Vol. II No. 5 January 1950

THE JOURNAL OF GEMMOLOGY

and

PROCEEDINGS OF THE
GEMMOLOGICAL
ASSOCIATION
OF GREAT BRITAIN

THE GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN
19/25 GUTTER LANE, LONDON, E.C.2

THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN (INC.)

(Originally founded in 1908 as the Education Committee of the National Association of Goldsmiths, reconstituted in 1931 as the Gemmological Association)

OFFICERS AND COUNCIL

President :
G. F. Herbert Smith, C.B.E., M.A., D.Sc.

Past Presidents :
The late Sir Henry Miers, D.Sc., M.A., F.R.S.
The late Sir William Bragg, O.M., K.B.E., F.R.S.

Vice-President :
E. A. Dodd.

Chairman : **F. H. Knowles-Brown, F.S.M.C., F.G.A.**

Vice-Chairman : **G. F. Claringbull, B.Sc., Ph.D., F.G.S.**

Treasurer : **S. F. Bones, F.G.A.**

Elected Fellows :
R. Blott. G. Clarkson. M. L. Crombie.
Sir James Walton, K.C.V.O. J. H. Stanley.
B. W. Anderson, B.Sc. T. G. Jones. R. K. Mitchell.
R. Webster.

General Secretary and Director of Examinations :
G. F. Andrews.

Curator : **Sir James Walton, K.C.V.O.**

Librarian : **H. Wheeler, F.G.A.**

Offices : 19/25 Gutter Lane, London, E.C. 2.
Telephone : MONarch 0871/4.

Affiliated Association : The Gemmological Association of Australia.

THE JOURNAL OF GEMMOLOGY

AND PROCEEDINGS OF THE
GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN

Vol. II, No. 5 JANUARY 1950

THE MINING AND HEAT TREATMENT OF ZIRCONS

by

W. C. BUCKINGHAM, F.G.A.

The collection of zircons, together with the photographs described in this article, were shown at the 1949 Gemmological Exhibition in London.

The writer's thanks are due to Messrs. George Lindley & Co. (London) Ltd., for the opportunity of examining the stones, and also for much of the information used as a basis for the article.

THE recent arrival in London of a large collection of zircon crystals and waterworn pebbles is affording an interesting opportunity for further research into the gemstone.

The parcels of stones making up the collection have been given a preliminary inspection, and a general description of them appears in this article, together with brief notes on their origin. They have been numbered for ease of reference.

Commercially, zircon is steadily regaining its pre-war popularity as an inexpensive yet real stone, and it is well known that the main source of the familiar heat-treated material is French Indo-China, via the cutting centre of Bangkok. From a gemmological point of view, however, there has been some difficulty in obtaining specimens which are definitely known as coming from a

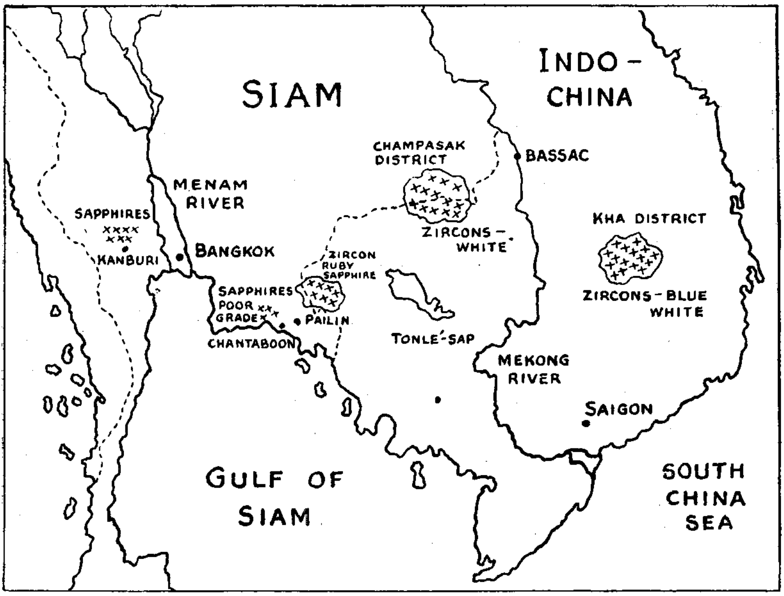


Fig. 1.

certain area or mine. This is perhaps the most interesting feature of the present collection under review. It has arrived with each of its twelve parcels of rough and semi-finished stones marked with the district of origin, and, in two cases, with the names of the mines where the crystals were obtained. Thus it is possible to study the characteristics of the rough, both before and after heat treatment, and to note any variation between specimens from each district.

