marambaia, *495*
—Urucum mine, kunzite, *368*
—Xanda, *495*
Brazilianite, Minas Gerais, Brazil, *494, 495, 497*
BRETHERTON, B. (*see* Linton, T., *et al.*)
Brewster angle, 233, *301*
BREY, G.P. (*see* Joswig, W., *et al.*)
BRICKER, G.A. (*see* Fisher, J., *et al.*)
Brilliance of diamond, theories, measurement, judgement, 209, perception, 212, understanding, 214; quantification and visualisation, *497*
BRONSTEIN, A., HOFER, S.C., Forever brilliant. The Aurora Collection of colored diamonds, *303*
BROWN, D.L., WILSON, W.E., The Rist and Ellis tracts, *490*
BROWN, G. (*see also* Bottrill, R.S., *et al.*, Free, J., *et al.*)
—, Australia's gemstone resources and their markets, *432*
—, Gemmological miscellany, *51, 298*
Brown, Judith A., obituary, 374
BRULEY, M., La liste de Mogok, *238*

Bruton, Eric M., obituary, 307, an appreciation, 372,
BUCCELATI, G., The Iron Crown and Imperial Europe, the Crown, the Kingdom and the Empire: a thousand years of history, *370*
BUERKI, P.R. (*see* Reinitz, I.M., *et al.*)
BULAKH, A.G. (*see* Zolotarev, A.A., *et al.*)
Bulatou, A., gift to GAGTL, 375
BURGESS, R. (*see* Johnson, L.H., *et al.*)
Burgoyne, Sheila, donor to GAGTL, 119
BURKE, P., The drowning dream [A tale], *114*
BURLAKOV, J.V. (*see* Gryoriev, V.V., *et al.*)
Burma (*see* Myanmar)
Burnstein, B.A., donor to GAGTL, 119
Burrell, D., 118
Burton, C.V., early diamond synthesis, 360
Burton, R., gift to GAGTL, 57, 309
BUTLER, W.C.F., letter to editor, 360
Buying guide:
—gold and platinum jewellery, *180*
—ruby, sapphire and emerald, *55*
BYCHOV, G.L. (*see* Barilo, S.N., *et al.*)

CAIRNCROSS, B., The Desmond Sacco collection: focus on southern Africa, *177*
—, Die Begleiter des Diamants in den Kimberliten Südafrikas, *364*
—, GUTZMER, J., Spektakuläre Mineralien aus dem Kalahari-Manganerzfeld, Südafrika, *364*
Cairncross, J.K., donor to GAGTL, 119
Calcite:
—Colombia, with emerald, *300*
—Germany, Idar-Oberstein, *365*
—Peru, 333
—Russia, Dal'negorsk, *492*
Callaghan, D., 372, 375
CALVO PEREZ, B. (*see* Gavrilenko, E.V., *et al.*)
Cameos (*see also* Jewellery):
—old and new, *55*
CAMM, S., Gold in the counties of Cornwall and Devon, *114*
Campbell Bridges, gift to GAGTL, 57
CAMPBELL, I.C.C., An independent gemmological examination of six De Beers synthetic diamonds, 32; amendment, 124
CAMPBELL, K.R. (*see* Hofmeister, A.M., *et al.*)
Canada (*see also* America, North):
—Alberta, Lethbridge, *494*
—British Columbia: Mount Ogden, Dease Lake, orthonephrite, 193, 194; Slocan Valley, Nelson, *298*
—diamond production, *172*
—gemstones, interest in, *50*
—North West Territories, Ekati diamond mine, *45(3), 53; 172, 371*
—Ontario: Toronto, Royal Ontario Museum, *497*; Wawa-Kinniwabi Lake area, diamond-bearing kimberlite, *107*
—Quebec, Asbestos and Thetford mines, garnets, *363*; Abloviak, Ungava Bay, *488*
—Slave Province: kimberlites, *301;* Lac de Gras mantle, *171*
—Yukon, Goal Net, Finlayson Lake, *492*
CANIL, D., FEDORTCHOUK, Y., Garnet dissolution and the emplacement of kimberlites, *301*
CANUT DE BON, C. (*see* Coenraads, R.R., *et al.*)
CAPDEVILA, R., ARNDT, N., LETENDRE, J., SAUVAGE, J.-F., Diamonds in volcaniclastic komatiite from French Guiana, *171*
CAPELLE, B. (*see* Rinaudo, C., *et al.*)
CARBONIN, S. (*see also* Ajò, D., *et al.*)
—, AJÒ, D., RIZZO, I., DE ZUANE, F., Identification of synthetic spinels by means of photoluminescence spectroscopy, 30
CARMONA, C.I., Estimating weights of mounted coloured stones, *50*
Carter, M.W., donor to GAGTL, 119
CARTIER, R.H., Critical angle vs. deviation angle vs Brewster angle, 233
—, Disclose, describe, dress-up, disguise, deceive ... credibility and gem descriptions, 426
CARTIGNY, P. (*see* De Corte, K., *et al.*)
Cartwright, Freda, gift to GAGTL, 375
Cassarino, P.R., gift to GAGTL, 504
Cassiterite: orange-purple, Sri Lanka, *297*
CASTRO, A.I. (*see* Kennedy, S.J., *et al.*)
Cathodoluminescence (CL) (*see* Spectroscopy: Cathodoluminescence)
Cat's-eye and asteriated gems: (*see* Chatoyancy)
Caycedo, M.J., donor to GAGTL, 119
Central African Republic, diamond exploitation, *45*
CESAR-MENDES, J., JORT-EVANGELISTA, H., WEGNER, R., Tourmaline and aquamarine deposits from Brazil, *490*
Ceylon (*see* Sri Lanka)
Chalain, J.-P., *301*
CHALAIN, J.-P., Mise à jour sur la détermination des substances de remplissage dans les émeraudes, *238*
—, FRITSCH, E., HÄNNI, H.A., Diamants de type IIa et traitment HPHT: identification, *488*
—, FRITSCH, E., HÄNNI, H.A., Détection des diamants GE POL: une première étape, *237*
—, FRITSCH, E., HÄNNI, H.A., Identification of GE POL diamonds: a second step, 73
—, FRITSCH, E., HÄNNI, H.A., Zur Bestimmung von GE POL Diamanten: erste Erkenntnisse, *295*
—, KRZEMNICKI, M.S., Synthetischer Moissanit und Diamant: Sichere Unterscheidung mit Hilfe, des reflektometers, *50*
Chalcedony:
—blue, Taiwan, properties, 276
—Madagascar, *48*
—silicified wood, *303*
CHAN, Y., PAN, F., REN, J., [The quantitative appraisal of the green of jadeite], *172*
Chandra, K.C.S., gift to GAGTL, 183
CHANDRAJITH, R. (*see* Dissanayake, C.B., *et al.*)
Chang, M.S.-H., donor to GAGTL, 119
CHANGLONG, Z. (*see* Zhenqiang, C., *et al.*)
CHANNER, D.M.DER. (*see* Kaminsky, F.V., *et al.*)
CHAPMAN, J. (*see Shigley, J.E., et al.*)
CHARLIER, J.-C. (*see* Palnichenko, A.V., *et al.*)
CHATRIAN, C. (*see* Rinaudo, C., *et al.*)
Chatoyancy:
—aquamarine, star, Brazil, 457
—beryl cat's-eye, *298*
—moonstone, star and cat's-eyes combined, 458
—quartz, Guizhou, China, *172*
—quartz-tourmaline cat's-eye, Brazil, 457
—rhodochrosite, star and cat's-eye, 459
—ruby, unusual, *49*
—sunstone cat's-eye, Russia, 458
—taaffeite, cat's-eye *174*
—topaz cat's-eye, Brazil, 456
—tourmaline , star, 459
—tremolite nephrite, *111*
CHAUSSIDON, M. (*see* Giuliani, G., *et al.*)
CHAUVAUX, B. (*see* Dereppe, J.M., *et al.*)
CHEILLETZ, A., DE DONATO, P., BARRÈS, O., La tracabilité des émeraudes: une avancée décisive obtenue par microscopie infrarouge, *498*
CHEN ZHONGHUI (*see* Li Liping, *et al.*)
CHEPUROV, A.I., FEDOROV, I.I., SONIN, V.M., BAGRYANTSEV, D.G., OSORGIN, N. YU, Diamond

formation during reduction of oxide and silicate-carbon systems at high *P-T* conditions, *175*
Chi Ho Cheung, donor to GAGTL, 119
Chiastolite, Myanmar, Kyaukse, *365*
CHIHARA, K., Jadeite in Japan, *490*
Chile, Coquimbo region, lapis lazuli, *239*
China:
—Ailaoshan pegmatite study, *298*
—Fujian, Mingxi, sapphire infrared study, *300*
—Guangxi Gemmological Institute, *499*
—Guizhou, Luodian County, *172*
—Hubei, Damaping, peridot, *47*
—Mufushan pegmatite study, *298*
—Sichuan, sceptre quartz, *368*
—Wuhan pearl culture farm, 265
—Yunnan, Wah Tu Wah mine, *300*
China Formosa Gem Lab, gift to GAGTL, 57
CHINN, I.L. (*see* Fitzsimons, I.C.W., *et al.*)
Chlorite: clinochlore 'Seraphinite', *298*
CHRISTIAN WEISS VERLAG, Madagaskar: das Paradies der Mineralien und Edelsteine, *116*
Chromaticity of Xinjiang jade, *173*
Chromite (*see* Spinel)
Chrysoberyl:
—alexandrite: Brazil, *495*, blue,161, cause of colour, 161; Madagascar, *109*; Sverdlovsk, Russia, 79, cathodoluminescence, 80
—alexandrite-emerald-phenakite mineralisation, Urals, *493*
—Brazil, Eastern Pegmatite Province, *495*
—cat's-eye, Madagascar, *109*
—Madagascar: new source, *108*, characteristics, 392; Anzacobe, *368*
—properties and modes of occurrence, *300*
—Raman spectroscopy, *240*
—Sri Lanka, *491*
—vanadium colour, green, *49*
Chrysocolla: Acari mine, Peru, 330
Citrine (*see* Quartz)
Clarke, N.V., donor to GAGTL, 119; obituary, 308
Clinochlore (*see* Chlorite)
Clinohumite:
—Tajikistan, Pamir mountains, Kukhi-lal area, 335, 336
—Taymyr region, northern Siberia, possible new source, 335, 338
CLOPTON, E.L., WILSON, W.E. (Eds), The Mineralogical record index, volumes I-XXV, 1970-1994, *500*
Clough, M. B., obituary, 374
Clutterbuck, G., 374
Coal: anthracite beads, 81
COBBAN, R.R. (*see* Eckel, E.B., *et al.*)
COENRAADS, R.R. (*see* Sutherland, F.L., *et al.*)
—, CANUT DE BON, C., Lapis lazuli from Coquimbo Region, Chile, *239*
—, LAIRD, J.W., The Slocan Valley sapphire deposit, Nelson, British Columbia, Canada, *298*
Coesite inclusions in Guinea diamonds, *238*
COLCHESTER, D.M., Geozoological prospecting for gold and gems, *46*
COLE, G.A.J., Memoir of localities of minerals of economic importance and metalliferous mines in Ireland, *114*
COLE, J.E. (*see* Shigley, J.E., *et al.*)
COLES, M., Jewellery: Two in one manual, *53*
Collections:
—al-Sabah, Kuwait National Museum, *434*
—Aurora Collection of colored diamonds, *303*
—Beck Collection of Beads, Cambridge, *114*
—Bergakademie, Freiburg, Saxony, Germany, *367*
—Desmond Sacco, southern Africa, *177*
—famous collectors, *116*
—Freilich, Joseph A., *300*
—Gilbert, London, *367*
—Polish jade, 468
—South Australian mineralogical, Adelaide, *367(2)*
Collins, A.T., 183, 309; awards address, 310
COLLINS, A.T., The colour of diamond and how it may be changed, 341; errata, 443
—, Improving the colour of gem-quality diamonds by high-pressure, high-temperature annealing, *362*
—, KANDA, H., KITAWAKI, H., Colour change produced in natural brown diamonds by high-pressure, high-temperature treatment, *362*
COLLINS, D.S. (*see* Eckel, E.B., *et al.*)
COLLINS, J.L., New CVD Diamond products, *45*
COLLINSON, D.W., Magnetic properties of polycrystalline diamonds, *106*
Colombia: *299(3)*
—Boyacá, La Pita, new commercial emerald deposit, *239*; *300*; Peñas Blancas, *300*
—Caribbean coast conch pearls, *299*
—emerald: deposit exploitation, *51*; new commercial deposits, *239, 299*; state of emerald trade, *298*
—Guiania, diamonds, *299*
—Mercarderes, Cauca Department, new discoveries, *299*
—Polveros, new commercial emerald deposit, *239*
—Quebrada Negra, Chivor, *299*
COLOMBO, F., RINAUDO, C., TROSSARELLI, C., The mineralogical composition of maw-sit-sit from Myanmar, 87
Colour:
—and optical properties of materials, *501*
—cause of in alexandrite, 16
—centres in diamond, 342
—changing: in barite, *48*; diamond, *52, 106*, 341, 349, *362, 363*; garnets, Madagascar, 395, Sri Lanka, *298*; tourmaline, *366*
—characterization in Type IIB diamonds, *45*
—colorimetry of Xinjiang jade, *173*
—definition of gemstones, *108*
—diffraction colours of opal, study, *365*
—enhancement: review, *298*; of diamonds, NovaDiamond, *432*; emeralds, overview, *240*; pearls, *174*; colourless quartz, *49*
—flashes in glass-filled diamonds, 271
—iridescence in fractured diamond, 272
—loss by solar radiation, in beryl, *49*
—of stones, *111, 174*
—origin of, *47, 48, 491*; V in chrysoberyl, *49*
—quantitative appraisal, in jade, *172*
—tourmaline, and composition, *494*
—variation mechanism in iron-containing beryl, *299*
Columbite:
—Australia, Londonderry quarry, *238*
—tantalite, Brazil, *495*
Commonwealth of Independent States (CIS) (*see under* Russia)
Conch, pearl, *Strombus gigas, 499*
Concretions, ornamental, *299*
Conferences, Symposia and Shows:
—Bologna 2000, *368*
—Delaware, New Jersey 2000, *368*
—Denver, Colorado, *497*
—Idar-Oberstein Gemmologisches Symposium 2000, abstracts, *432, 433(2)*
—Intergem 1999, *117*
—International Mineralogical Association Meeting, 1998, *45, 48*
—München Mineralientage: 1999, *117, 180, 300*; 2000, *303*

—Pasadena, *300*
—Springfield, Colorado, *497*
—Treasury of the World; British Museum, London, *434*
—Tucson: 2000, *239*, *368*; 2001, *494*
CONNOUÉ, J. (*see* Fritsch, E., *et al.*)
COOPER, M. (*see* King, J.M., *et al.*)
Cordierite:
—European Alps, *109*
—iolite: *493*; similar to feldspar, *48*; Madagascar, 393
Corrigendum, J. Gemmol., 61, 250
Corundum (*see also* Ruby *and* Sapphire):
—alkali basalt terrains, origins reappraisal, *111*
—colour diffusion detection, *493*
—comparative study of Karnakata, India sources, *49*
—geuda, Okkampitiya, Sri Lanka, 67
—Madagascar: new source, various colours, *108*, rhodolite coloured, *432*
—origin in basaltic fields, *496*
—padparadscha: 391; nomenclature problems, *433*
—Raman spectroscopy, *240*
—Sri Lanka, *491*
COWING, M., Diamond brilliance: theories, measurement and judgement, 209
CRABTREE, D. (*see* Morris, T.F., *et al.*)
CRAM, L., Beautiful opals: Australia's national gem. Special 2000 commemorative edition, *115*
Crawford, H.B.: obituary, 182, bequest to GAGTL, 374
Credibility and gem descriptions, 426
Critical angle, 231
Cropp & Farr Ltd., donors to GAGTL, 119
CROSS, B.L., The agates of northern Mexico, *370*
Cross, W.G., obituary, 182
Crystal field, crystal field transitions, description of, 163
Crystal forms, *176*
Crystal growth science and gemmology, *433*
Crystalline perfection of high purity synthetic diamond crystal, *113*
Crystallography, modern, *305*
CUMMING, A. (*see* Linton, T., *et al.*)
Curling stones: 286, properties of British, 289, processing, 289
Currie, S., gift to GAGTL, 57
Cuts and cutting:
—brilliant: mathematical modelling, *46*; a critique, *109*; crown angle estimation for diamond, *237*
—computing gem facetting, *498*
—emerald-, dumortierite, *240*
—nail head diamond, 216
—optimum cutting angles between main facets, *498*
—round brilliant, 224
—shallow crown angles, 220
—Tycoon, *296*
Czech Republic:
—Prague, National Museum, *493*
—review of gem occurrences, *111*

D-limonene immersion liquid for gemmology, *240*
DA COSTA, G.M., SABIONI, A.C.S., FERREIRA, C.M., Imperial topaz from Ouro Preto, Brazil: chemical character and thermal behaviour, 133
Dale, S., 309
Daly, Pat, gift to GAGTL, 375
Danburite:
—Afghanistan, *497*
—California, *48*
—Russia, Danburitiy mine, Dal'negorsk, *492*
DANILOV, B.S. (*see* Letnikov, F.A., *et al.*)
DANTAS, M.S.S. (*see* Pinheiro, M.V.B., *et al.*)
DA SILVA, J.B. (*see* Pinheiro, M.V.B., *et al.*)
Datolite, Dal'negorsk, Russia, *492*
DAVID, C., FRITSCH, E., Identification du traitement thermique à haute température des corindons par spectrometrie infra-rouge, *491*
Davidson, T., 185
DAVIES, R. (*see* Kaminsky, F.V., *et al.*)
DAVIES, R.M. (*see also* Griffin, W.L., *et al.*)
—, O'REILLY, S.Y., GRIFFIN, W.L., Diamonds from Wellington, NSW: insights into the origin of eastern Australian diamonds, *106*
DE, S., HEANEY, P.J., HARGRAVES, R.B., VICENZI, E.P., TAYLOR, P.T., Microstructural observations of polycrystalline diamond: a contribution to the carbonado conundrum, *106*
DEBAT, P. (*see* Mercier, A., *et al.*)
DE CORTE, K., CARTIGNY, P., SHATSKY, V.S., SOBOLEV, N.V., JAVOY, M., Evidence of fluid inclusions in metamorphic microdiamonds from the Kokchetav massif, northern Kazakhstan, *107*
DE DONATO, P. (*see* Cheilletz, A., *et al.*)
DEGHIONNO, D. (*see* Johnson, M.L., *et al.*)
de Goutière, A., Photographic competition 2000, 2nd prize, 181
DEICH, V.B. (*see* Moroz, I.I., *et al.*)
Deljanin, B., 308
Demantoid (*see* Garnet)
DEMIANETS, L.N. (*see* Shigley, J.E., *et al.*)
DE MILLE, C.N. (*see* Murphy, A.R., *et al.*)
DE NARVAEZ, D. (*see* Giuliani, G., *et al.*)
DENG, M., [Mineralogical characteristics of chatoyant quartz in Luodian County, Guizhou], *172*
DENNIS, D.J., Gems: a lively guide for the casual collector, *177*
De Poli, Vesta, gift to GAGTL, 121
De Regt, M.N., first prize, Photographic competition 2001, 435
DEREPPE, J.M., MOREAUX, C., CHAUVAUX, B., SCHWARZ, D., Classification of emeralds by artificial neural networks, 93
De Souza, Suzanne P., donor to GAGTL, 119
DE STEFANO, P., MARCON, R., MORABITO, S., Gemme: dati per l'identificazione, *177*
DEUTSCH, A. (*see* Kerschhofer, L., *et al.*)
Deviation angle, 233
DE WEERDT, F., VAN ROYEN, J., Investigation of seven diamonds, HPHT treated by NovaDiamond, 201
DE ZUANE, F (*see* Carbonin, S., *et al.*)
DHARMARATNE, P.G.R. (*see also* Francis, M.D.P.L., *et al.*)
—, Identification of some colourless gemstones from Sri Lanka, *47*
Diamond: *303*, *371*, *432*
—accessory minerals of diamondiferous rocks, Russia, *296*
—Africa, forecasts, *171*
—Aurora collection, *303*
—Australia: *171(2)*, *490*; first diamonds from Merlin, *171*
— -bearing xenoliths in lamprophyres, *362*
—black, irradiated, *488*
—Brazil, Sierra do Espinhaço, Minas Gerais, *432*
—brilliance: theories, measurement, judgement, 209, illumination, 211, perception, 212, understanding, 214; quantification and visualization, *497*
—brown, zoned blue and green, *52*
—Canada: North West Territory, *45(3)*; Ontario, *107*; Slave Province, *171*, *172*; production, *172*
—carbonado, *106*
—chameleon, *106*, *238*
—chemical variation, extreme, *295*
—clarity grading, *305*
—Colombia, alluvial, *299*
—colour changing: *106*, 341; Type I to green, *488*

—coloured, Aurora collection, *303*
—colour enhanced, NovaDiamond, *432*
—crown angle estimation, *237*
—famous, *302*
—fingerprinting two cut from same rough, *46*
—formation, Raman barometry, *237*
—French Guiana, in komatiite, *171*
—genesis in lower mantle, *172*
—GE POL treated, 73; *172*; detection of, *237*; spectroscopic evidence for, *237*
—Germany, Saxony, Erzegebirge, *363*
—Guinea, Kankan district, *238*
—HPHT treated: defects, 201;identification, *297, 488*; irregular shaped stones, 417; spectroscopic evidence for, *237*
—identification of natural and synthetic, *497*
—industrial, applications, economics and a view to the future, *490*
—investigation advances, *45*
—irradiated, *106, 488*
—irregular shapes of type II, 417
—luminescence in irradiated black, 488
—magnetic, *490*
—mantle geochemistry, *362*
—microdiamonds: Saxony, *363*; modes of formation, Kazakhstan, *107*
—MicroWorld of, *179*
—milky white, *490*
—minerals associated with in kimberlites, *364*
—moissanite: differentiation, *50(2), 51;* tester evaluation, *50*
—morphology as a possible indicator of source, *488*
—nature, origins and age, *237*
—origins, New South Wales, *106*
—polycrystalline: magnetic properties, *106,* microstructure, *106*
—products, CVD, *45*
—pseudo-dichroism, *490*
—Raman spectroscopy, *240, 363*
—, Rubies (..., emeralds, sapphires) are a girl's best friend, *178*
—Russian sources, *172*; Arkhangelsk kimberlite, accompanying minerals, *238*; review, *499*
—strongly zoned, IR spectra, *296*
—superdeep, Brazil, *489*
—Type I, HPHT treatments, *488*
—Type II: origin of irregular shapes of, 417, morphology and internal strain, 418
—Type IIa: distinguishing, 74 ; *237(2), 433; 499*
—Type IIb blue, characterizing natural-color, *45*
—Uzbekistan, *362*
—Venezuela, *489*
'Dianite' (*see* Nephrite)
Dichroism, pseudo-, in diamond, *490*
DICKIN, A.P. (*see* Rao, N.V.C., *et al.*)
Dictionary, Gemmological, *371*
DIGENNARO, M.A. (*see* Rinaudo, C., *et al.*)
DIGONNET, S., GOULET, N., BOURNE, J., STEVENSON, R., ARCHIBALD, D., Petrology of the Abloviak aillikite dykes, New Québec: evidence for a Cambrian diamondiferous alkaline province in north-eastern North America, *488*
Dimmick, Helen, Preliminary Trade Prize and Anderson Medal winner, 311
Diopside (*see* Pyroxene)
Directory to German gem trade, *177*
DIRLAM, D.M. (*see* Shigley, J.E., *et al.*)
Disclosure of gemstones and synthetics, *499*
Dislocation density in massive quartz crystals, *113*
DISSANAYAKE, C.B., CHANDRAJITH, R., TOBSCHALL, H.J., The geology, mineralogy and rare element chemistry of the gem deposits of Sri Lanka, *491*
D-limonene: a useful immersion liquid for gemmology, *240*
Dominican Republic: 'Larimar' pectolite, *297,* 332
Donations (*see* Gifts and Donations to GAGTL)
DOROGOVIN, B.A. (*see* Balitsky, V.S., *et al.*, Ostapenko, G.T., *et al.*)
Doublets: sapphirxe, natural/synthetic, *112*
Doulis, L.N., donor to GAGTL, 119
DOYLE, B.J. (*see* Griffin, W.L., *et al.*)
Dravite (*see* Tourmaline)
Dumortierite:
—emerald-cut from Sri Lanka, *240*
—Peru, 334
DUPRÉ, K., Energie aus farbigen kristallen: oxidische Lasekristalle-Herstellung, Bearbeitung, Andwendungen, *112*
Durham, D., Photographic competition 2000 winner, 181; gift to GAGTL, 244, 309
DUROC-DANNER, J.M., A very convincing forgery, 8
Dwyer-Hickey, P., gift to GAGTL, 121, 244
Dykhuis, Luella, gift to GAGTL, 57, donor to GAGTL, 119

EATON, W.D. (*see* Groat, L.A., *et al.*)
ECKEL, E.B.: Updated by Cobban, R.R., Collins, D.S., Foord, E.E., Kile, D.E., Modreski, P.J., Murphy, J.A., Minerals of Colorado, *115*
Eckermannite (*see* Amphiboles)
Eclogite:
—diamondiferous, Russian, *490*
—significance in diamond exploration, *107*
EDS (*see* Spectroscopy, EDS))
Egypt: emerald deposits, *366*
Ekanite: Sri Lanka, Okkampitiya, 67
Elbaite (*see* Tourmaline)
Electron paramagnetic resonance (EPR), description, 163
ELEN, S. (*see also* Balitsky, V.S., *et al.*; Johnson, M.L., *et al.*; Koivula, J.I., *et al.*; Shigley, J.E., *et al.*)
—, FRITSCH, E., The separation of natural from synthetic colourless sapphire, *172*
Ellis, T.L., obituary, 374
Emerald (*see also* Beryl):
—African, review of sources, formation, identification, *366*
— -alexandrite-phenakite mineralization, *493*
—Americas, *367*
—Asia, *367*
—Australia, *367*
—Brazil: Bahia, *491*; Eastern Brazil Pegmatite Province, genesis, *495(2)*; Minas Gerais, first production, *493*
—Canada, Yukon, *492*
—characterization, Kazakhstan, Delbegetey deposit, *108*
—classification by artificial neural networks:93, category 1, 97, category 2, 98, category 3, 98, category 4, 99, category 5, 100
—colour enhancement overview, *240*
—Colombian:gas bubble, *173*; trapiche, treated, *108;* new commercial deposits, *239, 298, 299(2)*; with calcite, *300*
—deposits, review, *495*
—fillers: identification, *173*; reviewed, *238*
—'Forgotten emeralds', *366*
—geological environments, 94
—history of, *239, 298(2)*
—laboratory investigation, *368*
—Lucky Horseshoe pendant, 484
—Mozambique, Morrua mine, *367*
—nature and locality determination, *498*
—origins of jewels from archaeological site in Rome, *365*
—Peruvian, *298*

—Rubies (diamonds, sapphires, ...) are a girl's best friend, *178*
—Ruby, sapphire and, buying guide, *55*
—Russian 'natural', *297*
—Somaliland, 145
—sources: distinguished by Raman spectroscopy, *48;* of classical and later times, review, *239, 298(2)*
—spectacle lens, 291
—The emerald, *115*
—trade routes, ancient, *298*
—USA, North Carolina, *490*
Energy Dispersive spectra (*see* Spectroscopy, Energy Dispersive)
England:
—Cornwall and Devon, gold in, *114*
—Derbyshire, Blue John, *115*
Enhancement: (*see* Treatment of gems)
Enstatite (*see* Pyroxene)
Epidote:
—Peru, 333
—Somaliland, 150
Equipment (*see* Instruments)
ERCIT, T.S. (*see* Groat, L.A., *et al.*)
Eritrea, peridot, *108*
ERNI, F.-X. (*see* Gübelin, E., *et al.*)
Euclase: Colombia, Quebrada Negra, *299(2)*
European Gemmological Laboratory, gift to GAGTL, 121
EVDOKIMOV, M.D., LADYGINA, M.Y., NESTEROV, A.R., Morphology of diamonds as a possible indicator of their genesis, *488*
Exhibitions (*see* Conferences ...)
Extralapis: *116, 302, 370*

Fabergé, 468
Faceting (*see* Cuts)
Faithfull, J., 375
Fakes, 'Power Beads', *433*
FALSTER, A.U., SIMMONS, W.B., WEBBER, K.L., NIZAMOFF, J.W., BARBOSA, C.P., GAINES, R.V., Minerals of the Brumado magnesite deposits, Serra das Eguas, Bahia, Brazil, *491*
—, SIMMONS, W.B., NIZAMOFF, J.W., WEBBER, K.L., Cuprian elbaite from the Boqueiron Zinho pegmatite, Paraiba, Brazil, *491*
FANNING, C.M. (*see* Sutherland, F.L., *et al.*)
FARELL, S. (*see* McLaurin, D., *et al.*)
FEDOROV, I.I. (*see* Chepurov, A.I., *et al.*)
FEDORTCHOUK, Y. (*see* Canil, D., *et al.*)
Feldspar:
—albite: in maw-sit-sit jade, 87, 89, chemical analysis, 90; Russia, Urals, *493*
—amazonite: Zapot pegmatite, Nevada, *108*; Urals, Russia, *493*
—labradorite: dyed dark blue, *46;* bicolour, Finland, *48*
—microcline, Londonderry, Australia, *238*
—moonstone: Queensland, Australia, *432;* blue, Sri Lanka, *53*; cat's-eye/star, Sri Lanka, 458
—sunstone cat's-eye, Russia, 458
Feng Hsiu Yin, gift to GAGTL, 57
FERNANDO, G.W.A.R. (*see* Mathavan, V., *et al.*)
FERREIRA, C.M. (*see* Da Costa, G.M., *et al.*)
FERRINI, V., SASSANO, G., Nature, origin and age of diamonds: a state-of-the-art report, *237*
Fessel, R.P., donor to GAGTL, 119
Field, D.S.M., obituary, 182
Fissure fillers (*see* Treatment)
Finland, Ylamaa, *48*
Fipke, Charles, *371*
FISHER, D., SPITS, R.A., Spectroscopic evidence of GE POL, HPHT-treated natural type IIa diamonds, *237*
FISHER, J., Les Pegmatites gemmifères à elements rares du sud de la Californie, *364*
—, FOORD, E.E., BRICKER, G.A., Geologia, mineralogia e storia della Himalaya Mine, *298*
FISHER, N.I. (*see* Griffin, W.L., *et al.*)
FITZSIMONS, I.C.W., HARTE, B., CHINN, I.L., GURNEY, J.J., TAYLOR, W.R., Extreme chemical variation in complex diamonds from George Creek, Colorado: a SIMS study of carbon isotope composition and nitrogen abundance, *295*
FLÖRKE, O.W., RÖLLER, K., SIEBERS, F., Eisen in Amethyst: Farbzentren und Zwillingsgefüge, *364*
Fluorite:
—barite inclusion, *48*
—Blue John, *115*
—Colombia, *299;* Peñas Blancas, *300*
—France, Aveyron, *303*
—invisible, *492*
—Italy, Bergamo, *110*
—Namibia: Erongo, *365*, Okorusu, *299*
—Peru, colourless, green and pink, 333
—Russia, Dal'negorsk, *492*
—USA: Arizona, *494*; Colorado, *494*
FOORD, E.E. (*see also* Bowersox, G.W., *et al;* Eckel, E.B., *et al.;* Fisher, J., *et al.*; Modreski, P.J., *et al.*)
—, SOREGAROLI, A.E., GORDON, H.M., The Zapot pegmatite, Mineral County, *108*
FORBES, J.S., Hallmark. A history of the London Assay Office, *53*
FORD, T.D., Derbyshire Blue John, *115*
FORESTIER, F.H., A travers la nomenclature des émeraudes de Puero Vejo, émeraudes vieilles, émeraudes de vieille roche, émeraudes de vieille mine, *298*
Forgeries: 8, 483
Forsterite (*see* Olivine)
FOURIE, L.F. (*see* Phillips, D., *et al.*)
Fourier Transform spectroscopy (*see* Spectroscopy: Infrared)
Franks, J.W., obituary, 374
France:
—Aveyron, Valzergues, *303*
—Cher, Quincy, opal new discovery, *239*
—Hautes-Alpes, Orpierre, quartz septaria, *109*
—Isère, La Combe de la Selle, Saint-Christophe-en-Oisans, *492*
—Paris, Laboratoire Français de Gemmologie,*493*
—Puy-de-Dôme, Saint-Nectaire, opal new discovery, *239*
—Var, opal new discovery, *239*
FRANCE-LANORD, C. (*see* Giuliani, G., *et al.*)
FRANCIS, M.D.P.L., DHARMARATNE, P.G.R., The fashioning of rock crystal for spectacles in Sri Lanka, 291
—, DHARMARATNE, P.G.R., Ornamental variety of pink marble with apatite found near Eppawala, Sri Lanka, *491*
Francis, R., donor to GAGTL, 119
Franks, J., 309
Fraquet, Helen, 308
FREE, I. (*see* Free, J., *et al.*)
FREE, J., FREE, I., BROWN, G., LINTON, T., Verneuil synthetic corundums with induced fingerprints, *112*
Freed, H., 'Forgotten emeralds', *366*
French Guiana, Dachine, *171*
Fresnoite: *113, 301, 366*
FREY, A., Schweizer Rubine von Hand geschliffen, *298*
FRIDKIN, V.M. (*see* Vainshtein, B.K., *et al.*)
FRIEDMAN, J. (*see* Griffin, W.L., *et al.*)
FRITSCH, E. (*see also* Chalain, J.-P., *et al.;* David, C., *et al.*; Elen, S., *et al.*)

—, Les diamants de type I traités à HPHT: Novatek, General Electric, russes et suédois, *488*
—, McCLURE, S.F., OSTROOUMOV, M., ANDRES, Y., MOSES, T., KOIVULA, J.I., KAMMERLING, R.C., The identification of Zachery-treated turquoise, *173*
—, RONDEAU, B., OSTROOUMOV, M., LASNIER, B., MARIE, A.-M., BARRAULT, A., WEY, J., CONNOUÉ, J., LEFRANT, S., Découvertes récentes sur l'opale, *239*
—, ROSSMAN, G.R., L'origine de la couleur des gemmes. 1[er] partie, *47*; 3[me] partie, *491*
FROLICK, V., Fire into ice: Charles Fipke and the great diamond hunt, *371*
Führbach, J.R., gift to GAGTL, 121, 183, 244, 309
FUKUSHIMA, H. (*see* Sunagawa, I., *et al.*)

GAA Instrument Evaluation Committee, *369*
GAINES, R.V. (*see* Falster, A., *et al.*)
GALIBERT, O. (*see* Hughes, R.W., *et al.*)
GAMBINI, E., Smeraldi in Laboratorio, *368*
GAMBONI, A., GAMBONI, T., I minerali dell'isola di Caprera, *364*
Gamma-ray diffractometry investigation of dislocation density in massive quartz crystals, *113*
GARANIN, V.K. (*see* Possoukhova, T.V., *et al.*)
GARCIA, H. (*see* Maitrallet, P., *et al.*)
Garland, Mary, donor to GAGTL, 119
Garnet:
—almandine, Bohemian, *493*
—andradite: Afghanistan, *300*, Yemen, *48*
—birefringence in, *109*
—Bohemian jewellery, *493*
—colour-change: from Madagascar: *367*, characteristics, 393, 397; chemical data, 400; comparison of colorimetric with chemical data, 395, 404; spectrometry, 402, 403; visual colour determination, 398; Sri Lanka, *298*
—Cr-poor, significance in diamond exploration, *107*
—Cr-pyrope, compositional systematics and relation to tectonic setting, *295*
—demantoid: northern Italy, *172*; Kashmir, Pakistan, *493*
—dissolution, and kimberlite emplacement, *300*
—grossular: emerald green, Madagascar, *47;* Mali, *48;* Quebec, Canada, *363*; Raman spectroscopy, *240*; Somaliland, 147
—hessonite: Madagascar, characteristics, 393; Sri Lanka, primary deposit, 70, secondary deposits, 65, chemical and physical properties, 71; *297*
—hydrogrossular, pink statuette, *240*
—inclusions in Guinea diamonds, *238*
—'Kunene', 129
—Madagascar, *109; 367,* characteristics, *393*
—'mandarin', 129
—mantle, study, *295*
—naming gem, *178*
—Nigeria, *109*; 129
—nomenclature, *50*
—pyralspite, birefringence in, *109*
—pyrope: Bohemia, *493*; Somaliland, 147, 148
—pyrope-almandine, Tanzania, *174*
—pyrope-spessartine: Madagascar, *48, 367*; Sri Lanka, grey-green, *297,* colour change, *298*
—review of, *239*
—rhodolite, Madagascar, 393
—simulants, defects in , *112*
—Somaliland, 147
—spessartine: Nigeria, *46;* 129, RI and SG, 130, compositions, 130, internal features, 131
—Sri Lanka, *491*
—tsavorite, Tanzania, *174*
—update, *239*
—uvarovite: Tibet, Bo Mi new find, *368*
GATTER, I., MORTEANI, G., The fluid inclusions in the gem-quality lazulite from the Banderinha formation (Diamantina, Minas Gerais, Brazil), *47*
Gau, R.B.R., donor to GAGTL, 119
GAULT, R.A. (*see* Groat, L.A., *et al.*)
GAUTHIER, J.-P., Le traitement des perles, *491*
GAUTRON, L., MEISSER, N., Prehnite from La Combe de la Selle, Christophe-en-Oisans, Isère, France, *492*
GAVRILENKO, E.V., CALVO PEREZ, B., Characterisation of emeralds from the Delbegetey deposit, Kazakhstan, *108*
Gay, A., donor to GAGTL, 119
Gay, M. and B., donors to GAGTL, 119
GELLER, B., Descriptive mineralogy of inclusions in some faceted gem topaz from Brazil, *492*
Gem-A, new GAGTL identifier, 438
Gem and jewelry pocket guide, *304*
Gem description and credibility, 426
Gem identification: new methods: laser tomography, *498*; X-ray transmission topography, *498*
Gem locations of the 1900s, comprehensive review, *368*
Gem material names, *365*
Gemmological Association and Gem Testing Laboratory of Great Britain: Proceedings of, and Notices: 56, 118, 181, 243, 307, 372, 435, 502
—Annual General Meeting: 2000, 243; 2001, 502
—Annual Conference: 1999, 56; 2000, 308
—Annual Report: 1999, 185; 2000, 440; officers, council, committees, 440; education, 440; the laboratory, 441, The Millenium Trade Dinner, 441; Trade fairs, 441; visits, 441; membership, 441; publications, 441; finance, 442
—Awards: 57, 309, 502; new, 376
—Bequests to, 374
—Donations to, 119
—Examinations, successes: Gem diamond, 188, 244, 376, 502; Gemmology, 57, 120, 246, 376 505; Prizes, 244, 245, 502
—Gem-A: 438, open days, 502
—Gifts to, 57, 121, 183, 244, 309, 375, 437, 504
—Members' Meetings, 56, 118, 183, 243, 308, 374, 437
—Membership and Qualifications: elections, 59, 122, 188, 249, 313, 378, 442, 507
—New prizes for students, 312
—News of Fellows, 118
—Obituaries: 56, 118, 182, 243, 307, 374, 436
—Photographic competition 2000, 56, 181; 2001, 435, 442
—Presentation of Awards: 1999, 57; 2000, 309
—Tutorial Centre, 247
Gemmological dictionary, *371*
Gemmological Instruments Ltd, 442
Gemmological news, *46, 369*
Gemmological notes, *297*
Gemmological short notes, *47*
Gemmologic Aktuell, *106, 108(2), 112(2), 432, 433, 490, 494, 499*
Gemmologisches Symposium 2000. Zusammenfassungen/Abstracts, *432, 433(2)*
Gemmology: *117*; applications of cathodoluminescence, *497*; Dictionary of, *304*
Gem news, *45(2), 47, 48, 51(2), 171, 173*
Gem News International, *493*
Gems (*see also* Jewellery):
—*115, 371*
—business and industry review, *110*
—Czech Republic, review, *111*
—data for identification, *177*
—definition by colour, *108*
—dictionary of, *304*