The sketch map (Fig. 1) showing the southern areas of both Thailand (Siam) and Indo-China gives the locations of the zircon mines in three well-defined groups, or districts, which are, in probable order of commercial importance, the Kha, Champasak, and Pailin districts. The main concentration of mines is in Indo-China, although the two latter districts lie actually on, or across, the border line of that country and Thailand.

In addition to being the chief source of zircon, the Kha district is of particular interest because it is the only area where the mined rough produces both blue and golden or colourless stones after suitable heat treatment. This group of mines is situated east of the

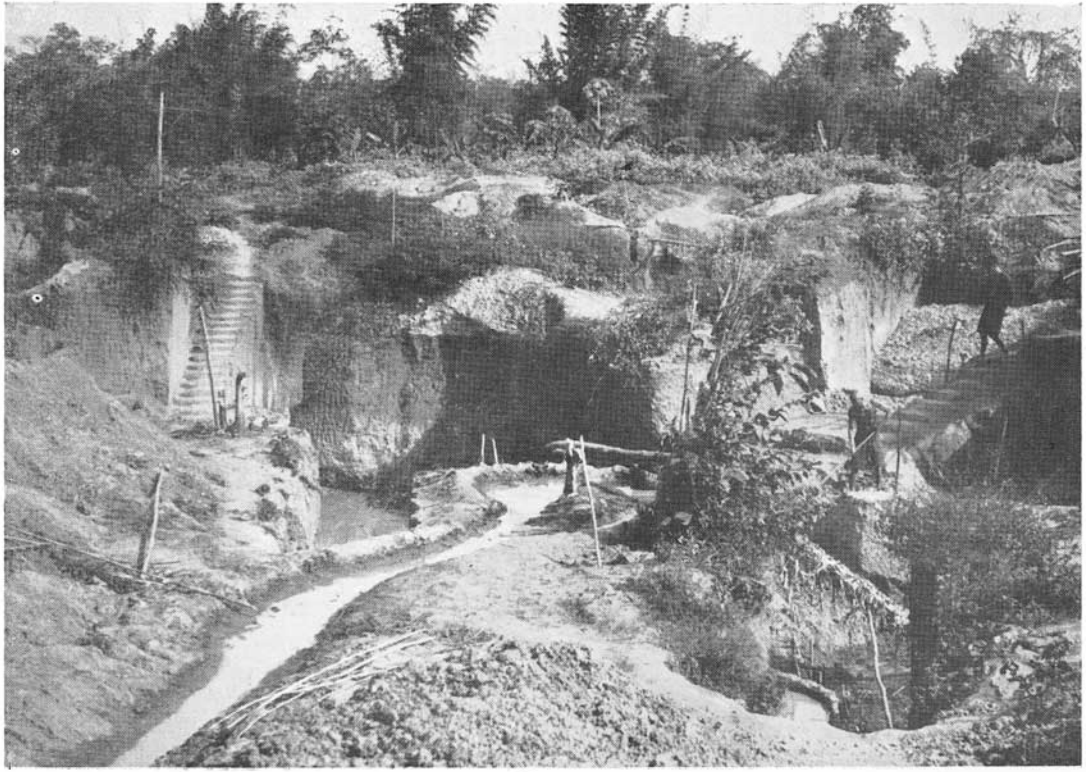


Fig. 2. — Typical zircon mine. Right — digging. Centre — washing earth away.