—geozoological prospecting, *46*
—Golconda, diamonds, *55*
—guide: for the casual collector, *177*; Romanian, *179*
—history, *53*
—identification in Japan, *493*
—introductory textbook, *179*
—Japan, table of related events, *494*
—nomenclature, *50,* a different view on, *239*
—occurrences and plate tectonics, *433*
—professional yearbook, *371*
—quality disclosure, *499*
—Slovakia, review, *111*
Gemsafrica, gift to GAGTL, 437
'Gem silica', Peru, 331
Gem Trade Lab Notes, *46(2), 49(2), 52(2), 174, 175, 238, 240, 299, 363, 366, 369*
General Electric (GE), *295*
GENOT, L., Les pierres de lune bleues de Meethiyagoda, Sri Lanka. [A thesis], *53*
Germany:
—Dresden, Green Vaults, *493*
—Eifel, Laacher See, haüyne, *366(2)*
—gem trade directory, *177*
—Idar-Oberstein: 468, 469; aragonite, *367*; calcite, *365*; Museum, *303(2), 305;* quartz twins, *49;* Portrait der Edelsteinmetropole, *117*
—Saxonian Erzegebirge: microdiamonds, *363*; Freiburg, Bergakademie, *367*
—Waldhambach, Rheinland-Pfälz, agates, *363*
GGG (*see* Simulants and ...)
GIARD, D. (*see also* Giuliani, G., *et al.*)
—, La mission française AFG en Colombie, *298*
—,(Ed.) L'émeraude. The Emerald. Connaissances actuelles et prospectives, *115*
GIBSON, S.A. (*see* Rao, N.V.C., *et al.*)
Gifts and donations to GAGTL: 57, 119, 120, 121, 183, 244, 309, 375, 437, 504
—Afzal Fatima Ali, 183
—Alabaster, Stephen P., 119
—Andersson, A., 183
—Argos Ltd, 504
—Armstrong, A.H.G., 119
—Bank, H., 183, 309
—Becker, F.A., 183
—Bonanno, Kathryn L., 119
—Bordbar, Hossein, 437
—Bouman, Henrietta A.E., 119
—Branco, Dr Rui P., 119
—Bridges, Campbell, 57
—Bulatou, A., 375
—Burgoyne, Sheila, 119
—Burnstein, Burton A., 119
—Burton, R., 57, 309
—Cairncross, James K., 119
—Campbell-Pedersen, Maggie, 121
—Carter, Maurice W., 119
—Cartwright, Freda, 375
—Cassarino, P.R., 504
—Caycedo, Miguel J., 119
—Chandra, K.C.S., 183
—Chang, Dr Morley Sheng-Hong, 119
—Chi Ho Cheung, 119
—China Formosa Gem Lab, 57
—Clarke, Norman V., 119
—Cropp & Farr Ltd., 119
—Currie, S., 57
—Daly, Pat, 375
—de Poli, Vesta, 121
—De Souza, Suzanne P., 119
—Doulis, Lester N., 119
—Durham, D., 244, 309
—Dwyer-Hickey, P., 121, 244
—Dykhuis, Luella, 57, 119
—European Gemmological Laboratory, 121
—Fan, E., 309
—Feng Hsiu Yin, 57
—Fessel, Robert P., 119
—Francis, Roger, 119
—Führbach, J.R., 121, 183, 244, 309
—Garland, Mary, 119
—Gau, Robert B.R., 119
—Gay, Alan, 119
—Gay, Bernice, 119
—Gay, Michael, 119
—Gemsafrica, 437
—Good, Amanda, 57
—Green, Gwynneth, 119
—Griffin, R., 121
—Hamza, H., 309
—Hansson, Britt Inger, 57
—Harding, Norman H., 119
—Heckman, Hayo W., 119
—Heetman, J.A.M.T., 119
—Heetman, Joannes G., 119
—Hendrix, M, 375, 437
—Hieter, Marie-Irene, 121
—Hill, Ann F., 119
—Hill, Dr Arthur E., 119
—Hinds, Andrew F., 119
—Holt, R., & Co. Ltd, 121
—Hong, Dr Angela S.L., 119
—Hui Chak Lun, 119
—Ishii, Hajime, 119
—Ito, Eiko, 183
—James, R., 375
—Jones, David C.B., 119
—Jones, G.H., 183
—Kalischer, Janice, 244, 309, 504
—Kallner, Anders B., 119
—Kelly, Susan M.B., 119
—Killingback, Harold, 119
—King, R.F., 183
—Kunkovsky, M., 375
—Kutchinsky, R., 375
—Kyaw Khaing Win, 375, 437, 504
—Lander, Charmain E.M., 119
—Lang, Lorna M., 119
—Langford, Michael L., 119
—Lau, Glady, 119
—Lin Hsin-Pei, 119
—Lo, L. Y.-S., 57
—Logan, Joan A., 119
—Logsdon, Maxon A., 119
—Lowe, Sylvia J., 119
—Ly, D., 437
—Lynch, Kieran J., 119
—McCallum, Marcus A., 119, 121
—McDowell, Robert B., 119
—MacLachlan, Caroline E., 119
—McShane, C., 183
—Marcia Lanyon Ltd, 57
—May, The Hon. Jasper, 119
—Michon-Bordes, Helena, 119
—Midlands Branch, GAGTL, 244
—Mitteregger, Unni, 119
—Mourtzanos, Stefanos, 119
—Nagel, W., 244
—Naudi, Sara, 119
—Niroo, Sousan, 119
—Nolens-Verhamme, Paule

—O'Connor, Peggy, 437
—Ou Hin Eng, Alice, 119
—Ou Yang, Mrs C.M., 57, 121
—Packer, Dian, 504
—Palmer, K., 183
—Parsons, M., 375
—Phillips, A.H., 375
—Photiou, Mariana, 375
—Porter, Mark A., 119
—Preseli Bluestone Ltd, 504
—Pun Yuk Ling, Maggie, 119
—Pyke, John S., 119
—Quy, Caroline E., 119
—Raney, Gerard, 119
—Read, Peter G., 119, 375, 437
—Robinson, David M., Ltd., 119
—Romario, Ing., 309
—Roper, Bebs, 119
—Roper, Thomas, 119
—Rowlands, Alan F., 119
—Salerno, S., 183
—Saul, J., 309
—Sayer, David J., 119
—Schatzle-Pariso, Arlette, 119
—Schreier, Larry, 119
—Seibert, Jack, 119
—Shen Feng, 309
—Shindler, B.D., 244
—Slater, Keri, 119
—Slater, Richard, 119
—Smith, Benjamin H., 120
—Smithers, Peggy, 244
—Sphinx & Femina Ltd, 183
—Spiro-Haccou, Geertruida J., 120
—Stanley, Edward, 120
—Stassinopoulos, Elias, 120
—Tang Wai Chun, 120
—Tarratt, C., 504
—Tayyo A., 121
—Thomis, Helen M., 120
—Thomson Gems Ltd., 57, 244, 504
—Tsoukopoulou, Ioanna L., 309
—Tsui, Sunny K., 120
—Tucker, William J., 120
—van der Giessen, Wilma, 57, 121
—van Rose, Susanna, 121, 437
—Vince, John O., 120
—Vuillet a Ciles, P., 183, 244, 437
—Ward, A.E., & Sons, 309
—Warriner, Elizabeth R., 120
—Watanabe, Masahiro, 120
—Webb, Malcolm H., 120
—Weller, G., 437
—Wilkins, Anthony E., 120
—Williams, Bear, 375
—Williams, Donald K., 120
—Wong Hon Chung, 120
—Won-Sa Kim, Professor, 119
—Zini, G., 309
GIULIANI, G. (*see also* Schwartz, D., *et al.*)
—, CHAUSSIDON, M., SCHUBNEL, H.-J., PIAT, D.H., ROLLION-BARD, C., FRANCE-LANORD, C., GIARD, D., DE NARVAEZ, D., RONDEAU, B., Historique de gisements d'émeraude et identification des émeraudes anciennes: part 1, *239*; part 2, *298*
Glass (*see also* Tektite):
—artificial: analyses, 282; immitating gem rough, 483
—beads, Anglo-Saxon, *116*
—blue: Taiwanese, imitating chalcedony, 275, properties, 276, 278, data, 279, spectroscopy, 280
—makusanite obsidian, Peru, 333
—natural, *110;* analyses, 282
—obsidian, Peru, 333
—with tridymite inclusions, a 'new' gemstone, *112*
Gold:
—Cornwall and Devon, *114*
—Biblical references, *495*
—geozoological prospecting, *46*
—jewellery buying guide, *180*
—Swiss localities, *180*
—The power of, *434*
GOLOVKO, A.V., YAKOVENKO, N.E., AKHMEDOV, N.A., [Discovery of diamonds in the south-western Uzbekistan.], *362*
Good, Amanda, gift to GAGTL, 57
Gosling, Elizabeth, 183
GOULET, N. (*see* Digonnet, S., *et al.*)
Grandidierite, Madagascar, *432*
GRANGE BOOKS, Gemstones, *115*
GRANT, R., WILSON, W.E., Dal'negorsk, Primorskiy Kray, Russia. [Famous mineral localities], *492*
Graphite, diamond formation by thermal activation, *241*
GRAZIANI, G., La provenienza geografica degli smeraldi archaeologici, *365*
Greece: Douros, *297*
Green, Gwynneth: 183; donor to GAGTL, 119
Greenland, tugtupite cabochon, *239*
Greigite inclusion in synthetic diamond, *175*
GREW, E.S., ANOVITZ, L.M., Boron: mineralogy, petrology and geochemistry, *178*
Griffin, R., gift to GAGTL, 121
GRIFFIN, W.L. (*see also* Davies, R.M., *et al.*; Kaminsky, F.V., *et al.*)
—, DOYLE, B.J., RYAN, C.G., PEARSON, N.J., O'REILLY, S.Y., DAVIES, R., KIVI, K., VAN ACHTERBERGH, E., NATAPOV, L.M., Layered mantle lithosphere in the Lac de Gras area, Slave Craton: composition, structure and origin, *171*
—, FISHER, N.I., FRIEDMAN, J., RYAN, C.G., O'REILLY, S.Y., Cr-pyrope garnets in the lithospheric mantle. I. Compositional systematics and relations to tectonic setting, *295*
GROAT, L.A., ERCIT, T.S., MARSHALL, D.D., GAULT, R.A., WISE, M.A., WENGZYNOWSKI, W., EATON, W.D., Canadian emeralds: the Crown showing, south-eastern Yukon, *492*
GROBON, C. (*see* Boillat, P.-Y., *et al.*, Notari, F., *et al.*)
GRYORIEV, V.V., BURLAKOV, J.V., POLENOV, J.A., KUZNEKOV, V.I., Rubinovoje: die roten Korunde von Rai-Iz im Polar-Ural, *365*
Grossular (*see* Garnet)
GU, C. (*see* Yuan, G., *et al.*)
Guatemala, Motagua Valley, jadeites and albitites, *173*
GÜBELIN, E. (*see also* Schmetzer, K., *et al.*)
—, ERNI, F.-X., Edelsteine: Symbole der Schönheit und der Macht, *54*
GUIDO, M., The glass beads of Anglo-Saxon England, c. AD 400-700, *116*
GUILLOU-GOTKOVSKY, E., La mine de fluorine de Valzergues, Aveyron, *303*
Guinea, Kankan district, *238*
GURNEY, J.J. (*see also* Fitzsimons, I.C.W., *et al.*)
Changes and new developments in Africa, *171*
GUTZMER, J. (*see* Cairncross, B., *et al.*)

Hackmanite (*see* Sodalite)
Hager, F., 185
HÄGER, T., Behandlung von Edelsteinen und ihrer Farbe, *108*
HALL, R.L. (*see* Mychaluk, K.A., *et al.*)

HAMID, G., KELLY, S.M.B., BROWN, G., Ruby from Tunduru-Songea, East Africa – some basic observations, *108*
HAMMER, V.M.F. (*see also* Smith, C.P., *et al.*; Stephan, J. *et al.;* Weerth, A., *et al.*)
—, BRANDSTÄTTER, F., LENGAUER, C.L., Neu: grüner Pargasit aus Pakistan, *47*
—, STEPHAN, J., Tester Model 590 for colourless moissanite/diamond – an instrument evaluation, *50*
—, STEPHAN, J., Mit High-tech ins nächste Jahrtausend, *295*
—, STEFAN, J., BRANDSTÄTTER, F., Zur Verwendung künstlicher Gläser als Schmuckmaterial: Schwarzes und blaues Glas mit ungewöhnlichen Einschlüssen, *112*
Hamza, H., gift to GAGTL, 309
Handbook of Mineralogy, Vol. IV, *302*
HANNEMAN, W.W., Dispersion, birefringence, and the critical angle refractometer, *497*
—,The Hanneman Refractometer, 155, *301*
—, In defence of gemmologists: a different view on nomenclature, *239*
—, Naming gem garnets, *178*
—, L_H – an 'old' gemmological property, *50*
Hänni, H., 375
HÄNNI, H.A. (*see also* Chalain, J.-P., *et al.;* Kiefert, L., *et al.*; Krzemnicki, M.S., *et al.*)
—, Gemmologische Kurzinformationen. Eine neue Lichtquelle von kurzwelligem UV-Licht für den SSEF IIa Diamond Spotter™ zum Nachweis des Diamanttyps IIa, *489*
—, Les grenats gemmes, *239*
—, Sintesi e trattamenti degli smeraldi, *369*
—, Sur la formation de nacre et les perles, *47*
—, SHUN TIEN WU, YUAN XINGQIANG, TSAI WEN-PO, A glass imitation of blue chalcedony, 275
Hansson, Britt Inger, gift to GAGTL, 57
Harding, N.H., donor to GAGTL, 119
Harding, R.R., 375
HARDING, R.R. (*see* Kennedy, S.J., *et al.*; Oldershaw, C., *et al.*)
Hardstones:
—Chinese nomenclature, *111, 174*
—German, *303*
HARGRAVES, R.B. (*see* De, S., *et al.*)
HARLOW, G.E. (*see also* Hughes, R.W., *et al.*, Johnson, C.A., *et al.*)
—, SORENSON, S.S., Jade occurrence and metasomatic origin, *492*
Harris, J., Photographic competition 2001, 2nd prize winner, 435
HARRIS, J.W. (*see* Izraeli, E.S., *et al.*, Joswig, W., *et al.*, Johnson, L.H., *et al.*)
HARTE, B. (*see* Fitzsimons, I.C.W., *et al.*)
Hatleberg, J.N., 183
Haüyne: Eifel, Germany, *366(2)*
HAWTHORNE, F.C., HENRY, D.J., Classification of the minerals of the tourmaline group, *239*
HAYASHI, M., The present status of application of instrumental methods of gem identification – examples of identifications using EDS, X-radiography, FT-IR, *497*
HAZEN, R.M., The diamond makers, *54*
HEADY, SUE, Rubies (diamonds, emeralds, sapphires) are a girls best friend, *178*
Healing stone, *298*
HEANEY, P.J. (*see* De, S., *et al.*)
Heckman, H.W., donor to GAGTL, 119
Heetman, J.A.M.T., donor to GAGTL, 119
Heetman, J.G., donor to GAGTL, 119
HEINZ, K. (*see* Mircea-Dragomir, A., *et al.*)
HELDNER, H., Blühende Fantasie, *365*
—, Zum Stabilisieren von Edelsteinen, *298*
Hemimorphite: properties, 276
Hendrix, M., gift to GAGTL, 375, 437
HENIG, M., PLANTZOS, D., Classicism to neo-classicism: essays dedicated to Gertrud Seidmann, *116*
HENN, J. (*see* Henn, U., *et al.*; Milisenda, C.C., *et al.*)
Henn, U., gift to GAGTL, 437
HENN, U. (*see also* Bank, H., *et al.*, Lind, T., *et al.*, Milisenda, C.C., *et al.*)
—, Edelsteinkundliches Fachworterbuch. Gemmological Dictionary, *371*
—, Gemmological Short Notes, *47*
—, Gemmologische Kurzinformationen, *108; 113(2)*
—, Synthetic fresnoite – a new gemstone simulant, *301*
—, Synthetische Alexandritdrillinge, *301*
—, HYRŠL, J., MILISENDA, C. C., Gem-quality clinohumite from Tajikistan and the Taymyr region, northern Siberia, 335
—, MILISENDA, C.C., Gemmologische Kurzinformationen, *113*
—, MILISENDA, C.C., The gemstone occurrences of Madagascar, *492*
—, MILISENDA, C.C., Synthetische rote Berylle aus Rusland, *51*
—, MILISENDA, C.C., HENN, J., Saphire aus einem neuen Vorkommen in Südwesten von Madagaskar, *108*
—, MILISENDA, C.C., PETSCH, E., Die Edelsteinvorkommen Madagaskars, *109*
—, PETSCH, E., Gemmologische Kurzinformationen Verschiedenfarbige Saphire aus Brasilien, *433*
HENRY, D.A. (*see* Birch, W.D., *et al.*)
HENRY, D.J. (*see* Hawthorne, F.C., *et al.*)
Herderite, Paraiba, Brazil, *496*
Hessonite (*see* Garnet)
Hieter, Marie-Irene, gift to GAGTL, 121
Hiddenite, Alexander County, North Carolina, *490*
Hill, Ann F., donor to GAGTL, 119
Hill, A.E., donor to GAGTL, 119
Hinds, A.F., donor to GAGTL, 119
HISHITANI, Y. (*see* Yoshimoto, M., *et al.*)
HLAING, U.T., Burmite – Burmese amber, *47*
—, Chiastolite from Kyaukse, Myanmar, *365*
—, Mong Hsu ruby revisited – some further data, *47*
Hodgkinson, A., 118(2), 375, 438
HODGKINSON, A., Gemstones in a new light, *50*
—, Scottish gem lab news, *492*
—, Visual optics II: diamond and gem identification without instruments: the Hodgkinson method, *54*
HOFER, S.C. (*see* Bronstein, A.)
HOFFMANN-ROTHE, R., Calcit aus Idar-Oberstein, *365*
HOFMEISTER, A.M., SCHAAL, R.B., CAMPBELL, K.R., BERRY, S.L., FAGAN, T.J., Prevalence and origin of birefringence in 48 garnets from the pyrope-almandine-grossularite-spessartine quaternary, *109*
HOLLOWAY, G., A personal critique of 'Modeling the appearance of the round brilliant cut diamond: an analysis of brilliance', *Gems & Gemology*, vol. 34, Fall 1998, pp. 158-83, *109*
—, Crown angle estimation for diamond using a 'tilt test', *237*
Holt, R., & Co. Ltd., gift to GAGTL, 121
HOLZHEY, G., Gelbgrüner Opal-CT aus Madagaskar – Ein Beitrag zur Untersuchung mikrokristalliner Opale, *365*
Hong, Angela, S.L., donor to GAGTL, 119
HOOVER, D.B., LINTON, T., Dispersion measurement with the gemmologist's refractometer – Part 1, *433*
HORIKAWA, Y., Identification of a new type of laser treatment (KM treatment) of diamonds, 259
HOSKIN, P.W.O. (*see* Sutherland, F.L., *et al.*)

HOZJAN, D.J. (*see* Murphy, A.R., *et al.*)
HUANG, E., Raman spectroscopic study of 15 gem minerals, *240*
Hubnerite, Peru, 333
Huddlestone, R., 243
HUGHES, R.W., GALIBERT, O., BOSSHART, G., WARD, F., OO, T., SMITH, M., TAY THYE SUN, HARLOW, G.E., Burmese jade: the inscrutable gem, *239*
Hui, Chak Lun, donor to GAGTL, 119
HUNTER, K. (*see* Linton, T., *et al.*)
HYRŠL, J. (*see also* Henn, U., *et al.*, Seifert, A.V., *et al.*)
—, Gemstones of Peru, 328
—, New gemmological study of large garnets of supposedly Czech origin, *493*
—, Some new unusual cat's-eyes and star stones, 456
—, PETROV, A., Sodalite from Bolivia, *47*
IHINGER, P.D., ZINK, S.I., Determination of relative growth rates of natural quartz crystals, *365*

Imitation gems (*see* Simulated gems)
Immersion fluid, D-limonene, *240*
Inclusions: *433*
—Ca-silicate in Guinea diamonds, *238*
—enstatite, in Madagascar spinels, 229
—ferropericlase in Guinea diamonds, *238*
—fingerprints induced in Verneuil rubies and sapphires, *112*
—fluid: in synthetic quartz, *113*; in sapphire, characteristics, *110, 240*
—flux in Kashan ruby identification, *497*
—garnet in Guinea diamonds, *238*
—gas, moveable in Colombian emerald, *173*
—greigite ('melnikovite') in synthetic diamond, *175*
—graphite in diamond, *490*
—hematite: in rock crystal, Namibia, *367;* in strawberry quartz, *368*
—in alexandrite: 80; Russia, 79
—in aquamarine, Zambia, *299*
—in blue opal, 277
—in blue chalcedony, 277
—in chatoyant stones, 456
—in clinohumite, Pamirs and Siberia, 338, 339
—in diamonds: *46(2)*; and what they tell us, *490*
—in euclase, Colombian, *299*
—in lazulite, fluid, *47*
—in makusanite obsidian, Peru, 333
—in rock crystal, Swiss, *366*
—in sapphire, unusual, Montana, *48*
—in synthetic diamonds, 41
—in taaffeite, Sri Lankan, *240*
—in topaz: *52*; Brazilian, *492*
—in tourmaline, Zambia, *299*
—jelly-like in blue opal and blue chalcedony, 277
—larnite in Guinea diamonds, *238*
—laser bleaching in diamonds, KM-treated, 259
—lithiophilite in quartz, *366*
—periclase in Guinea diamonds, *238*
—pyrite in Colombian emeralds, *299*
—titanite-structured, in Guinea diamonds, *238*
—walstromite in Guinea diamonds, *238*
—wollastonite in artifical blue glass, 279, 283
INDENBOM, V.L. (*see* Vainshtein, B.K., *et al.*)
India: *46*
—Andhra Pradesh, Narayanpet kimberlites, *296*
—Cuddapah basin kimberlites, isotope study, *296*
—gems and gem industry, *178*
—Himachal Pradesh, mineral occurrences, *46*
—Himalaya, mineral occurrences, *300*
—Karakoram, mineral occurrences, *300*
—Karnataka: corundum comparative study, *49;* Narayanpet kimberlites, *296*
—Southern, Anathapur district, Wajrakarur pipe-10, *107*
—Tamil Nadu, Karur, *368*
Indo-China (*see* Vietnam)
Indonesia: radioactive rubies from, *51*
Infrared spectroscopy (*see* Spectroscopy: Infrared)
INOUE, K., Quantification and visualisation of diamond brilliancy, *497*
Instruments:
—Brewster-angle Meter, 236, *301*
—Critical Angle Refractometer, *497*
—Diamond Proover II, evaluated, *240*
—Firescope, 222
—Hanneman-Hodgkinson refractometer, *50, 301, 492*
—Hanneman refractometer: 155, *301;* construction notes, 158, operation notes, 159; *301*
—Hanneman tanzanite filter, *492*
—moissanite/diamond tester, model 590, Evaluation, *50*
—Nelson M17 gemstone cooling unit, *300*
—Presidium moissanite tester, report, *369*
—refractometers and pin-hole disc, *51;* simple teaching aid, *51*
—refractometer fluid; Warning, 1.815 fluid, *240*
—SSEF IIa Diamond Spotter, *489*
—SSEF IIa Diamond Illuminator, *489*
Iolite (*see* Cordierite)
Iraq: ornamental concretions, *299*
Iran, anhydrite, faceted, 366
Ireland, mineral and metalliferous mine localities, *114*
Iron Crown and Imperial Europe; the Crown, the Kingdom and the Empire: a thousand years of history, *370*
Irradiation (*see* Treatment)
Ishii, Hajime, donor to GAGTL, 119
ISSI, J.-P. (*see* Palnichenko, A.V., *et al.*)
ISTROOUMOV, M., TALAY, H.A., Diffraction colours of opal: First spectrometric data, *365*
Italy:
—Bergamo, Brembana and Seriana, quartz and fluorite, *110*
—Maddalena Archipelago, Cabrera island, *364*
—Rome, emeralds from Roman period archaeological site, *365*
—Val Malenco, *172*
Ito, Eiko, gift to GAGTL, 183
Ivory:
—characterization of recent and fossil, *49*
—spectacle frames, Sri Lankan, 292
Ixer, R., 183
IZRAELI, E.S., HARRIS, J.W., NAVON, O., Raman barometry of diamond formation, *237*

Jackson, B., 185, 309
JACKSON, B. (*see* Kinnaird, J.A., *et al.*)
Jade (*see also* Nephrite, Jadeite): *434*
—Ancient Chinese jades (Part 1), *114*
—cathodoluminescence distinguishing, *51*
—Burmese, review, *239*
—China, Xinjiang, *173*
—chromaticity, *173*
—colour, quantitative appraisal, 172
—colorimetry, *173*
—Maw-sit-sit: 87, gemmology, 88, X-ray analysis, 88, optics and mineral chemistry, 89; comments by Win Htein and Aye Myo Naing, and reply by C. Rinaudo, 251
—occurrence and metasomatic origin, *492*
—palun, 251
—palwan, 251
Jadeite: *434*

—crust, character of, *174*
—Guatemala, Motagua valley, origin, *173*
—Hte long sein – a new variety of chrome-jadeite jade, 321, origin of name, 322, characteristics, 322, 323, petrology, 324, chemistry, 326
—Japan, *490*
—Raman spectroscopy, *240*
JAHN, S. (*see also* Schneider, G., *et al.*)
—, Das blaue Wunder vom Erongo-auf Aquamarin-jagd im Innern Namibias, *365*
—, BAHMANN, U., Die miarolen im Erongo-granit: ein Eldorado für Aquamarin, Schörl & Co, *365*
James, R., gift to GAGTL, 375
James, Victoria, Photographic competition 2000, 3rd prize winner, 181
JANS, V. (*see* Pfander, P., *et al.*)
Japan:
—gem identification, *493*
—gemmological history, *494*
—Niigata Prefecture, Himekawa and Itogawa, jadeite, *490*
—Tokyo National Science Museum, *303*
JAVOY, M. (*see* De Corte, K., *et al.*)
Jet, 81
Jewellery and jewellers (*see also* Collections):
—1530 – 1930, *180*
—antique checklist, *179*
—Artists', in contemporary Europe, *371*
—Bohemian garnet, *493*
—brooch set with faceted haüyne and diamonds, *366(2)*
—Diessbach, *493*
—famous collectors, *116*
—from eight centuries, *242*
—gold and platinum, buying guide, *180*
—Golden Fleece, Order of, *493*
—Iron Crown and Imperial Europe: the Crown, the Kingdom and the Empire: a thousand years of history, *370*
—Japan, table of related events, *494*
—'Light-tree-water-being' pendant, 257
—Mughal, *434*
—of the 1900s, *366*
—'power bracelets', 485
—pre-Columbian, Antigua, *367*
—professional yearbook 2000, *371*
—reference and price guide, *242*
—retail guide, *370*
—Roman intaglio, 484
—Two in one manual, *53*
—women designers, *371*
JIANG, H. (*see* Yuan, G., *et al.*)
JILANG, Z. (*see* Zhenqiang, C., *et al.*)
JIN, C. (*see* Yuan, G., *et al.*)
JIN, Y. (*see* Yuan, G., *et al.*)
Jobbins, E.A., Presentation of Awards address, 58
Jobin, M., gift to GAGTL, 244
JOHNSON, C.A., HARLOW, G.E., Guatemala jadeites and albites were formed by deuterium-rich serpentinizing fluids deep within a subduction zone, *173*
JOHNSON, L.H., BURGESS, R., TURNER, G., MILLEDGE, H.J., HARRIS, J.W., Noble gases and halogen geochemistry of mantle, fluids: comparison of African and Canadian diamonds, *362*
JOHNSON, M.L. (*see also* Moses, T.M., *et al.*; Scott Hemphill, T., *et al.*)
—, Technological developments in the 1990s: their impact on gemology, *368*
—, ELEN, S., MUHLMEISTER, S., On the identification of various emerald filling substances, *173*
—, KOIVULA, J.I., Gem News, *45(2), 47, 48, 51(2), 52, 173*
—, KOIVULA, J.I., McCLURE, S.F., DeGHIONNO, D., Gem News, *171, 173, 239, 296, 298, 365*
JONES, A.M. (*see* Palnichenko, A.V., *et al.*)
Jones, D.C.B., donor to GAGTL, 119
Jones, G.H., gift to GAGTL, 183
JORT-EVANGELISTA, H. (*see* Cesar-Mendes, J., *et al.*)
JOSWIG, W., STACHEL, T., HARRIS, J.W., BAUR, W.H., BREY, G.P., New Ca-silicate inclusions in diamonds – tracers from lower mantle, *238*
Joyner, Louise, Anderson-Bank prize winner, 310

KAKIHANA, M. (*see* Yoshimoto, M., *et al.*)
KALASHNIKOVA, I.I., NAUMOV, V.S., KURBAKOV, A.I., SOKOLOV, A.E., PASHKOV, S.S., Gamma-ray diffractometry investigation of dislocation density in massive quartz crystals, *113*
Kalischer, Janice, gift to GAGTL, 244, 309, 504
Kalner, A.B., donor to GAGTL, 119
KALUBANDARA, S.T. (*see* Mathavan, V., *et al.*)
KAMINSKY, F.V., ZAKHARCHENKO, O.D., DAVIES, R., GRIFFIN, W.L., KHACHATRYAN-BLINOVA, G.K., SHIRYAEV, A.A., Superdeep diamonds from the Juina area, Mato Grosso State, Brazil, *489*
—, ZAKHARCHENKO, O.D., GRIFFIN, W.L., CHANNER, D.M. DeR., KHACHATRYAN-BLINOVA, G.K., Diamonds from the Guyaniamo area, Venezuela, *489*
KAMMERLING, R.C. (*see* Fritsch, E., *et al.*)
KAMPF, A.R., Minas Gerais – past and present, *493*
KANDA, H. (*see also* Collins, A.T., *et al.*)
—, Growth of high pressure synthetic diamonds, *498*
KANIS, J. (*see also* Schwarz, D., *et al.*)
—, Smeraldi dall'Africa, *366*
KAPPEL, J., Deutsche Steinschneidekunst aus dem Grünem Gewolbe zu Dresden (Sonderausstellung im Deutschen Edelsteinmuseum Idar-Oberstein 1 Oktober bis 6 Dezember 1998), *303*
KARANTH, R.V., Gems and gem industry of India, *178*
KARFUNKEL, J. (*see* Banko, A., *et al.*, Pinheiro, M.V.B., *et al.*)
KATO, A., A method for computation of gem faceting, *498*
—, Re-examination of optimum cutting angles between main facets of gemstones based on geometrical optics, *498*
Kazakhstan (*see* Russia)
KEENE, M., SALAM KAOUKJI, Treasury of the world: jewelled arts of India in the age of the Mughals, *434*
Kelly, Susan M.B., donor to GAGTL, 119
KELLY, S.M.B. (*see* Hamid, G., *et al.*)
KENNEDY, S.J., Notes from the laboratory, 265, 483
—, CASTRO, A.I., HARDING, R.R., Notes from the laboratory, 79
Kenya:
—Kisoli, 25
—Lasamba, 25
—Mangari, *173*
—Mukongonyi, 25
—Mwakisunzuru, 25
—Taita Hills, 130
—Yellow Mine, Taita-Taveta District, 11, geology, 15
KEQIN, C. (*see* Xuemei, H., *et al.*; Zhenqiang, C., *et al.*)
KERSCHHOFER, L., SHÄRER, U., DEUTSCH, A., Evidence for crystals from the lower mantle: baddeleyite megacrysts of the Mbuji Mayi kimberlite, *489*
KHALIDI, O., Romance of the Golconda diamonds, *55*
KHACHATRYAN-BLINOVA, G.K. (*see* Kaminsky, F.V., *et al.*)
KHOKHRYAKOV, A.F. (*see* Sokol, A.G., *et al.*)
Kiduah meyuhad (KM) laser treatment, 259
KIEFERT, L. (*see also* Schmetzer, K., *et al.*)

—, Hauyn aus der Eifel – ein attraktiver Edelstein, *366*
KIEFERT, L., SCHMETZER, K., HÄNNI, H.A., Synthetic moissanite from Russia, 471
KILE, D.E. (*see* Eckel, E.B., *et al.*)
Killingback, H., donor to GAGTL, 119
Kim, Won-Sa, donor to GAGTL, 119
Kimberlite:
—Arkhangelsk, Russia, diamonds and accompanying minerals, *238*
—Australia, Merlin field, *238*
—Canada, Slave Province, *301*
—emplacement, *301*
—group II magmatism, implications for origin, *107*
—India: Narayanpet, geology, petrology, geochemistry, *296;* Cuddapah basin, isotope study, *296*
—indicator mineral types, abundances and distribution in alluvial sediments, Ontario: implications for the presence of diamond-bearing kimberlite, *107*
—Mbuji Mayi, *489*
—minerals associated with diamonds in, *364*
—ultrabasic xenoliths in, Canada, *171*
—Voorspoed, South Africa, geochronological study, *107*
KING, J.M. (*see also* McLure, S.F., *et al.*)
—, MOSES, T.M., SHIGLEY, J.E., WELBOURN, C.M., LAWSON, S.C., COOPER, M., Characterizing natural-color Type IIb blue diamonds, *45*
King, R.F., gift to GAGTL, 183
KING, T.F., Mineralogy of Maine. Volume 2: mining history, gems and geology, *500*
Kinnaird, Judith, 243
KINNAIRD, J.A., JACKSON, B., Somaliland – a potential gem producer in the Mozambique Belt, 139
KITAMURA, M. (*see* Miyata, T., *et al.*)
KITAWAKI, H. (*see* Collins, A.T., *et al.,* Miyata, H., *et al.*)
KIVI, K. (*see* Griffin, W.L., *et al.*)
KIVIETS, G.B. (*see* Phillips, D., *et al.*)
KLAPPENBACH, K. (*see* Mullis, J., *et al.*)
KLAPPER, H. (*see* Smith, C.P., *et al.*)
Knight, Irene, 309
KNOBLOCH, G., Maissau: Amethyst aus Niederösterreich, *298*
KOINUMA, H. (*see* Yoshimoto, M., *et al.*)
KOIVULA, J.I. (*see also* Fritsch, E., *et al.;* Johnson, M.L., *et al.*; Moses, T.M., *et al.*; McLure, S.F., *et al.;* Shigley, J.E., *et al.)*
—, The MicroWorld of Diamonds, *179*
—, ELEN, S., Barite inclusions in Fluorite, *48*
—, Unusual inclusions in quartz, *366*
—, TANNOUS, M., SCHMETZER, K., Synthetic gem materials and simulants in the 1990s, *369*
Komatiite, diamonds in, *171*
KOMATSU, H., The identification of gems in Japan, *493*
Kosmochlor (*see* Pyroxenes)
KOYAVA, V.T. (*see* Barilo, S.N., *et al.*)
KRAMBROCK, K. (*see* Pinheiro, M.V.B., *et al.*)
Krzemnicki, M.S., *301*
KRZEMNICKI, M.S. (*see also* Chalain, J.-P., *et al.*)
—, HÄNNI, H.A., REUSSER, E., Colour-change garnets from Madagascar: comparison of colorimetric with chemical data, 395
KUDRYAVTSEVA, G.P. (*see* Possoukhova, T.V., *et al.*)
Kuncovsky, M., gift to GAGTL, 375
Kunzite:
—Afghanistan, Kunar, Nuristan, *368*
—Brazil: Eastern Pegmatite Province, Minas Gerais, *495(3)*; Urucum, *368*
—Madagascar, 393
—Nigeria, *494*
—USA, California, *364*
KURBAKOV, A.I. (*see* Kalashnikova, I.I., *et al.*)
KURNEVICH, L.A. (*see* Barilo, S.N., *et al.*)
Kutchinsky, R., gift to GAGTL, 375
Kuwait:
—al-Sabah collection, *434*
—Dar al-Athar al-Islamiyyah (Kuwait National Museum), *434*
KUZNEKOV, V.I. (*see* Gryoriev, V.V., *et al.*)
KVASNITSA, V.N. (*see* Ostapenko, G.T., *et al.*)
KHVOROV, P.V. (*see* Pautov, L.A., *et al.*)
Kyanite, Raman spectroscopy, *240*
Kyaw Khaing Win, gift to GAGTL, 375, 437, 504

Laboratoire Français de Gemmologie, *493*
Labradorite (*see* Feldspar)
LADYGINA, M.Y. (*see* Evdokimov, M.D., *et al.*)
LAIRD, J.W. (*see* Coenraads, R.R., *et al.*)
Lamproite: India, Cuddapah basin isotope study, *296*
Lamprophyre:
—aillikite dykes, Quebec, *488*
—camptonite-monchiquite, diamondiferous xenoliths in, *362*
—shonkinite-porphyries, diamondiferous xenoliths in, *362*
Lancaster, D., 309
LANCET, B., L'exploitation diamantifère en République Centre-Africaine, *45*
Lander, Charmain E.M., donor to GAGTL, 119
LANDMANN, A., Synthetische Quartzkristalle – Kristalleigenschaften, hydrothermale Züchtung und gemmologische Unterscheidung von natürlichen Quartzkristallen, *113*
Lang, Lorna M., donor to GAGTL, 119
Langford, M.L., donor to GAGTL, 119
Lapis Lazuli:
—Chile, Coquimbo region, *239*
—history, *368*
—USA, Blue Winkle mine, Denver, *48*
Larcher, D., 183
Larimar (*see* Pectolite)
Larnite inclusions in Guinea diamonds, *238*
LARSON, W.F. (*see* Shigley, J.E., *et al.*)
Laser crystals, discussion of growth and coloration, *112*
Laser tomography, *498*
LASNIER, B. (*see* Fritsch, E., *et al.*)
Lau, Gladys, donor to GAGTL, 119
LAURS, B.M. (*see also* Bowersox, G.W., *et al.;* Shigley, J.E., *et al.*)
—, Gem News International, *493*
LAWSON, S.C. (*see* King, J.M., *et al.*)
Lazare Kaplan (LKI), *295*
Lazulite:
—Austria, *297*
—Brazil, *47*
LEFRANT, S. (*see* Fritsch, E., *et al.*)
LENGAUER, C.L. (*see* Hammer, V.M.F., *et al.*)
LENZ, G., Die Entstehung der Farben in Achaten, *109*
LEONUK, N.I. (*see* Barilo, S.N., *et al.*)
Lepidolite (*see* Mica:)
LERGIER, W., WEISS, S., Schatzkammer Alpen: Alpine Edelsteine (1), *109*
LETENDRE, J. (*see* Capdevila, R., *et al.*)
LETNIKOV, F.A., ZVONKOVA, N.G., SIZYKH, N.V., DANILOV, B.S., [Accessory minerals from eclogites and diamond-bearing rocks of Kumdykul deposit] *296*
Letters to the Editor, 124, 251, 360
LEVINSON, A.A. (*see* Murphy, A.R., *et al.;* Mychaluk, K.A., *et al.*)
LI, S. (*see* Yuan, G., *et al.*)
LI, W., LI, Z., MAO, Y., [A study on mineralogic and physicochemical characteristics of beryls and aqua-

marines in pegmatites of different origin] *298*
—, WU, R., [The colorimetry and chromaticity study of Xinjiang Hetian jade] *173*
LI, X., YUAN, K., [Study on the mechanism of colour variation for iron-containing beryl] *299*
LI, Z. (*see* Li, W., *et al.*)
LIANG, J. (*see* Wang, J., *et al.*)
LIEBER, W., Rodochrosit-Stalaktiten, *366*
LI JIAN, QI (*see* Ou Yang, C.M., *et al.*)
LI LIPING, CHEN ZHONGHUI, Cultured pearls and colour-changed cultured pearls: Raman spectra, 449
Limonite: channel filling in topaz, *48*
LIN, B., WAN, H., PENG, M., [Study of inclusion in synthetic diamond] *175*
Lin, Hsin-Pei, donor to GAGTL, 119
LIND, T., Les grenats du Millénaire, *240*
LIND, T., HENN, U., A new find of spessartine garnets in Nigeria, 129
LINTON, T. (*see also* Free, J., *et al.*; Hoover, D.B., *et al.*)
—, A warning: beware of 1.815 refractometer contact fluid, *240*
—, D-limonene: a useful immersion liquid for gemmology, *240*
—, Refractometers and the pin-hole disc, *51*
—, Evaluation of a teaching aid for 'Visual Optics', *51*
—, Surface reflectivity of synthetic moissanite – a warning about heating, *369*
—, BRETHERTON, B., Nelson M117 gemstone cooling unit, *300*
—, CUMMING, A., HUNTER, K., Diamond Proover II, *241*
—, HUNTER, K., Presidium moissanite tester (a GAA Instrument Evaluation Committee report), *369*
—, HUNTER, K., CUMMING, A., The Hanneman refractometer, *301*
—, HUNTER, K., CUMMING, A., The Brewster-angle meter, *301*
Lithiophilite inclusion in quartz, *366*
LITJENS, R.C., De wondere Wereld van de Edelsteen, *179*
Liu Jiewen, Anderson medal award, 58
LIU, L., Genesis of diamonds in the lower mantle, *172*
LIU, X.-W. [SEM study of jadeite jade], *493*
Lo, L. Y-S., gift to GAGTL, 57
Logan, Joan A., donor to GAGTL, 119
Logsdon, M.A., donor to GAGTL, 119
London Assay Office, history of, *53*
London Diamond Bourse and Club, 185
Lowe, S.J., donor to GAGTL, 119
LU, T. (*see* Balitsky, V.S., *et al.*; Shigley, J.E., *et al.*)
Lucky Horseshoe pendant, 484
Luminescence in irradiated black diamonds, *488*
LUPEI, A., STOICESCU, C., LUPEI, V., X-ray and spectral characterization of defects in garnets, *112*
LUPEI, V. (*see* Lupei, A., *et al.*)
Ly, D., gift to GAGTL, 437
LYCKBERG, P., YE ZAGORSKY, V., Gem pegmatites of the Ural Mountains, Russia, *493*
Lynch, K.J., donor to GAGTL, 119