Mekong River and about 150 miles north of Saigon. There is a very definite backbone of mountainous country down the whole length of the east coast of Indo-China. Peaks rise almost to 7,000 feet near the coast, but there is a rather gradual descent in the west, towards the Mekong valley. Lying in the foothills the mines are only readily accessible from the river. This disadvantage of the rugged country is perhaps offset by the fact that the mountains seem to act as a definite check to both the S.W. and N.E. monsoons. Thus a fairly constant rainfall of over 60 inches a year ensures the all-important water supply for both domestic and mining purposes. The use of water for the preliminary excavation and removal of the zircon bearing ground is well illustrated in Fig. 2.

A journey to the Kha district from Bangkok is not lightly undertaken since it entails an arduous trek for eleven to twelve days, of which only the first few hours can be made in any degree of comfort by train. The rest of the travelling must be accomplished partly overland by bullock cart and elephant (Fig. 3), and partly by water in small boats along the Mekong and one of its tributaries, the Sé-San.

The mines in this district are about 10-20 miles from each other, and it is from one of these, the Looi mine, that parcel 1 originated. This parcel consists of about 30 per cent. worn pebbles and 70 per cent. pieces clearly showing traces of crystal form. Unfortunately, the conditions of growth or method of digging have resulted in almost every piece being fractured, or showing imperfect cleavage planes. Only in the largest crystal, weighing about 6.5 carats and used for a preliminary density test, is it possible to see part of the tetragonal dipyramidal terminations together with two adjacent prism faces. The colour of this parcel varies from a pale straw to a deep red-brown translucency. The fractured surfaces display the peculiar lustre of zircon, best described as adamantine but yet possessing a certain greasy quality even in the rough.

Zircon crystals from the Kha district produce blue, white and golden stones after heat treatment, but it would appear that the colour is determined primarily by the actual mine of origin. The rough from the Looi mine (as in parcel 1) will change, with suitable period and degree of heating, firstly to blue and then to white or golden stones, whilst crystals from another mine in the same district will give only colourless zircons after treatment.

Fig. 3.—The elephant journey takes six days through jungle.

Parcel 2 represents a similar collection of specimens to those in parcel 1. They come from the same mine and have undergone the initial heating. The resultant colour varies in shade from pale sky-blue to deep blue-green, whilst the fractured surfaces seem to have a rather higher degree of lustre than the untreated red-brown stones. The fact that the worn surfaces have a more pronounced " satin " appearance than before heating is probably due to the slight increase in brittleness which occurs in all zircons during the firing process. Two specimens selected for comparative density tests were, firstly, a completely fractured and partly worn pebble of medium sky-blue weighing 12.33 carats, and, secondly, an interesting crystal of almost perfect form showing the intermediate pyramid faces in addition to the usual pyramidal terminations, together with three prism faces. The remaining face is distorted due to conditions of growth. This second crystal is of clear medium sky-blue colour and weighs 8.78 carats.

Although B. W. Anderson, in his summary of Dr. W. E. Eppler's findings,* places the actual degree of heat at 900-1,000° C. for a period of 1½-2 hours, it would appear that these two factors

---

* " Gemmologist," Vol. VII, No. 75, October, 1937.

vary considerably according to the source of the rough, and the operator. It is quite definite, however, that the heating of such rough as this from the Looi mine is done in a small fireclay crucible which is closed to give a reducing atmosphere. Somewhat primitive stoves are still in use for this purpose, as shown in Fig. 4. They are provided with suitable apertures and grates for draught and contain the crucible holding about a kilogram of zircon, the crucible itself being surrounded by small coal or charcoal. A tall funnel, as seen on the left of the photograph, can be added to increase the draught and thus raise the temperature as required. Both crystals and worn pebbles undergo the same treatment and achieve similar percentages of results in change of colour.

The wastage in this firing stage is very high, over 70 per cent. of the rough having to be rejected as not up to gem standard. All clear, but pale blue stones from the treated parcel are given a further prolonged period of heating in the closed crucible which has the effect of bleaching the poor blue, resulting in colourless material. The temperature for this stage is critical, and must be determined after long experience, since underheated stones tend to fade from white to a brown shade, whilst overheating means an undesirable cloudy appearance.