McCallum, M.A., donor to GAGTL, 119; gift to GAGTL, 121
McCLURE, S.F. (*see also* Fritsch, E., *et al.*; Johnson, M.L., *et al.*; Moses, T.M., *et al.*; Shigley, J.E., *et al.*)
—, KING, J.M., KOIVULA, J.I., MOSES, T.M., A new lasering technique for diamonds, *296*
—, SMITH, C.P., Gemstone enhancement and detection in the 1900s, *366*
McDowell, R.B., donor to GAGTL, 119
MACHIN, K.J. (*see* Phillips, D., *et al.*)
McIvor, P., 243
MacLachlan, Caroline E., donor to GAGTL, 119
McLaughlin, R. W., Mineral Hall, Royal Ontario Museum, *497*
McLAURIN, D., ARIZMENDI, E., FARELL, S., NAVA, M., Pearls and pearl oysters in the Gulf of California, Mexico – an update, *48*
McLeod, M., 438
McShane, C., gift to GAGTL, 183
Madagascar:
—agates and other concretions, *299*
—Amboudrohefeha, 390
—Ancazoabo, 385, 386
—Andranolava, 386
—Andranondambo, sapphires, 229, *368*, 385
—Antsiranana, sapphires, *367*
—Anzacobe, *368*
—apatite cat's-eye, *363*
—Bekily: green grossular, *47;* colour change garnets, *367*
—beryl, 393
—chalcedony, *48*
—chrysoberyl, *368*, 392
—cordierite, iolite, 393
—corundum, rhodolite coloured, *432*
—Ejeda, 386
—emerald, review of deposits, *366*
—Fotiyola, 386
—garnets: 393, colour change, 393; comparison of colorimetric with chemical data, *46*, 395; pyrope-spessartine, *48*, *367*
—gemstone occurrences and geology, *492*
—gemstone varieties, *109*
—grandidierite, *432*
—Ihosy, 386
—Ilakaka, 229, 385, 386
—kunzite, 393
—Mananjary, 385
—minerals and gemstones, *116*, 385
—Murarano, 386
—new gemstone occurrences: *46*, *108;* 385, geology, 387, characteristics of gems, 389
—opal-CT, green, *365*
—ornamental concretions, *299*
—quartz with unusual inclusions, *366*
—Ranohira – Sakaraha area, *108*, 385, 386
—ruby: 409; mineralization, *240*
—sapphire, 389
—sphene, *298*
—spinels: 392; inclusions in, 229
—topaz, 393
—tourmaline, 393, *496*
—Vatomandry area, rubies from: 409, gemmological properties,411
—zircon, 393
Magnesite deposit, Brumado, Bahia, Brazil, associated minerals, *491*
MAHROOF, M.M.M., Brothers corundum: sapphires in Sri Lanka, *109*
MAITRALLET, P., Elements pratiques de recherche du traitment des émeraudes par analyse spectrométrique infrarouge, *241*
—, GARCIA, H., Laboratoire Français de Gemmologie: principaux examens pratiqués pour identifier le traitment thermique des saphirs, *493*
MAKHINA, I.B. (*see* Balitsky, V.S., *et al.*)
Makusanite obsidian (*see* Glass)
Malachite: central Africa, 334
Malagasy Republic (*see* Madagascar)
MALANGO, V. (*see* Milisenda, C.C., *et al.*)
Malawi:
—Chimwadzulu Hill, *239*

—sapphires, yellow and green, *493*
Mali: grossular, *48*
Malca-Amit (UK) Ltd, 185
Manganotantalite, Mozambique, *364, 367*
Mantle fluid geochemistry, comparison of African and Canadian diamonds, *362*
MANUTCHEHR-DANAI, M., Dictionary of gems and gemology, *304*
MAO, Y. (*see* Li, W., *et al.*)
Marcia Lanyon Ltd, gift to GAGTL, 57
MARCON, R. (*see* De Stefano, P., *et al.*)
Marble, pink ornamental, Sri Lanka, *491*
MARIE, A-M. (*see* Fritsch, E., *et al.*)
MAR'IN, A.A. (*see* Balitsky, V.S., *et al.*)
MARSHALL, D.D. (*see* Groat, L.A., *et al.*)
MARTIN, R., Les septarias de la région d'Orpierre, Hautes-Alpes (F), décadence de leurs minéraux, *109*
MARUTA, H. (*see* Yoshimoto, M., *et al.*)
Mason, Shena, *375*
MASSI, L., FRITSCH, E., Les corindons diffusés, *493*
MASSONNE, H.J. (*see* Nasdala, L., *et al.*)
MATHAVAN, V., KALUBANDARA, S.T., FERNANDO, G.W.A.R., Occurrences of two new types of gem deposits in the Okkampitiya gem field, Sri Lanka, 65
Maurer, Bob, Photographic competition 2001, 3rd prize winner, 435
Mauretania, diamond prospects, *171*
Maw-sit-sit (*see* Jade; Myanmar)
May, J., donor to GAGTL, 119
MEDENBACH, O., Kristalle und Polarisationsfarben, *112*
MEISSER, N. (*see* Gautron, L., *et al.*)
'Melnikovite' inclusion in synthetic diamond, *175*
Mercer, I., 118
MERCIER, A., DEBAT, P., SAUL, J.H., Exotic origin of the ruby deposits of Mangari area in SE Kenya, *173*
—, RAKOTONDRAZAFY, M., RAVOLOMIANDRINARIVO, B., Ruby mineralization in southwest Madagascar, *240*
Meteorites (*see* Tektites)
Mexico: (*see also* America, North)
—an update, *48*
—northern, agates of, *370*
—Mapimi, opal new discovery, *239*
—Pearls and pearl oysters in the Gulf of, *48*
Miarolitic cavities in Namibian granite, *365*
Micas:
—biotite, eastern Brazil, chemical compositon, *495*
—lepidolite, Londonderry, Australia, *238*
—phlogopite, Mogok, Myanmar, *497*
MICHELOU, J.-C. (*see also* Osorio, C.E., *et al.*)
—, L'état actuel de la commercialisation des émeraudes, *240*
Michon-Bordes, Helena, 119
Microcline (*see* Feldspar)
MIGLIOLI, A. (*see* Amabili, M., *et al.*)
Mikimoto Pearl Island, *241*
MIKHAILOV, V.P. (*see* Barilo, S.N., *et al.*)
MILISENDA, C. C. (*see also* Bank, H., *et al.*, Henn, U., *et al.*)
—, Gemmologie Aktuell, *490, 493, 499*
—, HENN, U., Die Edelsteine Sri Lankas: Vorkommen und Genese, *48*
—, HENN, U., HENN, J., New gemstone occurrences in the south-west of Madagascar, 385
—, HENN, U., HENN, J., Demantoide aus Pakistan, *494*
—, MALANGO, V., TAUPITZ, K.C., Edelsteine aus Sambia – Teil 2: Turmalin und Aquamarin, *299*
—, ZANG, J., Spessartine aus Nigeria, *109*
MILLEDGE, H.J. (*see* Johnson, L.H., *et al.*)
Millennium Trade Dinner, 185
MILLER, A.M., Cameos old and new. 2nd edn, *55*
Miller, Jeanne S., obituary, 374
Miller's Jewellery antiques checklist, *179*
Mineralogical Record index, *500*
Mines and mining:
—Acari, Peru, 330
—Adelaide Proprietry, Dundas, Tasmania, *238*
—Alto Ligonha, Mozambique, *364, 367*
—Argyle: New South Wales, Australia, *171*, discovery and mining, *490*
—Arqueana, Minas Gerais, Brazil, *494*
—Asbestos, Quebec, Canada, *363*
—Batalha, Paraiba, Brazil, *491*
—Blu Moon, British Columbia, Canada, *298*
—Blu Starr, British Columbia, Canada, *298*
—Blue Winkle, Denver, USA, *48*
—Brazil: *110*; pegmatite mining history, *495*
—Canadian diamond production, *172*
—Capão, Ouro Preto, Brazil, 134
—Carmen Lira, Peru, 333
—Casapalca, Peru, 333
—Crown, Yukon, Canada, *492*
—Danburitiy, Dal'negorsk, Russia, *492*
—Dattawa, Myanmar, *48*
—Ekati, North West Territories, Canada, *45(3), 53, 172, 371*
—emerald, history of, *239, 298(2)*, trade routes, *298*
—Four Pearls, Arizona, USA, *48*
—Gillette, Connecticut, USA, *497*
—Golconda, India, *55*
—Golodnij, Urals, Russia, *493*
—Himalaya, California, USA, detailed account, *298; 364*
—Hofmeyer, Zambia, *299*
—Homestake, Arizona, *494*
—Huanzala, Peru, 334
—Ireland, localities, *114*
—Jagoda, Zambia, *299*
—John Saul Mine, Kenya, 11
—Kapirinkesa, Zambia, *299*
—Kazionnitsa, Urals, Russia, *493*
—La Pita, Boyacá, Colombia, *239, 300*
—Little Three, California, *48, 364*
—Londonderry quarries, Australia, *238*
—Lundazi, Zambia, *299*
—Maine, USA, geology, mining history, *500*
—Maissau, Austria, *298*
—Malisheva mine, Jekaterinburg, Sverdlovsk, Russia, 80
—Manuelita, Peru, 332, 333
—Merlin, Northern Territory, Australia, *171(2)*; *238*
—Minas Gerais: discovery and exploitation, *493*; development and geological environment, *495*; famous mines and gem crystals, *495*
—Mogok, Myanmar, account of working, *238*; history, *501*
—Mokrusha, Urals, Russia, *493*
—Morococha, Peru, 333
—Morrua, Mozambique, *367*
—Mutuca, Minas Gerais, Brazil, *368*
—Muzo-Cosquez area, Colombia, *300*
—Naipa, Mozambique, *364*
—Olympic Dam, South Australia, *300*
—Pederneira, Minas Gerais, Brazil, *494*
—San Genaro, Peru, 332
—Sri Lanka, a history, *109*
—Staraja Mylnitsa, Urals, Russia, *493*
—Starewa Jama, Urals, Russia, *493*
—Stewart Lithia, California, USA, *364*
—Sunnyside, Colorado, *497*
—Sweet Home, Alma, Colorado, *494, 497*
—Takavara mine, Urals, Russia, 85

—Telirio, Minas Gerais, Brazil, *494*
—Thetford, Quebec, Canada, *363*
—Tourmaline King, California, USA, *364*
—Tourmaline Queen, California, USA, *364*
—Turmalina, Peru, 333
—Tyazhitnitza, Urals, Russia, *493*
—Udachnaya, Siberia, *237*
—Urucum, Brazil, *368*
—Valzergues, Aveyron, France, *303*
—Wah Tu Wah, Yunnan, China, *300*
—Yellow Mine, Taita-Taveta, Kenya, 11, 12; geology, 14
—Zapot, Mineral Co., Nevada, USA, *108, 368*
—Zambia, *299*
MIRCEA-DRAGOMIR, A., HEINZ, K., Pietre pretioase fine ornamentale, perle, *179*
MISIOROWSKI, E.B., Jewelry of the 1900s, *366*
Mitteregger, U., donor to GAGTL, 119
MIYATA, T., KITAWAKI, H., KITAMURA, M., Cathodoluminescence method and its applications to gemmology, *498*
MODRESKI, P.J. (*see also* Eckel, E.B., *et al.*)
—, FOORD, E.E., BARBOSA, C.P., Composition and colour of uvite-dravite tourmaline from Brumado, Bahia, Brazil, *494*
Monnickendam, J., 185, 309
Moonstone (*see* Feldspar)
MOORE, T., What's new in minerals: Tucson Show 2001, *494*
MORABITO, S. (*see* De Stefano, P., *et al.*)
MOREAUX, C. (*see* Dereppe, J.M., *et al.*)
Morganite:
—Brazil, *495*
—Mozambique, Alto Ligonha, *364, 368*
—USA, California, *364*
MOROZ, I.I., ROTH, M.L., DEICH, V.B., The visible absorption spectroscopy of emeralds from different deposits, *109*
MORRIS, T.F., CRABTREE, D., SAGE, R.P., AVERILL, S.A., Types, abundances and distribution of kimberlite indicator minerals in alluvial sediments, Wawa-Kinniwabi Lake area, north-eastern Ontario: implications for the presence of diamond-bearing kimberlite, *107*
MORTEANI, G. (*see* Gatter, I., *et al.*; Preinfalk, C., *et al.*)
MOSES, T.M. (*see also* Fritsch, E., *et al.*; King, J.M., *et al.*; McLure, S.F., *et al.*; Reinitz, I.M., *et al.*; Shigley, J.E., *et al.*; Scarratt, K., *et al.*)
—, McCLURE, S.F., JOHNSON, M.L., Gem Trade Lab. Notes, *490, 499*
—, REINITZ, I., McLURE, S.F., Gem Trade Lab Notes, *46(2), 49(2), 52(2), 174, 175, 238, 240, 296, 299, 363, 366, 369*
—, SHIGLEY, J.E., McCLURE, S.F., KOIVULA, J.I., VAN DAELE, M., Observations of GE-processed diamonds: a photographic record, *172*
Mourtzanos, S., donor to GAGTL, 119
Mozambique:
—Alto Ligonha pegmatite, *363, 367, 368*
—emerald resources review, *366*
Mozambique Orogenic Belt, 139
MUFTAKHOV, V.A. (*see* Pautov, L.A., *et al.*)
MUHLMEISTER, S. (*see* Johnson, M.L., *et al.*)
MUKHERJEE, A., RAO, K.S., BABU, E.V.S.S.K., ROY, G., Compositional study of spinels from Wajrakarur pipe-10 (Anumpalle), Anathapur district and its significance in diamond prospectivity, *107*
MÜLLENMEISTER, H.J., Inklusen-Bernsteine: Informationsträger vergangener Erdepochen, *494*
MULLIS, J., KLAPPENBACH, K., OBERHÄNSLI, R., Kronleuchter aus Bergkristall, *366*
Munsteiner, Bernd, gem cutter, *363*
MUNN, G.C., The triumph of love: jewellery 1530-1930, *180*
MURPHY, A.R., HOZJAN, D.J., DE MILLE, C.N., LEVINSON, A.A., Pre-Columbian gems and ornamental materials from Antigua, West Indies, *367*
MURPHY, J.A. (*see* Eckel, E.B., *et al.*)
Murray, Jaqueline K., obituary, 374
Museums:
—American Museum of Natural History, New York, USA, *303*; 468
—Cambridge University Museum of Archaeology and Anthropology, *114*
—Green Vaults, Dresden, Germany, *493*
—Idar-Oberstein, Germany, *303(2), 305*
—Kuwait National Museum, Kuwait, *434*
—Museum Victoria, Melbourne, Australia, *364*
—Muzeum Mineralogicznego, Wroclaw, Poland, 466, 467
—Natural History, London. New mineral and gem gallery, *111*
—Pearl Museum, Japan, guide to *242*
—Prague National Museum, Czech Republic, *493*
—Royal Ontario, Canada, *497*
—South Australian, Adelaide, *367(2)*
—Stockholm, Nationalmuseum, gem exhibition, *242*
—Tokyo National Science Museum, Japan, *303*
Mussel, pearl, *Hyriopsis cumingii*, 265, *300*
Myanmar:
—Hpakan, *239*
—jade: htc long sein, 321; maw-sit-sit, 87; palwan, palun, 251; review, *239*
—jade simulant, *48*
—Kachin, Maingkwan, burmite, *47*
—Kyaukse, chiastolite, *365*
—Mogok: *497*; account of working, *238*; Dattawa Mine, hackmanite, *48*; unusual red spinel, *49*; Valley of rubies and sapphires, *501*
—Pein Pyit, red spinel, *368*
—Tawmaw, *239*
—Yangon jade auction, 321
MYCHALUK, K.A., LEVINSON, A.A., HALL, R.L., Ammolite: iridescent fossilized ammonite from southern Alberta, Canada, *494*

Nagel, W., gift to GAGTL, 244
Names, obsolete mineral, *176*
Namibia:
—Erongo Mountains: aquamarine, *364, 365(2),* Bergsig 274, *497*; beryl, *300*
—Kunene, 129, 130
—Okorusu, *299*
—Orange River, quartzes, *367*
—tourmaline, general survey, *240*
NASDALA, L., MASSONNE, H.J., Microdiamonds from the Saxonian Erzgebirge, Germany: in-situ micro-Raman characterisation, *363*
Nassau, K., *301*; 437; 438(2)
NATAPOV, L.M. (*see* Griffin, W.L., *et al.*)
Natrolite in maw-sit-sit jade, 88
Naudi, Sara, donor to GAGTL, 119
NAUMOV, V.S. (*see* Kalashnikova, I.I., *et al.*)
NAVA, M. (*see* McLaurin, D., *et al.*)
NAVON, O. (*see* Izraeli, E.S., *et al.*)
NAVONE, R. (*see* Rinaudo, C., *et al.*)
Nelson, J., August Köehler Medal winner, 502
Nephrite (*see also* Amphibole; Jade):
—Australia, Eyre Peninsula, 193, 195, mode of origin, 197, geochemistry, 199
—Canada, British Columbia, 193, 194, mode of origin, 197, geochemistry, 199

—chatoyant, *111*
—'Dianite', *239*
—Poland, 461, history, 461, geology, 463, analyses, 467, mining, 468
—Raman spectroscopy, *240*
—Siberian blue, *239*
—two contrasting types, 193
Nero, Roman emperor, 291
NESTEROV, A.R. (*see* Evdokimov, M.D., *et al.*)
Neural networks, artificial, classification of emeralds, 93
NEWMAN, R., Gem and jewelry pocket guide, *304*
—, Ruby, sapphire and emerald buying guide, *55*
New Zealand, abalone blister pearls, cultured, *52*
NICHOL, D., Nephrite jade from Jordanów Slaski, Poland, 461
—, Ornamental granite from Ailsa Craig, Scotland, 286
—, Two contrasting nephrite jade types, 193
NICHOLS, M.C. (*see* Anthony, J.W., *et al.*)
NIEDERMAYER, G., Achat in Osterreich, *174*
—, Über Achate und vergleichbare Hohlraumfüllungen in Sedimentgesteinen, *299*
—, SOLTAU, H., Die spektakulären Quarze vom Orange River, *367*
Nigeria:
—emerald, sources review, *366*
—Ibadan, *46, 494*
—Iseyin, *109*
—Jos, *494*
—Ogbomosho, red tourmaline, *48*
—Oyo City, *497*
—spessartine garnet, *46, 109*, 129
—tourmaline, yellow, *363*
NIKISCHER, T., Modern mineral identification techniques. 1. WDS and EDS, *112*
NING, Y. (*see* Yuan, G., *et al.*)
Niroo, Sousan, donor to GAGTL, 119
NISHIBAYASHI, Y. (*see* Sumiya, H., *et al.*)
NISHIO, S. (*see* Yoshimoto, M., *et al.*)
NIZAMOFF, J.W. (*see* Falster, A., *et al.*; Simmons, W.B., *et al.*)
Nolens-Verhamme, P., donor to GAGTL, 119
Nomarski differential interference microscopy, 260
North America (*see also* Canada, Mexico, USA)
—Cambrian diamondiferous province in NE, *488*
—emeralds, *496*
NOTARI, F. (*see also* Boillat, P.-Y., *et al.*)
—, BOILLAT, P.-Y., L'euclase bleu-verte de Colombie, *299*
—, BOILLAT, P.-Y., GROBON, C., La tanzanite (b zoïsite): detection de traitment thermique, *494*
—, BOILLAT, P.-Y., GROBON, C., Quartz aSiO_2: discrimination des améthystes et des citrines naturelles et synthétiques, *499*
Notes from the laboratory, 79, 265, 483
NovaDiamond, HPHT gem treatment, 201, 341, *362, 432*
Novatek, 341, *488*