Parcel 3 consists of specimens from this bleaching process and the stones are of clear to cloudy white with fused black particles, together with possible galena, adhering to the fractured surfaces.

Some of the rough from the initial firing will show the intrinsic characteristics of golden zircon, and these pieces undergo their second heating in a perforated crucible which allows free access of oxygen. From such crystals are cut the lesser known but equally beautiful red to golden-brown zircons which, save for their higher lustre and " steely " aspect, are very close in colour to the various shades of citrine.

This range of colour is well seen in parcel 4, which is of roughly shaped round stones varying from pale orange to reddish-orange and golden yellow. Exact determination of colour and purity is difficult at this stage owing to the frosted surface imparted by the carborundum shaping wheel.

Whilst dealing with the Kha district material it is interesting to take note of the Hua Tek mine. Although this source has been completely exhausted for many years, a small supply of crystals mined there is included in the collection under parcel 5. The rough

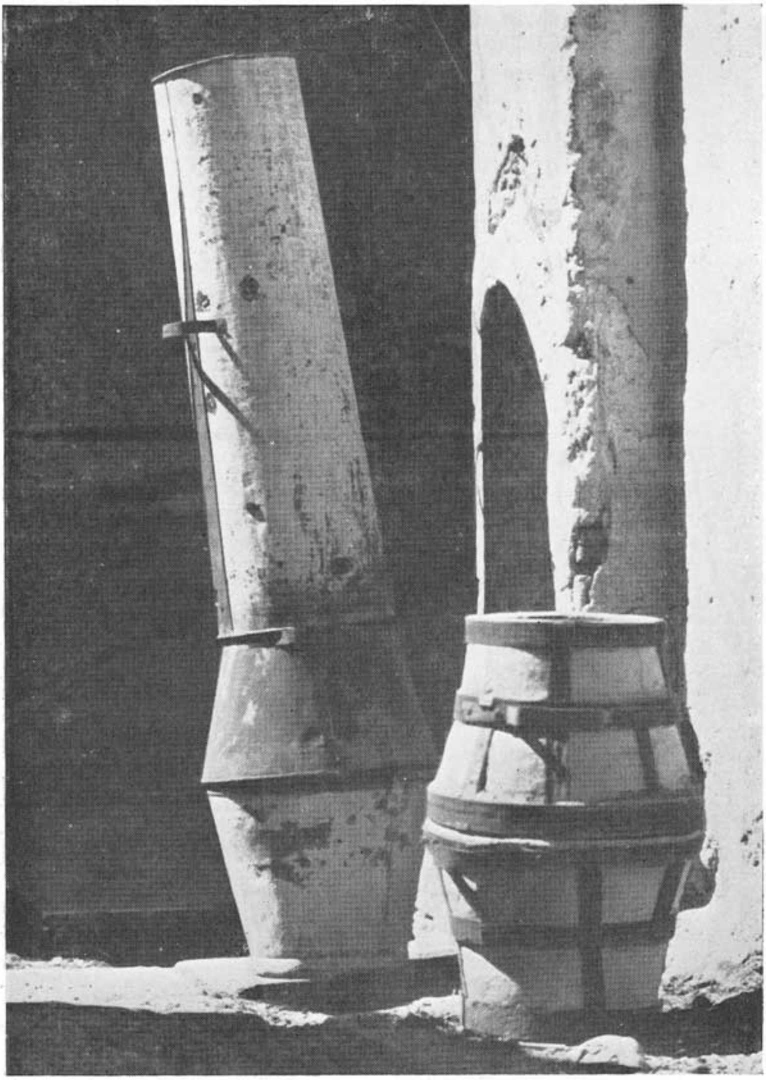


Fig. 4. Heating rough zircons. Left—Tall funnel filled with coal; Right—1 kilogram of rough being heated.

from this mine was considered to produce the finest white zircons of all, possessing a higher degree of brilliancy than stones from other diggings. This belief is well borne out by the appearance of the zircon in this parcel, since even in the rough unheated state this is very bright clear material ranging from the natural colourless to a pale straw colour. The average size of this rough is extremely small—905 stones in the parcel weigh only 416.25 carats, and the largest, a tabular crystal, weighs only 0.8 carat.