OBERHÄNSLI, R. (*see* Mullis, J., *et al.*)
Obituaries:
—Aburrow, M.B., 56
—Beraet, C.J., 243
—Biggs, Margaret J., 374, 437
—Blackmore, H., 118
—Brown, Judith A., 374
—Bruton, E.M., 307; Appreciation, 372
—Cartwright, D.R., 243
—Clarke, N.V., 308
—Clough, M.B., 374
—Crawford, H.B., 182
—Cross, W.G., 182
—Ellis, T.L., 374
—Field, D.S.M., 182
—Franks, J.W., 374, 437
—Miller, Jeanne S., 374
—Milton, M.S., 56
—Murray, Jaqueline, 374
—Olsen, S.G., 308
—Osmond, Catherine, 374
—Rowlands, A., 243
—Syed Jafer Ali, 118
—Tamotsu, Ishiwatari, 243
—Toole, J.L., 308
—Twemlow-Krzempek, Evelyn, 437
—Westgard, Helge R., 118
Obsidian (*see* Glass)
O'Connor, Peggy, gift to GAGTL, 437
O'Donoghue, M., 118, 309, 440
O'DONOGHUE, M., Business and industry review: gemstones, *110*
OHTANI, H., Chronological table of events related to gemstones and jewellery in Japan, *494*
Oldershaw, Cally, 118
OLDERSHAW, C., WOODWARD, C., HARDING, R., Gemstones. 2nd edn, *371*
Olenite (*see* Tourmaline)
Olivine (*see also* Peridot)
—Raman spectroscopy, *240*
Olsen, S.G., obituary, 308
Oman, ornamental concretions, *299*
OO, T. (*see* Hughes, R.W., *et al.*)
Opal:
—'Andean', 328
—'Atlas', South Australia, *300*
—'Aurora Borealis' carved opal, *298*
—Australian: description of locations, *240*; geology of, *496*
—Beautiful opals: Australia's national gem, *115*
—black, fossils, Lightning Ridge, *117*
—blue, Var, France, *239*; Peru, 328
—blue-green, Peru, Arequipa, new discovery, *239*
—Brazil, Piaui, *495*
—diffraction colours of, *365*
—mauve, Madagascar, Androy, new discovery, *239*
—moss, Norseman, Australia, *238*
—new discoveries, *239*
—opal-CT, green , Madagascar, *365*
—pink: Montana, USA, *239*, Quincy, Cher, France, *239*, Mapimi, Mexico, *239*; Peru, 328
—Raman spectroscopy, *241*
—rediscover Australian, *302*
—Somaliland, 148
—two-phase inclusions in Australian, *108*
—USA, Oregon, *298*
—White Cliffs field, Australia, history, *49*
—yellow, Saint-Nectaire, France, *239*
Optical absorption (*see* Spectroscopy, Optical Absorption)
Optical properties of materials, *501*
Opticon resin, *297*
Ordway, A., A highgrader's story, *366*
O'REILLY, S.Y. (*see* Davies, R.M., *et al.;* Griffin, W.L., *et al.*)
Osmund, Catherine, obituary, 374
OSORGIN, N. YU (*see* Chepurov, A.I., *et al.*)
OSORIO, C.E., MICHELOU, J-C., Nouvelles découvertes d'émeraudes et pierres de Colombie, *299*
OSTAPENKO, G.T., KVASNITSA, V.N., TIMOSHKOVA, L.P., SEMENKO, N.P., DOROGOVIN, B.A., Synthetic andalusite crystals: morphology and growth features, *113*
OSTROOUMOV, M. (*see* Fritsch, E., *et al.*)

Ou, Hin Eng Alice, donor to GAGTL, 119
Ou Yang, Mrs C.M., gifts to GAGTL, 57, 121
OU YANG, C.M., Jadeite jade [in Chinese], *434*
—, LI JIAN, QI, Hte long sein – a new variety of chrome jadeite jade, 321
Oved Diamond Company, *297*
OWERS, C., Industrial diamond: applications, economics and a view to the future, *490*
Oyster, pearl, *Pteriidae, 499*

PAGET, D., Canadian diamond production: a Government perspective, *172*
Packer, Dian, gift to GAGTL, 504
Pakistan: *300*
—cat's-eye beryl, *298*
—Chundao Hill, 133
— Hunza valley, *47*
—Kashmir, *494*
Palmer, K., gift to GAGTL, 183
PALNICHENKO, A.V., JONES, A.M., CHARLIER, J.-C., ARONIN, A.S., ISSI, J.-P., Diamond formation by thermal activation of graphite, *241*
Palwan, palun (*see* Jade)
PAL'YANOV, G.A. (*see* Sokol, A.G., *et al.*)
PAL'YANOV, Y.N. (*see* Sokol, A.G., *et al.*)
PAN, F. (*see* Chan, Y., *et al.*)
PANIAGO, R. (*see* Pinheiro, M.V.B., *et al.*)
PANJIKAR, J., Comparative study of corundum from various Indian occurrences: corundum from Karnataka, *49*
PAPI, S., RHODES, A., Famous jewelry collectors, *116*
PAPIKE, J.J. (Ed), Planetary materials, *371*
Pargasite (*see* Amphibole)
Parsons, M., gift to GAGTL, 375
PASHKOV, S.S. (*see* Kalashnikova, I.I., *et al.*)
PATSCH, L.C., Aragonit-Pseudomorphosen in Achatmandeln aus Idar-Oberstein, *367*
PAUTOV, L.A., KHVOROV, P.V., MUFTAKHOV, V.A., AGAKHANOV, A.A., Sogdianite and sugilite from Dara-i-Pioz massif (Tajikistan), *495*
PAYETTE, F., A propos de l'opale australienne, *240*
Pearls and shell:
—abalone, cultured blister pearls, New Zealand, *52*
—ammonite shell, *365-6*
—Bangladesh, 486,
—black pearls, 269
—Chinese, their culturing and trading, *368*
—clam: formation and quality, *499*, short necked clam, *499*
—conch: Colombian, *299;* formation and quality, *499*
—concretion from Pacific Coast, USA, oyster, *49*
—cultured: China main producer, *52;* faceted, *52;* farm, Wuhan, 265; tissue nucleation, *300*
—enhancement of colour, *174*
—formation: *499*, of nacre, *47*
—freshwater cultured: structure, *110;* Chinese, 265, *300*, *433*; colour changed, dyed, irradiated, study of, 449, results, 451, Raman spectroscopy, 452; naming guidelines, 487
—Gulf of California, Mexico, *48*
—hollow, 268
—irradiated, 449
—large sizes, 269
—Lure of the pearl: pearl culture in Australia, *114*
—Mikimoto Pearl Museum, Japan, *242*
—mussel, *Hyriopsis cumingii*, 265, *300*
—non-nucleated: cultured, 265, *300*, natural, 268
—optical and electron microscope study, *499*
—*Pteriidae* oyster, *499*
—quality analysis and control, *499*
—sea shell, Peru, 334
—*Strombus gigas* conch, *499*
—treatment of, *491*
—The drowning dream [A tale], *114*
PEARSON, N.J. (*see* Griffin, W.L., *et al.*)
Pectolite:
—Dominican Republic, *297*, 332
—'Larimar', *297*, 332,
—properties, 276
Pedersen, Maggie Campbell, 121
PEDROSA-SOARES, A.C. (*see* Pinheiro, M.V.B., *et al.;* Pinto, C.P., *et al.*)
Pegasus Overseas Ltd., 341
PENG, M. (*see* Lin, B., *et al.*, Wang, J., *et al.*, Zhang, E., *et al.*)
PERETTI, A (*see* Schmetzer, K., *et al.*)
Periclase inclusions in Guinea diamonds, *238*
Peridot (*see also* Olivine):
—Eritrea, *108*
—green glass simulants, *174*
—Hubei, China, *47*
—Zabargad Island, geodynamic histories, *300*
Peru:
—Arequipa, Acari, *239*; 329, 330, 331; Ica, 333; Lily, 330; Morochata, 332; Pasto Bueno, 331, 333; Pisco, 330; Uchucchacua, 331
—emeralds, *298*
—gemstones of, 328
—Huancavelica, 332
—Lima, Canta, 334
—Makusani, 333
—Moquegua, 332
—Piura, Turmalina, 333
Petalite, Londonderry, Australia, *238*
PETROV, A. (*see* Hyršl, J., *et al.*)
PETSCH, E. (*see also* Henn, U., *et al.*)
—, La tourmaline, *240*
PEZZOTTA, F., Selvino e Zogno: quarzo e fluorite, *110*
PFANDER, P., JANS, V., Gold in der Schweiz 2 Auflage, *180*
Phenakite (*see also* Synthetic gemstones):
—Colorado, USA, 84
—Urals, Russia: 84; emerald-alexandrite- mineralization, *493*
Phillips, A.H., gift to GAGTL, 375
PHILLIPS, D., MACHIN, K.J., KIVIETS, G.B., FOURIE, L.F., ROBERTS, M.A., SKINNER, E.M.W., A petrographic and $^{40}Ar/^{39}Ar$ geochronological study of the Voorspoed kimberlite, South Africa: implications for the origin of group II kimberlite magmatism, *107*
Phlogopite (*see* Micas)
Photiou, Mariana, gift to GAGTL, 375
Photoluminescence (*see* Spectroscopy, Photoluminescent)
PIAT, D.H. (*see* Giuliani, G., *et al.*)
Pike, Corinna, 183
PINHEIRO, M.V.B., BASILIO, M.S., KRAMBROCK, K., DANTAS, M.S.S., PANIAGO, R., ASSUNÇÃO, A.L., PEDROSA-SOARES, A.C., The cause of colour of the blue alexandrites from Malacacheta, Minas Gerais, Brazil, 161
—, KRAMBROCK, K., KARFUNKEL, J., DA SILVA, J.B., The effect of the gamma-radiation dose combined with heat on the colour enhancement of colourless quartz, *49*
PINTER, C., Tränen aus Glas, *110*
PINTO, C.P., PEDROSA-SOARES, A.C., Brazilian gem provinces, *495*
Planetary materials, *371*
PLANTZOS, D. (*see also* Henig, M., *et al.*)
—, Artists' jewellery in contemporary Europe: a female perspective, *371*

Platinum jewellery buying guide, *180*
Plato lines in sapphire, 270
Pliny the Elder (23-79 AD), 291
Pocket guide, Gem and jewelry, *304*
POGSON, R., SUTHERLAND, L., WEBB, G., The mineralogical collection of the South Australian Museum, Adelaide, *367*
Poland, Jordanów Slaski, jade, 461
Polarized light investigation, *112*
POLENOV, J.A. (*see* Gryoriev, V.V., *et al.*)
Polishing by hand, Swiss rubies, *298*
Pollucite, Brazil, *495*
Polyhedra, *180, 305*
PONAHLO, J. (*see also* Smith, C.P., *et al.*)
—, Cathodoluminescence du jade, *51*
Porter, M.A., donor to GAGTL, 119
POSSOUKHOVA, T.V., KUDRYAVTSEVA, G.P., GARANIN, V.K., Diamonds and accompanying minerals from the Arkhangelsk kimberlite, *238*
Power bracelets, 485
POYNDER, M., Jewellery reference and price guide. 2nd revised edn, *242*
POZZA, G. (*see* Ajò, D., *et al.*)
Prehnite,
—Australia, *493*
—La Combe de la Selle, Isère, France, *492*
PREINFALK, C., MORTEANI, G., The eastern Brazilian pegmatite province, *495*
—, MORTEANI, G., The chemical composition of biotite from granitic pegmatites and from metamorphic emerald deposits in the Eastern Btrazilian Pegmatite Province [EBPP], *495*
Preseli Bluestone Ltd, gift to GAGTL, 504
PRIESTER, M., Der Achat- und Amethystbergbau in der Region Medio Alto Uruguai in Rio Grande do Sul, Brasilien: Eine geologische und technische Betrachtung, *110*
PROCTOR, K., The history of Brazilian pegmatite gem mining, *495*
—, The development and present geologic environment of the most important gem crystals and mines of Minas Gerais, Brazil, *495*
—, The famous tourmaline, aquamarine and kunzite mines of Minas Gerais and their greatest gem crystals, *495*
Prospecting:
—diamond, significance of eclogite and Cr-poor garnet, *107*
—geozoological for gold and gems, *46*
Proustite, Peru, 332
Pugh, M., 183
Pun, Maggie Y.L., donor to GAGTL, 119
Pyke, J.S., donor to GAGTL, 119; 309
PYLE, D.M. (*see* Rao, N.V.C., *et al.*)
Pyrargyrite, Peru, 332:
Pyrite:
—in Colombian emeralds, *299*
—'marcasite', Peru, 334
Pyrope (*see* Garnet)
Pyroxene (*see also* Jadeite):
—clinoenstatite, Pakistan, *300*
—diopside: 'Aowien', Afghanistan, *433*; Somaliland, 150
—enstatite: inclusions in Madagascar spinels, 229, chemical analyses, 231; Tanzania, Mpwa-Mpwa, *368*
—kosmochlor, in maw-sit-sit jade, 87, chemical analysis, 90

Quartz (*see also* Agate; Chalcedony; Jasper):
—amethyst: Austria, Hohe Tauern, *50*, Maissau, *298;* Brazil, *46, 110*, 334, *495, 496*; Colombia, new discovery, *299;* Namibia, Orange River, *367*; Somaliland, 150; colour and iron solubility, *364;* discriminating between natural and synthetic, *499*; sceptre forms, *367, 496*; USA, Arizona, *48;* North Carolina, *490*
—ametrine, Bolivia, 334
—chatoyant, China, *172*
—China, *172, 368,*
—citrine: Cabrera Island, Arcipelago di la Maddalena, *364;* discriminating between natural and synthetic, *499*
—differentiation from synthetic, *49, 499*
—gamma-ray diffractometry, dislocation density, *113*
—growth rates of natural, *365*
—inclusions, unusual, *366*
—Italy, Bergamo, *110; 364*
—Peru, 333
—Raman spectroscopy, *240*
—rock crystal: Brazil, 334; Namibia, Brandberg, *367*, Orange River, *367*; spectacle lenses, 291
—rose, Sapucaia occurrence, Brazil, *112*
—sceptre: Brazil, Paraiba, *496*; China, Sichuan, *368;* Italy, *110*
—septaria, France, *109*
—smoky: Australia, Torrington, NSW, *238*; Italy, Cabrera Island, Arcipelago di la Maddalena, *364;* USA, Zapot pegmatite, Nevada, *108;* North Carolina, *490*; Russia, Urals, *493*
—spectacle lenses, 291
—strawberry: Chihuahua, Mexico, *368*; Kazakhstan, *368*
—tourmalinated: *298;* cat's-eye, 457
—twins, Idar-Oberstein, *49*
—twinning, Brazil and Japan laws, *496*
Quartzite: dyed, 276, *499*
Quy, Caroline E., donor to GAGTL, 119

Radioactivity in gems, regulations, 82
Ralfe, G., 185
RAKOTONDRAZAFY, M. (*see* Mercier, A., *et al.*)
Raman spectroscopy (*see* Spectroscopy, Raman)
Raney, G., donor to GAGTL, 119
RANKIN, A.H. (*see* Srithai, B., *et al.*)
RAO, K.R.P., REDDY, T.A.K., RAO, K.V.S., RAO, K.S.B., RAO, N.V., Geology, petrology and geochemistry of Narayanpet kimberlites in Andhra Pradesh and Karnataka, *296*
RAO, K.S. (*see* Mukherjee, A., *et al.*)
RAO, K.S.B. (*see* Rao, K.R.P., *et al.*)
RAO, K.V.S. (*see* Rao, K.R.P., *et al.*)
RAO, N.V. (*see* Rao, K.R.P., *et al.*)
RAO, N.V.C., GIBSON, S.A., PYLE, D.M., DICKIN, A.P., Contrasting isotopic mantle sources for Proterozoic lamproites and kimberlites from the Cuddapah basin and eastern Dharwar craton: implications for Proterozoic mantle heterogeneity beneath southern India, *296*
Rare-element minerals, California, *364*
RAVOLOMIANDRINARIVO, B. (*see* Mercier, A., *et al.*)
Read, P.G., donor to GAGTL, 119; gift to GAGTL, 375, 437
READ, P.G., Gemmology, *117*
Reconstructed materials, *298*
REDDY, T.A.K. (*see* Rao, K.R.P., *et al.*)
REED, W. (*see* Aquilina, B., *et al.*)
REINITZ, I. (*see* Moses, T.M., *et al.*; Scott Hemphill, T., *et al.*)
REINITZ, I.M., BUERKI, P.R., SHIGLEY, J.E., McCLURE, S.F., MOSES, T.M., Identification of HPHT-treated yellow to green diamonds, *297*
REN, J. (*see* Chan, Y., *et al.*)
REUSSER, E. (*see* Krzemnicki, M.S., *et al.*)
Refractometer 1.815 contact fluid, a warning, *240*
RHODES, A. (*see* Papi, S., *et al.*)