Leaving the main area of production, the next in importance is the Champasak district, which lies partly in Thailand and partly in Indo-China. It is almost due west of Bassak, a town on the Mekong, and is centred chiefly on a ridge of high ground, the Dang-Bek, rising in this part to 1,000 feet. The Dang-Bek range separates the Eastern basin of Thailand from Cambodia in Indo-China, and the frontier follows it very closely, from Watana in the west, to the Mekong. Although Cambodia is supplied with water in the dry months from the natural reservoir of Tonlé-Sap (inland lake) and the small streams which feed it, the Eastern basin is notorious as a very dry area. The long period of drought influences the mines in the Champasak area in that they can only be worked for about two months in the year during the rains.

The parcel, No. 6, containing specimens from this district, is not attributed to a definite mine, but consists of pieces averaging a rather larger size than those from the Kha mines. They are a consistent dark opaque brown in colour, and the largest crystal, used for density tests, is one with long prism faces and one termination showing two pyramid faces very pronounced in a wedge shape. The piece weighs 39.40 carats. This material produces only colourless stones after heating, and before the main firing process it is pre-heated to increase its transparency and facilitate inspection for cracks and inclusions. The inspection stage is represented by a further parcel, No. 7, whilst the stones in parcel 8 show the appearance after the final heating. Treated zircons from the Champasak mines are a much clearer white than those from other districts, and they never fade to brown. However, the temperature during firing must be closely watched, as underheating results in a blackish cast in the crystals.

The final and least important present-day source of commercial zircons is the Pailin district, very close to the mines from which come the well-known dark blue sapphires. This area is just above

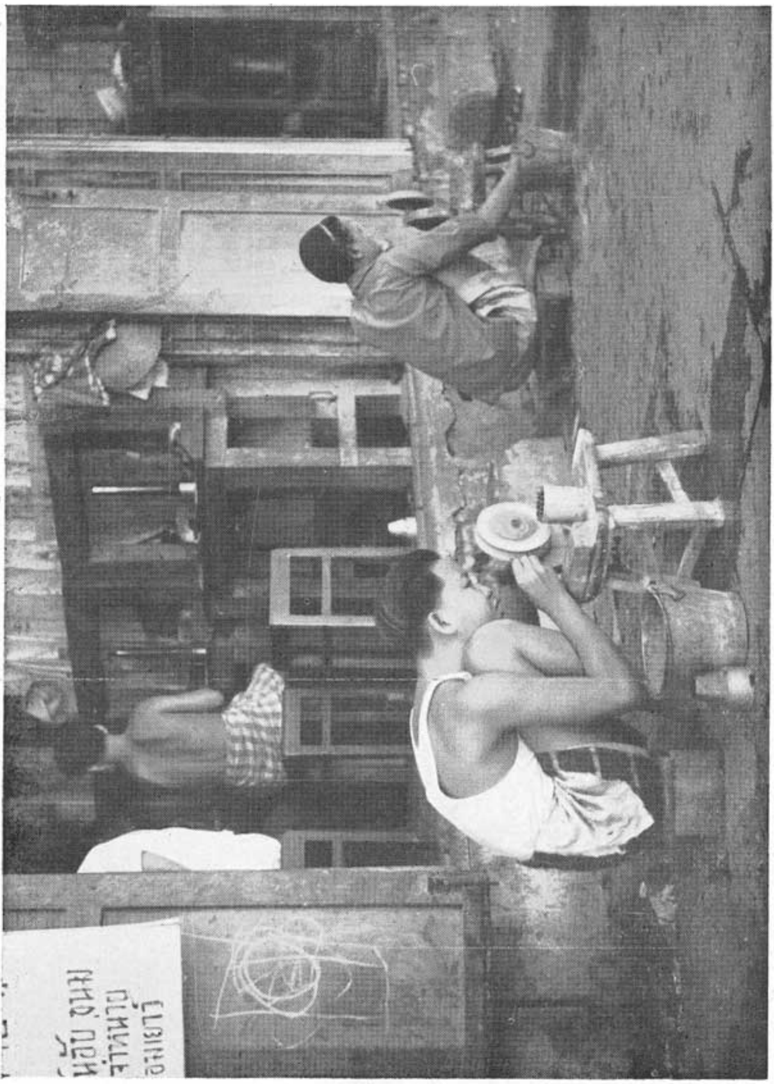


Fig. 5. Native lapidaries. Rough shaping of crystals on handwheel.

Chantabun, a town on the northern coast of the Gulf of Siam, also a centre of poorer grade sapphires. The zircon rough from this district, represented in parcel 9, gives a colourless stone after treatment and only in sizes suitable for producing small brilliant-cut stones. The untreated rough is a fairly constant clear light red-brown colour averaging about 4.0 carats per piece. It is estimated that another year or two will see the chief Pailin mine completely worked out.

The remaining parcels of specimens in this new collection show the process of cutting and polishing the rough from different districts. This work is done almost exclusively in Bangkok. A preliminary stage is the shaping, which is carried out against a small vertical carborundum hand wheel, as in Fig. 5. This is followed by a smoothing operation on a horizontal wheel, also of carborundum, turning in water-filled enclosure.

The actual facet cutting and the final polishing are done on the normal type of steel lap, the same wheel being used for both operations. This is well shown in Fig. 6. Boart is used for cutting and polishing, and a facet cut on the inner portion of the lap face is immediately polished on the outer rim.

The finished gemstones are carefully graded for colour and purity, chiefly into three classes for both white and blue. Special quality blue stones are the deepest and most prized colour, whilst the white are particularly clean and brilliant. First quality blue zircons cover a good average range from medium sky-blue to deep steel-blue, and the commercial or lowest quality in both varieties provides stones particularly suitable for grouping " en masse."

In conclusion, it is of interest to record one or two points regarding change of colour in finished zircons. These are exposed to strong sunlight in a current of air for 48 hours after polishing, and stones which then show a tendency to revert to their original colour are rejected before shipment. Experience proves that this treatment cuts down the proportion of subsequent colour changes to a very small amount. A draught, or a damp atmosphere, will often cause a blue zircon to undergo an apparent reversion to brown or green-blue. This change is only temporary, however, and if the stone is wrapped and left in the dark for a short period its original shade of blue is restored. White zircons sometimes show a tinge of yellow after they have been wrapped and stored for a long time, but when unwrapped and exposed to the air they regain their normal white brilliancy in a matter of minutes.

It is hoped to carry out extensive density and optical tests on specimens from this collection, and any interesting results will be recorded in a future article.

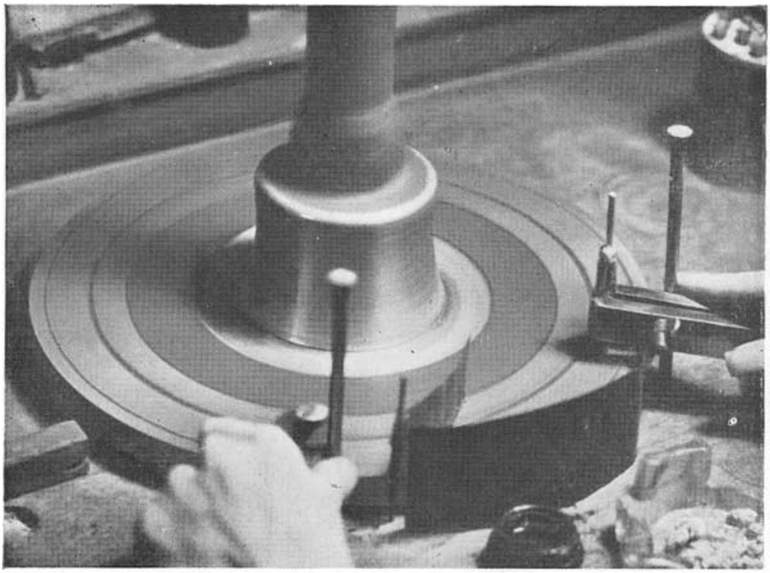


Fig. 6. Right hand—cutting facets ; Left hand—spreading surface of lap with boart inserted in a lead rod.