Rhodizite, Urals, Russia, *493*
Rhodochrosite:
—Argentina, Catamarca. Stalactite, *366*
—Peru, 331
—South Africa, Kalahari, *364*
—star and cat's-eye, Russia, 459
—USA, Colorado, *497*
Rhodonite, Peru, 334
Rhodolite (*see* Garnets)
Rinaudo, C., reply to comments on maw-sit-sit jade paper, Colombo, Rinaudo, Trossarelli, 2000 (above), 251
RINAUDO, C. (*see also* Colombo, F., *et al.*)
—, CAPELLE, B., NAVONE, R., A new method to identify a cut gemstone, *498*
—, DIGENNARO, M.A., NAVONE, R., CHATRIAN, C., Investigations about the structure of freshwater cultured pearls, *110*
RIZZO, I. (*see* Ajò, D., *et al.*, Carbonin, S., *et al.*)
ROBERTS, M.A. (*see* Phillips, D., *et al.*)
Robinson, David M., Ltd., donor to GAGTL, 119
ROESER, H., Uber das Salz der Erde und vom Gold aus Ophir-Mineralogisches aus der Bibel, *495*
ROLANDI, V., Characterisation of recent and fossil ivory, *49*
RÖLLER, K. (*see* Flörke, O.W., *et al.*)
ROLLION-BARD C. (*see* Giuliani, G., *et al.*)
Romario, Ing., gift to GAGTL, 309
ROMERO SILVA, J.C., Rubellitkristalle aus den Pegmatiten von Estepona bei Malága, Spanien, *367*
RONDEAU, B. (*see* Fritsch, E., *et al.*)
Roper, T. and B., donors to GAGTL, 119
Rose, N., Bruton medal winner, 310
ROSSMAN, G.R. (*see* Balitsky, V.S., *et al.*; Fritsch, E., *et al.*)
Rossmanite (*see* Tourmaline)
ROTH, M.L. (*see* Moroz, I.I., *et al.*)
ROTLEWICZ, P.J., Les inclusions de pyrite dans l'émeraude de Colombie, *299*
ROWE, G., White Cliffs: Australia's first commercial opal field – a century of history, *49*
Rowlands, A.F., donor to GAGTL, 119
ROY, G. (*see* Mukherjee, A., *et al.*)
Ruby:
—, (diamond, emeralds, sapphires) are a girl's best friend, *178*
—Afghanistan, Jegdalek, *297*
—Colombia, *299*
—European Alps, *109*
—glass filled, *366, 496*
—Indonesia, radioactive, *51*
—Kenya, Mangari area, exotic origins, *173*
—Madagascar: Ilakaka, *49;* mineralization, *240*; Vatomandry area, 409, chemistry, 414, gemmological properties, 411
—Malawi, *239*
—Mogok, chemical analysis, 414
—Mong Hsu: *47;* chemical analysis, 414; glass fracture filling, *366, 496*
—Somaliland, 146
—, sapphire and emerald buying guide, *55*
—Switzerland, *298*
—Tanzania, properties and morphology, *108*
—Thailand/Cambodia, chemical analysis, 414
—trapiche: texture formation, *174*; Vietnam, *48*
—Russia: 'natural', *297;* Rai-Iz, Urals, *365*
Russia: 458, 459
—alexandrite, 79
—Archangelsk, *238*
—Dal'negorsk, *492*
—diamond sources, *172*
—famous mineral localities, *492*
—Kazakhstan: Delbegetey emerald deposit, *108*; Kokchetav massif, *107*
—Kola Peninsula, shomiokite (Y), *111*
—Kumdykul, accessory minerals of diamond-bearing rocks, *296*
—Minerals of, *497*
—Moscow, Institute of Crystallography, *499*
—Siberia: Taymyr region, 335; Udachnaya mine, *238, 490*
—Sverdlovsk, Jekaterinburg, 80
—Tajikistan: Dara-i-Pioz, *495*; Pamir Mountains, *300,* 335, Kukhi-lal, 336
—Transbaikalia, *496*
—Urals: Chelyabinsk, *48;* Miass, *493*; mines, *493*; Mursinka-Adui, *493;* Rai-Iz, *365*; Sarapulka, *493*; Shaitanka, *493*; Takovaja, *493*; Takvara, 85;
—Uzbekistan, diamondiferous lamprophyres, *362, 488*
—Yakutia, diamondiferous eclogite, *490*
RUSTEMEYER, P., Okorusu: Fundstelle attraktiver Fluorite in Namibia, *299*
Rutile:
—Pakistan, *300*
—USA, North Carolina, *490*
RYAN, C.G. (*see* Griffin, W.L., *et al.*)

SABIONI, A.C.S. (*see* da Costa, G.M., *et al.*)
SAGE, R.P. (*see* Morris, T.F., *et al.*)
SALAM KAOUKJI (*see* Keene, M., *et al.*)
Salerno, S., gift to GAGTL, 183
Salt, Biblical references, *495*
Sapphire:
—Afghanistan, Jegdalek, *297*
—Australia, star, *108*
—Brazil, Manhuacu, Sacramento, Minas Gerais, *433*
—Canada, Blu Moon, Blu Starr, *298*
—Chelyabinsk, Urals, Russia, *48*
—Colombia, *299*
—colourless as diamond substitute, *172*
—Dry Cotton Gulch, Montana, unusual inclusions, *48*
—fluid inclusion characteristics, *110*
—identification natural, synthetic, heat enhanced, *497*
—Madagascar: Antsiranana, *367*; Ilakaka, *49;* Ranohira-Sakaraha new source, similar to Tanzanian, *109,* characteristics, 389
—Malawi, *494*
—Rubies (diamonds, emeralds, ...) are a girl's best friend, *178*
—Ruby, sapphire and emerald buying guide, *55*
—Somaliland, 146
—Sri Lanka, Okkampitiya, 67
—Tanzania, Kalalani, Tanga Province, reddish-orange, *174*
—Thailand, *110, 240*
SASSANO, G. (*see* Ferrini, V., *et al.*)
SATOH, S. (*see* Sumiya, H., *et al.*)
Saul, J., gift to GAGTL, 309
SAUL, J.H. (*see* Mercier, A., *et al.*)
Saxony (*see* Germany)
Sayer, D.J., donor to GAGTL, 119
Scapolite, Mozambique, Alto Ligonha, *364*
SCARRATT, K., Glass-filled rubies ou rubis rebouches, *495*
—, MOSES, T.M., AKAMATSU, S., Characteristics of nuclei of Chinese freshwater cultured pearls, *299*
SCHAAL, R.B. (*see* Hofmeister, A.M., *et al.*)
SCHÄFER, K., Vogelschnäbel und Sterne, *49*
SCHAFER, P., ARIT, T., Die Pegmatite von Alto Ligonha in Nord-Mozambique, *367*
Schatzle-Pariso, Arlette, donor to GAGTL, 119
Scheelite:
—Mozambique, *367*

—Peru, 333
— -powellite, 85
SCHIEBEL, W., Ein Besuch beim grössten Opal Australiens, *300*
SCHMETZER, K. (*see also* Koivula, J.I., *et al.*; Kiefert, L., *et al.*; Schwartz, D., *et al.;* Smith, C.P., *et al.;* Sunagawa, I., *et al.*)
—, letter to the editor, 'topaz-type diffusion process'of natural corundum, 360
—, Ruby and variously coloured sapphires from Ilakaka, Madagascar, *49*
—, BERNHARDT, H.-J., Farbwechselnde Granate aus Madagascar, *367*
—, GÜBELIN, E., BERNHARDT, H.-J., KIEFERT, L., Oriented inclusions in spinels from Madagascar, 229
—, KIEFERT, L., BERNHARDT, H.-J., Purple to purplish-red chromium-bearing taaffeites, *240*
—, PERETTI, A., Characterization of a group of experimental Russian hydrothermal synthetic sapphires, 1
—, PERETTI, A., Some diagnostic features of Russian hydrothermal synthetic rubies and sapphires, *175*
SCHMIDT, G. (*see* Snow, J.E., *et al.*)
SCHNEIDER, G., JAHN, S., Der Brandberg und die Mineralienfunde in seiner Umgebung, *367*
SCHOLZE, R., Amethystfund in den Hohen Tauern, *50*
Schreier, L., donor to GAGTL, 119
SCHRODER, T., The Gilbert Collection at Somerset House, *367*
SCHUBNEL, H.-J. (*see* Giuliani, G., *et al.*)
SCHULZE, D.J., The significance of eclogite and Cr-poor megacryst garnets in diamond exploration, *107*
SCHWARTZ, D. (*see also* Dereppe, J.M., *et al.;* Sutherland, F.L., *et al.*)
—, Smeraldi dalle Americhe, dall'Asia e dall'Australia, *367*
—, GIULIANI, G., Emerald deposits – a review, *495*
—, KANIS, J., SCHMETZER, K., Sapphires from Antsiranana Province, northern Madagascar, *367*
—, SCHMETZER, K., Rubies from the Vatomandry area, eastern Madagascar, 409
SCIESA, E. (*see* Bedognè, F., *et al.*)
Scotland: Ailsa Crag, Firth of Clyde, 286
SCOTT HEMPHILL, T., REINITZ, I.M., JOHNSON, M.L., SHIGLEY, J.E., Modelling the appearance of the round brilliant-cut diamond: an analysis of brilliance, *46*
Scottish gem lab news, *492*
Sebba, F., early diamond synthesis, 360
SECHOS, B., Treatments, *304*
—, Diamond clarity grading, *305*
Seibert, J., donor to GAGTL, 119
Seidmann, Gertrud, essays dedicated to, *116*
SEIFERT, A.V., HYRŠL, J., Sapphire and garnet from Kalalani, Tanga Province, Tanzania, *174*
SEMENKO, N.P. (*see* Ostapenko, G.T., *et al.*)
Septaria, quartz, Hautes-Alpes, France, *109*
Seraphinite (*see* Chlorite)
Serpentine, antigorite, Afghanistan, *48*
SHAN, G. (*see* Xuemei, H., *et al.*)
SHÄRER, U. (*see* Kerschhofer, L., *et al.*)
SHATSKY, V.S. (*see* De Corte, K., *et al.*)
Shell (*see* Pearls and shell)
Shen Feng, gift to GAGTL, 309
Sherman, G., 308
SHIDA, J., Laser tomography; a new powerful method to identify natural, synthetic and treated stones – case study of corundum, *498*
SHIGLEY, J.E. (*see also* Balitsky, V.S., *et al.*; BOWERSOX, G.W., *et al.;* King, J.M., *et al.*; Moses, T.M., *et al.;* Reinitz, I.M., *et al.*; Scott Hemphill, T., *et al.*)
—, CHAPMAN, J., ELLISON, R.K., Discovery and mining of the Argyle diamond deposit, Australia, *490*
—, DIRLAM, D.M., LAURS, B.M., BOEHM, E.W., BOSSHART, G., LARSON, W.F., Gem localities of the 1900s, *368*
—, McCLURE, S.F., COLE, J.E., KOIVULA, J.I., LU, T., ELEN, S., DEMIANETS, L.N., Hydrothermal synthetic red beryl from the Institute of Crystallography, Moscow, *499*
—, McCLURE, S.F., KOIVULA, J.I., MOSES, T.M., New filling material for diamonds from Oved Diamond Company: a preliminary study, *297*
Shindler, B.D., gift to GAGTL, 244
SHIRYAEV, A.A. (*see* Kaminsky, F.V., *et al.*)
SHIRYAEV, S.V. (*see* Barilo, S.N., *et al.*)
Shomiokite-(Y): Russia, Kola Peninsula, *111*
Short gemmological notes, *301*
Shows (*see* Conferences)
SHUN TIEN WU (*see* Hänni, H.A., *et al.*)
Siberia (*see* Russia)
SIEBERS, F. (*see* Flörke, O.W., *et al.*)
Silicified wood (*see* Chalcedony)
Simkiss, Wendy, 118
SIMMONS, W.B. (*see also* Falster, A., *et al.*)
—, WEBBER, K.L., FALSTER, A.U., NIZAMOFF, J.W., Gem tourmaline chemistry and paragenesis, *495*
SIMONET, C., Geology of the Yellow Mine (Taita-Taveta District, Kenya) and other yellow tourmaline deposits in East Africa, 11
Simulants and simulated gemstones (*see also* Synthetic gemstones):
—1990s developments, *369*
—chalcedony: blue, 276, Taiwan glass, 275,
—CZ, offered as sapphire, *499*
—diamond: cubic zirconia, 8, 272; gallium phosphide, *52*, synthetic moissanite, *52*, 471; sapphire, colourless, *172*
—emerald, glass, 483
—GGG, defects in, *112*
—trapiche emerald, *52*
—jade: sodic amphiboles, *48;* treated quartz, *112;* dyed quartzite, *499*
—peridot; Chinese green glass, *174*
—power bracelets, 485
—reconstructed stones, *298*
—ruby: dyed quartz, *369*; glass 483
—sapphire; synthetic spinel, 30
—tanzanite: synthetic forsterite, *113*, Co-doped, *175*; synthetic spinel, *112*
—'Terbium', synthetic fresnoite, *301*
—YAG, defects in, *112*
—yttrium aluminate, orthorhombic, *492*
Site symmetry, description of, 163
SIZYKH, N.V. (*see* Letnikov, F.A., *et al.*)
SKINNER, E.M.W. (*see* Phillips, D., *et al.*)
Slater, R. and K., donors to GAGTL, 119
Slovakia, gem review, *111*
SMALLWOOD, A., A preliminary investigation of precious opal by laser Raman spectroscopy, *241*
SMIRNOVA, T.V. (*see* Barilo, S.N., *et al.*)
Smith, B.H., donor to GAGTL, 120
SMITH, C.P. (*see also* Bowersox, G.W., *et al.*; McClure, S.F., *et al.*)
—, BOSSHART, G., PONAHLO, J., HAMMER, V.M.F., KLAPPER, H., SCHMETZER, K., GE-POL diamonds: before and after, *363*
SMITH. E., Black opal fossils from Lightning Ridge: treasures from the Rainbow billabong, *117*
SMITH, M. (*see* Hughes, R.W., *et al.*)
Smithers, Peggy, gift to GAGTL, 244

SNOW, J.E., SCHMIDT, G., Proterozoic melting in the northern peridotite massif, Zabargad Island: Os isotopic evidence, *300*
Soapstone, Bridgetown, Australia, *238*
SOBCZAK, N. (*see* Sobczak, T.)
SOBCZAK, T., SOBCZAK, N., Tanzanit, *110*
SOBOLEV, N.V. (*see also* De Corte, K., *et al.*)
—, Russian diamond sources, *172*
Sodalite:
—Afghanistan, purple, *300*
—Bolivia, *47*, 334
—Hackmanite, Myanmar, *48*
Sogdianite, Tajikistan analyses, *495*
SOKOL, A.G., TOMILENKO, A.A., PAL'YANOV, Y.N., BORZDOV, Y.M., PAL'YANOV, G.A., KHOKHRYAKOV, A.F., Fluid regime of diamond crystallisation in carbonate-carbon systems, *363*
SOKOLOV, A.E. (*see* Kalashnikova, I.I., *et al.*)
SOLTAU, H. (*see* Niedermayr, G., *et al.*)
Somaliland:
—potential gem production, 139, varieties, 140, geology, 141, 151, comparisons pegmatite petrology, 143, recovery, 144, mineral descriptions, 144
SONG, H. (*see* Yuan, G., *et al.*)
SONIN, V.M. (*see* Chepurov, A.I., *et al.*)
SORENSON, S.S. (*see* Harlow, G.E., *et al.*)
South Africa:
—diamond prospects, *171*
—emerald resources review, *366*
—Kalahari, fine minerals, *364*
—Voorspoed kimbe rlite, geochronological study, *107*
Southern African minerals, Desmond Sacco collection, *177*
Spain:
—Malaga, Estepona near, *367*
Spectacle lenses, history, 291, manufacture from rock crystal, 292
Spectroscopy, cathodoluminescence (CL):
—alexandrite, Russia, 80
—applications to gemmology, *498*
—jade, *51*
Spectroscopy, energy dispersive (EDS):
—description and role in mineral identification, *112*
Spectroscopy, FTIR:
—alexandrite, natural and synthetic, *497*
—diamonds, HPHT treated, 205
—jadeite, natural and resin impregnated, *497*
Spectroscopy, infrared (IR):
—artificial blue glass, Taiwan, 281
—diamond, HPHT treated, 205, 206, 207; strongly zoned, *296*
—emerald fillers, *241*; nature and locality determination, *498*
—high temperature treatment of ruby and sapphire, *491*
—jadeite, 324
—sapphires, Mingxi, Fujian, China, *300*
—synthetic quartz, *113*
Spectroscopy, optical absorption:
—alexandrite, Brazil, 165
—artificial blue glass, Taiwan, 280
—clinohumite, Pamirs and Siberia, 337
—diamond, synthetic, 36, 37, 38, 39, 40
—emeralds, *109*
—garnet: colour change, Madagascar, 401, 402; defect characterization, *112*; Namibian spessartine, 132; Nigerian spessartine, 131, 132
—heat treatment in sapphires, *493*
—moissanite, Russian synthetic, 479
—sapphire: Madagascar, 390, 391; synthetic, 3, 5;
—tourmaline, yellow, Kenya, 23
Spectroscopy, photoluminescence:
—synthetic spinel identification, 30, *297*
Spectroscopy, Raman:
—artificial blue glass, Taiwan, 283
—beryl, *240*
—chrysoberyl, *240*
—corundum, *240*
—diamond: *240*, *363*; formation, *237*; type IIa near-colourless, 76, brown, 77; GE POL treated, 78
—emerald sources, *48*
—enstatite inclusions in Madagascan spinel, 231
—grossular, *240*
—inclusions in diamonds, *46(2)*
—jade: hte-long-sein, 325, jadeite, *240*, 325, *pyroxene*, 325
—kyanite, *240*
—moissanite, Russian synthetic, 474
—nephrite, *240*
—olivine, *240*
—opal, *241*
—pearls: dyed freshwater cultivated, 452, Tahitian, 452
—quartz, *240*
—spinel, *240*
—study of 15 gem minerals, *240*
—tourmaline, *240*
—tanzanite, *240*
—zircon, *240*
Spectroscopy, ultra-violet (UV):
—heat treatment in sapphires, *493*
—Imperial topaz, 136
Spectroscopy, wave length dispersive (WDS):
—description and role in mineral identification, *112*
Spectroscopy, X-ray photo-electron (XPS), description, 163
Spessartine (*see* Garnet)
Sphalerite, Peru, 333
Sphene:
—Brazil, Minas Gerais, *497*
—Italy, Cabrera Island, Arcipelago di la Maddalena, *364*
—Madagascar, deposits, *298*
—Somaliland, 150
—Sri Lanka, *491*
Sphinx & Femina Ltd, gift to GAGTL, 183
Spinel:
—chromite: in maw-sit-sit jade, 88, 90, 92; co-genetic with diamond, Southern India, *107*
—compositional study, Southern India, *107*
—Madagascar: 231; new source, *108*, characteristics, 392
—Myanmar, red octahedra, *368*
—oriented inclusions in, Madagascar, 229
—Raman spectroscopy, *240*
—red, unusual, *49*
—Somaliland, 150
—Sri Lanka, Okkampitiya, 67; *491*
Spirou-Haccou, Geertruida J., donor to GAGTL, 120
SPITS, R.A. (*see* Fisher, D., *et al.*)
Spodumene:
—Brazil, *495*
—USA, Hiddenite, North Carolina, *490*
Sri Lanka:
—colourless gems, *47*
—corundum, *109*
—dumortierite, emerald-cut, *240*
—Eppawala, pink marble, *491*
—gem deposits, geology, mineralogy, rare element chemistry, *491*
—Kahamba, 292
—King Bhuvanekabahu, 292
—Meethiyagoda, moonstones, *53*
—mining in, a history, *109*
—moonstone, 458

—Okkampitiya gem field, 65, geological setting, 66, secondary deposits, 67, mining and exploration, 70, primary deposits, 70
—radioactive zircon, *108*
—spectacle manufacture, 291
—study of gemstone occurrences, *48*
—taaffeite, *240*
SRITHAI, B., RANKIN, A.H., Fluid inclusion characteristics of sapphires from Thailand, *110, 240*
STACHEL, T. (*see* Joswig, W., *et al.*)
STANEK, J., Kamienie szlachetne i ozdobne czech, *111*
Stanley, E., donor to GAGTL, 120
Stassinopoulos, E., donor to GAGTL, 120
Stather, Memory, 183, 185
STEPHAN, J. (*see also* Hammer, V.M.F., *et al.*)
—, HAMMER, V.M.F., Schleifwürdiger Shomiokit-(Y) von Lovozero, Halbinsel Kola, Rußland, *111*
STEVENS, E.L., The nomenclature of gemstones. With special reference to the garnet and tourmaline mineral groups, *50*
STEVENSON, R. (*see* Digonnet, S., *et al.*)
Stibiotantalite, Mozambique, Alto Ligonha, *364*
Stichtite, Australia, *238*
STOICESCU, C. (*see* Lupei, A., *et al.*)
Sugarman, N., early diamond synthesis, 360
Sugilite:
—lavender, greenspotted, *366*
—Tajikistan, analyses, *495*
SUMIYA, H., TODA, N., NISHIBAYASHI, Y., SATOH, S., Crystalline perfection of high purity synthetic diamond crystal, *113*
SUNAGAWA, I., A discussion on the origin of irregular shapes of type II diamonds, 417
—, Quartz crystals twinned after Brazil and Japan laws – origin of their morphological and textural characteristics, *496*
—, BERNHARDT, H.-J., SCHMETZER, K., Texture formation and element partitioning in trapiche ruby, *174*
—, YASUDA, T., FUKUSHIMA, H., Fingerprinting of two diamonds cut from the same rough, *46*
Sunstone (*see* Feldspar)
SUTHERLAND, F.L. (*see also* Pogson, R., *et al.*; Webb, G.B., *et al.*)
—, HOSKIN, P.W.O., FANNING, C.M., COENRAADS, R.R., Models of corundum origin from alkali basaltic terrains: a reappraisal, *111*
—, SCHWARTZ, D., Origin of gem corundums from basaltic fields, *496*
Switzerland:
—gold localities, *180*
—inclusions in rock crystal, *366*
—rubies, *298*
—Val Traversagna, *298*
Symposia (*see* Conferences)
Symes, R.F., 118
Synthetic gemstones (*see also* Simulants and ....):
—1990s developments, *369*
—alexandrite, Russian, twinned, *301*
—ametrine, Russian, *174*
—amethyst: Chinese, identifying features, *51;* wedge-shaped twinning, 271
—andalusite, morphology and growth features, *113*
—apatite, colour changing, *499*
—aquamarine, hydrothermal, *113*
—beryl: red, from Russia, *51;* hydrothermal, red, from Russia, *499*
—cubic zirconia (CZ), diamond simulant, 8
—corundum, Russian hydrothermal multicolours, *499*
—diamonds: black, *175,* synthetic moissanite offered as, *369;* crystalline perfection of high purity, *113;* crystallization in carbonate-carbon systems, *363;* daylight/incandescent light colour change, *52;* De Beers, 32, characteristics, 34, inclusions, 41; early vapour-phase synthesis, 360; epitaxial growth on sapphire, *175;* formation during reduction at high *P-T* conditions, *175;* by thermal activation of graphite, *241;* GE POL Identification 73, *295, 296;* growth on silicon tips, *113;* greigite inclusion in, *175*; growth of high pressure, *498*; The diamond formula, *176*; The diamond makers, *54;* light blue, *238*;
—difficulties in distinguishing from natural, *295*
—emerald: controlled crystallization from the flux melt, *175*; hydrothermal, Chinese, *499*, Russian, *297;* synthesis and treatments, *369*
—forsterite: Co-doped, imitating tanzanite, *175;* offered as tanzanite, *113*
—fresnoite, *301*
—moissanite: differentiation from diamond, *50(2), 51;* tester evaluation, *50;* lab report, *51; 363*; surface reflectivity affected by heating, *369*; offered as black diamond, *369;* Russian, study of, 471, polytype determination, 473, gemmology, 475, microscopy, 476, chemistry, 477, spectroscopy, 474, 479
—perovskite, *492*
—quartz, differentiation from natural, *49*
—ruby: flux grown, Greece, *297;* Knischka, *112*; hydrothermal, Russian, diagnostic features, *175, 297,* interesting inclusions in, *369*; Verneuil with induced fingerprints, *112*
—Russian, review, *369*
—sapphire: colourless as diamond substitute, *172*; Plato lines in, 270; Russian hydrothermal, characterization, 1, 2, diagnostic features, *175*; Verneuil with induced fingerprints, *112*
—spinel: photoluminescence spectroscopy identification,, 30, *297;* unusual bubbles and growth bands in, 271