CANADIAN GEMS AND GEM LOCALITIES *(continued from page 194)*

UVAROVITE.—A number of small green crystals, too small to cut.

WALRUS IVORY.—Two tusks from Baffin Land. Also a replica of a seal carved from walrus ivory by the Esquimaux.

WILSONITE.—Several fine reddish-to-purple cabochons, from Minden, Ontario.

ZIRCON.—Several brilliant- and mixed-cut stones in fine orange and red colours. Cut from fragments of large crystals. This material turns colourless when heated. Renfrew County, Ontario.

ZONOCHLORATE.—A number of fine cabochons from the islands off Nipigon Harbour, Ontario.

Canadian Gems and Gem Localities

By D. S. M. FIELD

SUPPLEMENT
to
Parts I & II
Vol. I
Nos. 5, 6 and 8

ALMANDINE (Province of Quebec).—Labelle County, Joly Township, Range 1, Lot 16, two miles west of Labelle Station. Transparent and deep red masses, weighing up to a hundred pounds, occur in several parallel four-foot veins of solid pyrrhotite. This has been given the highest official rating of any Canadian red garnet. (G.S.C., No. 677 (1927), pp. 19 and 32.)

AXINITE (Ontario and Quebec).—Some fine crystals of axinite were found, many years ago, in a primitive rock boulder, near Hawksbury, Prescott County, Ontario. (G.S.C., New Series, IV, 22T.)

Axinite has also been found, in place, by Dr. R. Bell, in small veins in trap rock, about one and one-half miles south of the mouth of Little Whale River, on the east coast of Hudson Bay, in Quebec Province. The mineral is found in association with epidote, calcite and quartz. The colour is a fine purplish brown.

BLOODSTONE (Nova Scotia).—This mineral has been found, in place, by C. W. Willimott, at Two Islands, Bay of Fundy Region, Nova Scotia.

CHIASTOLITE (New Brunswick, Nova Scotia and Quebec).—Good specimens of Chiastolite occur in a fine-grained micaceous schist at Moore's Mills, Charlotte County, N.B. ; in Compton, Frontenac and Stanstead Counties, P.Q. ; and in fair macles at Geizer's Hill, Halifax County, N.S.

DEMANTOID (Quebec).—Occurs sparingly, in good-sized light green crystals (transparent in part), on the dumps adjoining the Chrome pits, Black Lake Region, P.Q. (Priv. Comm., Dr. Carl Faessler, Université Laval, Quebec City). (This garnet was first identified as Demantoid by Dr. Faessler in 1941.)

EMERALD (Ontario).—Small crystals of emerald occur in Northern Ontario, but none have been found which are large enough to cut.

HOWLITE (Nova Scotia) (Hydrous Silico-borate of Calcium).—This beautiful ornamental mineral was first identified as a new species by Dr. Henry How, of King's College, Windsor, N.S. (circa 1860), and was described by him as a silicoborocalcite. Howlite is ivory white in colour, but usually has veins of other colours—often jet black—and attractive dendritic markings. It occurs, in Nova Scotia, in the form of nodules, ranging in size from that of a pigeon's egg to that of a man's head. (V. Johnston, Memoir 74, G.S.C.) These nodules are found embedded in gypsum, or anhydrite and gypsum, at Brockville, Newport Station, Noel, Wentworth, etc., all in Hants Co., N.S. The mineral takes a high polish, and is therefore well adapted for extensive use in the Arts.

JET (Nova Scotia).—Jet is found, in fine pieces, at Pictou, N.S. It is less hard than the famous Whitby material, but it takes a good polish.

PEARLS (New Brunswick and Quebec).—Fresh-water mussels (Uniondae) are to be found in practically all Canadian streams where fish may be found, but there has not been much pearl hunting done in this part of the Continent.