TACHIBANA, T. (*see* Yoshimoto, M., *et al.*)
Taaffeite:
—cats-eye, *174*
—Sri Lanka: *297;* purple, *240*
Tajikistan (*see* Russia)
TALAY, H.A. (*see* Istroumov, M., *et al.*)
TANG, D. [The infrared spectra of Mingxi sapphires, Fujian], *300*
Tang Wai Chun, donor to GAGTL, 120
TANNOUS, M. (*see* Koivula, J.I., *et al.*)
Tanzania:
—emerald resources review, *366*
—Mpwa-Mpwa, enstatite, *368*
—Lengasti, 25, 26
—Tanga Province, Kalalani, *174*
—Tunduru-Songea, *108*
—Umba, *49*
—zoisite, *299*
Tanzanite (*see* Zoisite)
TAO, M.G., Chinese Pearls: their culturing and trading, *368*
Tarratt, C., gift to GAGTL, 504
TAUPITZ, K.C. (*see* Milisenda, C.C., *et al.*)
TAYLOR, L.A., *et al.*, Diamonds and their mineral inclusions, and whaqt they tell us: a detailed 'pull-apart' of a diamondiferous eclogite, *490*
TAYLOR, P., The simpler? polyhedra. Part 3, *180*; Part 4, *305*
TAYLOR, P.T. (*see* De, S., *et al.*)
TAYLOR, W.R. (*see* Fitzsimons, I.C.W., *et al.*)
TAY THYE SUN (*see also* Hughes, R.W., *et al.*)
—, Disclosure – gemstones and synthetics, *499*
Tayyo, A., gift to GAGTL, 121

Techniques:
—1990s developments and their impact on gemmology, *368*
—discrimination between natural and synthetic amethyst and citrine, *499*
—dispersion measurement with the gemmologist's refractometer, *433*
—estimating weights of mounted stones, *50*
—Hanneman-Hodgkinson refractometer, *301, 492*
—The Hodgkinson method of identification, *54*
—Kiduah mayuhad (KM) laser treatment, method, 259
—Nelson Pavilion Facet Fingerprinter, *51*
—Nomarski differential interference microscopy, 260
—polymer impregnation testing for, *52*
—reflectivity of synthetic moissanite, validity of method, *301;* a warning about heating, *369*
—tanzanite identification, Hanneman filter, *492*
Tektite (*see also* Glass):
—worldwide, *110*
'Terbium' (*see* Simulants)
THEMELIS, T., Mogôk - Valley of rubies and sapphires, *501*
Thermal conductivity, diamond and moissanite, *50*
Thomas, Allyson, Deeks Diamond prize winner, 502
Thomis, Helen M., donor to GAGTL, 120
Thomson Gems Ltd., gift to GAGTL, 57, 244, 504
TIAN, Y. (*see* Yuan, G., *et al.*)
Tibet: Bo Mi, uvarovite, *368*
Tiffany & Co., 468
TILLEY, R., Colour and the optical properties of materials, *501*
TIMOSHKOVA, L.P. (*see* Ostapenko, G.T., *et al.*)
Titanite (*see* Sphene)
TOBSCHALL, H.J. (*see* Dissanayake, C.B., *et al.*)
TODA, N. (*see* Sumiya, H., *et al.*)
Tolkowsky, Marcel, 223
TOMBS, G.A., Chatoyant tremolite (nephrite), *111*
TOMILENKO, A.A. (*see* Sokol, A.G., *et al.*)
Toole, J.L., obituary, 308
Topaz:
—Brazil: cat's-eye, 456; Brumado, *491*; Minas Gerais, *495*
—China, Tu Wah mine, Yunnan, *300*
—Imperial from Capão, Brazil, 133, chemical characters, 134, 135, thermal characters, 134, 136, chemical formula, 138
—limonite-filled channels, *48*
—Madagascar, 393
—Russia, Urals, *493*
—Somaliland, 150
—Sri Lanka, *491*
—Zapot pegmatite, Nevada, *108, 368*
Tortoise shell spectacle frames, Sri Lankan, 292
Tourmaline:
—apparent change-of-colour, *366*
—Brazilian, general survey, *240*; *366; 490*; colour and composition, *494*; *495*(3); Minas Gerais famous mines, *495*
—catalogue, Idar-Oberstein, *305*
—chemistry and paragenesis, *496*
—classification, *239*
—dravite: Brazil, Bahia, *491,* colour and composition, *494*; yellow (savannah), Kenya, 11, characteristics, 19, chemical analyses, 21; Madagascar, characteristics, 393; Tanzania, Lengasti, 26
—elbaite: *174*; Afghanistan, *300*; Brazil, *368, 491(2),494* ; Madagascar, 393; Mozambique, *364;* Myanmar, *497*; California, USA, *364*; Connecticut, USA, *497*
—elbaite-tsilaisite series, Nigeria, *363*
—Li-Al, distinguishing between species, *174*
—Madagascar, *109,* 393
—Mozambique, *367*
—Namibian, general survey, *240*
—Nigeria: orange, *363*; red, *48,* raspberry red, *497*, yellow, *363*
—nomenclature, *50*
—olenite, *174*
—orange, Nigeria, *363*
—Paraiba, dyed, *433*
—'Paraiba tourmaline', *491*
—pink, Catlin Creek and Ravensthorpe, Australia, *238*
—Raman spectroscopy, *240*
—rossmanite, *48, 174*
—red: Nigeria, *48;* Viet Nam, *108*
—rubellite: Malaga, Spain, *367*; Urals, Russia, *493*
—Russia, Urals, *493*
—schorl, Erongo, Namibia, *365*
—Somaliland, 150
—Sri Lanka, Okkampitiya, 67; *491*
—star elbaite, 459
—USA, Alexander county, North Carolina, *490*
—violet, possibly from Paraiba, Brazil, *366*
—yellow, Nigeria, *363*
—USA, San Diego, California, mining, *366*
—uvite: Bahia, Brazil, *491,* colour and composition, *494*; Madagascar, characteristics, 393
—Zambia, *299*
TOWNSEND, I.J., The geology of Australian opal deposits, *496*
Trading Standards, 83
Treatment of gems: *304*
—colour enhancement: review, *298;* of diamonds, detection, 353; NovaDiamond, *432;* emeralds, overview, *240*; pearls, *174*
—diffusion: corundum, 273, 485, detection, *493*; rock crystal, *108;* sapphire, recognition, *52, 108*
—dyeing: chalcedony, 276; black pearls, 269; coloured freshwater pearls, 449, 453; dark blue labradorite, *46;* quartzite, 276, *499*; red stones, Afghanistan, *433*; rock crystal, *297;* rubies, *108;* Paraiba tourmaline, *433*
—enhancement and detection in the 1900s, *366;* present Russian, *369*
—filled: pearls, 268; ruby, identification, *174,* glass in Mong Hsu ruby, *366, 495*
—fillers: new for diamonds, *297;* substances for emeralds, identification, *173,* infrared spectroscopy, *241,* reviewed, *238*
—gamma-ray plus heat colour enhancement of quartz, *49*
—GE POL diamond treatment: identification, 73; *113, 296;* photographic record, *172*; detection, *237*; spectroscopic evidence for, *237;* HPHT treated, *363*
—glass-filled diamonds, colour flashes, 271, *496*
—glass sealed and dyed rubies, *108*
—heat: detection in tanzanite, *494*; effect on synthetic moissanite surface reflectivity, *369*; ruby, Madagascar, 414; sapphire, identification of, *493*
—high temperature, of ruby and sapphire, identification, *491*
—HPHT, diamonds: 201, *363;* colour changes, 350, *362(2), 488*; identification, *297, 488*; spectroscopic evidence for, *237*; UV identification, *489*
—impregnation, opal, *297*
—inclusion bleaching in diamonds, 259, identification, 263
—irradiation: diamond, *52;* colour change, type Ib diamond, *52;* regulation, 82; topaz, 82, 83
—Kiduah Meyuhad (KM) laser, method, 259
—lapis, blue dyed, *51*
—'lasered' pearls, 449
—lasering, new, for diamonds, *296*
—pearls, *491*
—resin impregnation, Colombian trapiche emerald, *108*

—'topaz-type diffusion process' of natural corundum, 273, 360
—Zachery treatment of turquoise, identification, *17; 363*; 485
Tremolite: (*see* Amphibole)
Triplets:
- ammonite shell, iridescent, *365*
TROSSARELLI, C. (*see* Colombo, F., *et al.*)
TSAI WEN-PO (*see* Hänni, H.A., *et al.*)
Tsavorite (*see* Garnet)
Tsoukopoulou, Ioanna Lalaounis, gift to GAGTL, 309
Tsui, S.K., donor to GAGTL, 120
Tucker, W.J., donor to GAGTL, 120
Tugtupite, Greenland, *239*
TURNER, G. (*see* Johnson, L.H., *et al.*)
TUROWSKI, S. (*see* Borchardt, R., *et al.*)
Turquoise:
—Zachery treated, identification, *173*; *363*, 485
Twinning:
—amethyst: *433*, wedge-shaped twinning, 271
—quartz: vogelschnäbel, *49;* Brazil and Japan laws, *496*
—study of, *117*
—synthetic alexandrite, *301*

Ultraviolet (*see* Spectroscopy, UV)
USA (*see also* America, North):
—Arizona: Maricopa County, *48;* Oatman County, Homestake, *494*
—California: *299, 364*; Fresno County, *301;* Mesa Grande, *298, 364*; Pala, *364*; Ramona, *48*, 130, *364*; San Diego, *366;* vesuvianite, *493*
—Carolina, North; Rist and Ellis properties, Alexander county, *490*
—Colorado: Alma, Sweet Home, *494, 497*; Denver, *48;* George Creek, *295;* Mt Antero, 85, *497*; minerals of, *115*; St Peter's dome, *497*
—Connecticut, Haddam Neck, *497*
—Maine: Mineralogy of, *500*, geology, *500*, mining history, *500*
—Mexico, pearls and pearl oysters of the Gulf of California, *48*
—Montana: Dry Cotton Gulch, *48;* opal, new discovery, *239*
—Nevada, Zapot pegmatite, Mineral County, *108, 368*
—New York, Museum of Natural History, *303*
—Oregon, opal, *298*
—Utah, Cedar City, Iron County, *300*
—Virginia, Rutherford mine, 130
Uvarovite (*see* Garnet)
Uvite (*see* Tourmaline)

VAINSHTEIN, B.K., FRIDKIN, V.M., INDENBOM, V.L., Structure of crystals (3rd revised edn). Modern crystallography, *305*
VAN ACHTERBERGH, E. (*see* Griffin, W.L., *et al.*)
VAN DAELE, M. (*see* Moses, T.M., *et al.*)
van der Giessen, Wilma, gift to GAGTL, 57, 121
van Rose, Susanna, gift to GAGTL, 121, 437
VAN ROYEN, J. (*see* De Weerdt, F., *et al.*)
Venzuela, Guaniamo, Bolivar State, diamonds, *489*
Vesuvianite:
—European Alps, *109*
—Somaliland, 150
—USA, California, *493*
VICENZI, E.P. (*see* De, S., *et al.*)
Victorite (*see* Aragonite)
Vietnam:
—Luc Yen, red tourmaline, *108*
—Yen Bai Province, *48*
VIGNOLA, P. (*see* Bedognè, F., *et al.*)
VILLA, E. (*see* Bank, F., *et al.*)
Vince, J.O., donor to GAGTL, 120
Visual optics, 234
Von Bolton, W., early diamond synthesis, 360
Vuillet à Ciles, P., gift to GAGTL, 183, 437
VUILLET À CILES, P., La fluorite verte de Peñas Blancas, *300*

WADA, K., Formation and quality of pearls, *499*
Walstromite inclusions in Guinea diamonds, *238*
WAN, H. (*see also* Lin, B., *et al.*)
—, [The identification of a filled ruby] *174*
WANG, J., LIANG, J., PENG, M., [The enhancement and treatment of pearl's colour] *174*
Ward, A.E., & Sons Ltd, gift to GAGTL, 309
WARD, F. (*see* Hughes, R.W., *et al.*)
Warriner, Elizabeth R., donor to GAGTL, 120
Watanabe, M., donor to GAGTL, 120
Watson, Vivian, gift to GAGTL, 244
Wave Length Dispersive spectroscopy (*see* Spectroscopy, Wave Length Dispersive)
WEBB, G.B. (*see also* Pogson, R., *et al.*)
—, SUTHERLAND, F.L., Gemstones of New England, *111*
Webb, M.H., donor to GAGTL, 120
WEBBER, K.L. (*see* Falster, A., *et al.*, Simmons, W.B., *et al.*)
Webster, S., lecturer, 118
WEERTH, A., HAMMER, V.M.F., Neue Überraschungen aus dem Pamir, dem Karakorum und dem Himalaya, *300*
WEGNER, R. (*see also* Cesar-Mendes, J., *et al.*)
—, Recent mineral occurrences from north-eastern Brazil, *496*
WEINER, K.-L., WEISE, C., Lapis lazuli-Lasurit. Zur Kulturgesichichte eines Minerales, *368*
WEINING, Z. (*see* Zhenqiang, C., *et al.*)
WEISE, C. (*see* Weiner, K.-L., *et al.*)
WEISS, S. (*see* Lergier, W., *et al.*)
WELBOURN, C.M. (*see* King, J.M., *et al.*)
Weller, G., gift to GAGTL, 437
Weldon, R., 243
WENGZYNOWSKI, W. (*see* Groat, L.A., *et al.*)
WENTZELL, C.Y., Cultured abalone blister pearls from New Zealand, *52*
WEY, J (*see* Fritsch, E., *et al.*)
What's new in minerals, *300, 368(2), 494*; *497*
WHITE, J.S., Gallery review: the R S McLaughlin Mineral Hall, Royal Ontario Museum, *497*
—, The new Mineral and Gem Gallery at the British Museum, *111*
—, Strawberry quartz, *368*
Whittaker, S., 374
WIGHT, W., Explosion of interest in Canadian gemstones, *50*
Wilkins, A.E., donor to GAGTL, 120
Williams, B., gift to GAGTL, 375
Williams, D.K., donor to GAGTL, 120
WILSON, M., The colour of stones, *111, 174*
WILSON, W.E. (*see also* Bettencourt Dias, M., *et al.*, Brown, D.L., *et al.*, Clopton, E.L., *et al.*, Grant, R., *et al.*)
—, Martin Zinn III, *112*
—, Lavra Berilo Branco: the original 'Sapucaia' rose quartz occurrence, Minas Gerais, Brazil, *112*
Win Htein, comment on maw-sit-sit jade paper, Colombo, Rinaudo, Trossarelli, 2000 (above)), 251
WISE, M.A. (*see* Groat, L.A., *et al.*)
Wong Hon Chung, donor to GAGTL, 120
WOODWARD, C. (*see* Oldershaw, C., *et al.*)
WU, R. (*see* Li, W., *et al.*)

X-ray diffraction:
—defects in garnets, *112*
—maw-sit-sit jade, 88
X-ray photo-electron spectroscopy (XPS), description, 163
X-ray transmission topography, *498*
XUEMEI, H., KEQIN, C., SHAN, G., New find of gem quality uvarovite in Tibet, *368*

YAG (*see* Simulants and ...)
YAKOVENKO, N.E. (*see* Golovko, A.V., *et al.*)
YASUDA, T. (*see* Sunagawa, I., *et al.*)
Yemen: *48, 371*
YE ZAGORSKY, V. (*see* Lyckberg, P., *et al.*)
YIN, X. (*see* Zhang, E., *et al.*)
YOSHIDA, K. (*see* Yoshimoto, M., *et al.*)
YOSHIMOTO, M., YOSHIDA, K., MARUTA, H., HISHITANI, Y., KOINUMA, H., NISHIO, S., KAKIHANA, M., TACHIBANA, T., Epitaxial diamond growth on sapphire in an oxidizing environment, *175*
Young, R., *243*
YUAN, G., JIN, Y., JIN, C., ZHANG, B., SONG, H., NING, Y., ZHOU, T., JIANG, H., LI, S., TIAN, Y., GU, C., Growth of diamond on silicon tips, *113*
YUAN, J.C.C., Russian colourless synthetic diamonds, *499*
YUAN, K. (*see* Li, X., *et al.*)
YUAN XINGQIANG (*see* Hänni, H.A., *et al.*)

ZACKE AUCTIONS VIENNA, Ancient Chinese jades (Part 1), *114*
Zabargad Island, peridotite study, *300*
Zambia:
—emerald resources review, *366*
—Kapirinkesa, *299*
—Lundazi-Chama, *299*
ZHANG, B. (*see* Yuan, G., *et al.*)
ZHANG, E., YIN, X., PENG, M., [Discussion on character of the rough jadeite crust.], *174*
ZHENQIANG, C., JILANG, Z., KEQIN, C., CHANGLONG, Z., WEINING, Z., Characterization of a new Chinese hydrothermally grown emerald, *499*
ZHOU, T. (*see* Yuan, G., *et al.*)
Zimbabwe:
—emerald resources review, *366*
Zini, Grazia, gift to GAGTL, 309
ZINK, S.I. (*see* Ihinger, P.D., *et al.*)
Zinn, Martin, III, biography, *112*
Zircon:
—Italy, Cabrera Island, Arcipelago di la Maddalena, *364*
—Madagascar, *109,* 393
—Pakistan, *300*
—Raman spectroscopy, *240*
—Somaliland, 151
—Sri Lanka, Okkampitiya, 67; radioactive, *108*; *491*
—USA, Colorado, *497*
Zoisite:
—bicoloured, Tanzania, *299*
—tanzanite, detection of thermal treatment, *494*; distinguishing from imitations, *492*; Raman spectroscopy, *240*; review, *110*
ZOLOTAREV, A.A., BULAKH, A.G., [Rossmanite, olenite, elbaite and the 50% rule as a basis for distinguishing between mineral species in Li-Al tourmalines.], *174*
Zoysa, Gamini, 375
ZVONKOVA, N.G. (*see* Letnikov, F.A., *et al.*)

ISSN: 1355-4565

Produced and printed by Stephen Austin & Sons Ltd, Hertford, England