Some years ago, a unio containing a fine round pink pearl, weighing about 30 grains, was taken near the City of St. John, N.B. This was acquired by George Renolts, Esq., of Toronto, Ontario.

The writer possesses a remarkably good egg-shaped " black " pearl, found last year by Mr. R. T. LeBlanc in a qua-hog clam (Venus mercenaria) in Westmorland County, N.B. This gem weighs about 16 grains and ranges in colour from deep blackish violet on the larger end to light brownish mauve on the other, with a small, slightly opalescent round spot of white at the very tip. This pearl lacks orient, but possesses a high lustre and is without blemish. It is by far the finest specimen of its kind the writer has seen. Viewed with the smaller end up, the pearl resembles a good star-sapphire—as seen in diffused light.

In the Province of Quebec, lumbermen sometimes catch unios for food by fastening small branches to the rear of their rafts when travelling down the rivers in the early Spring. The mussels, touched by the ends of the branches, quickly close their shells, and some at least are caught on the leaves and twigs. When a sufficient number of them become attached, the branches are hauled up and the molluscs removed. Some of these unios contain good pearls, but the majority are baroques.

ROCK CRYSTAL AND MORION (Ontario and Nova Scotia).—A great deposit of rock crystal of the finest optical quality was recently discovered near Black Rapids, North of Gananoque, Ontario. Several tons of choice crystals—some of them sixteen inches in length—were mined and stockpiled during the summer of 1947.

Morion quartz and rock crystal of great size occur at Joe Bell Brook, Chester, and near Lake Ramsay, Nova Scotia. One crystal from the last-named locality measures twenty-six and three-quarters inches in length. It is in the Provincial Museum, Halifax, Nova Scotia.

ROSE QUARTZ (Nova Scotia).—Occurs in the form of pebbles near the town of Shelburne, N.S.

SPHALERITE (New Brunswick).—Honey-yellow, gem sphalerite (blende) occurs with galena, in veins traversing dolomite, at Frenchman's Creek, Lancaster County, N.B. The zinc mines of New Brunswick are quite well known as a source of this rare gem material.

A PRIVATE COLLECTION OF CANADIAN GEMSTONES AND ORNAMENTAL MINERALS

Descriptions and remarks are based on information furnished by the owner of the Collection, an amateur gem collector and lapidary of Toronto, Ontario.

AGATE.—Several hundred cabochons, many showing fine patterns. Chiefly from Michipicoten Island, Lake Superior (Can.). This locality furnishes a great plenty of colourful material of highest quality. (See also Cornelian, Chalcedony, Jasper, Eye-Agate, etc.)

ALMANDINE.—Rough material from Baffin Land (Can. Arctic). This will furnish good faceted stones.

AMAZONITE.—Several cut specimens of fine quality from Renfrew and Parry Sound Districts of Ontario. This material is found in all shades of green, the best of which approaches good emerald colour, with white stripes.

AMETHYST.—Several mixed- and step-cut stones. Deep violet with crimson shades. Thunder Bay, Lake Superior (Canada). Also a small deep-purple brilliant from Blomidon, Nova Scotia.

ANDALUSITE (var.: CHIASTOLITE).—Polished slab. Brown and black with fine chiastolite pattern. Great Slave Lake, N.W.T. (Canada). Great Slave Lake material is outstanding for size and pattern.

APATITE.—Brilliant- and mixed-cut stones (green). Wilberforce, Haliburton County, Ontario. Dichroic.

AQUAMARINE.—Brilliant- and mixed-cut stones from Butt Township, Nipissing District, and from Quadville, Renfrew County, Ontario. The fine blue colour and the clarity of these stones matches the best from Brazil.

AVENTURINE—FELDSPAR. (See " SUNSTONE.")

BLOODSTONE.—Small narrow cabochon from Bay of Fundy, N.S. This material is of fine colour and quality, but is scarce in large sizes.

CELESTITE.—The collector has facet-cut the translucent orange from Ontario and says that transparent blue (similar to that found in New York State) occurs in the Niagara limestone.

CHALCEDONY.—Large grey double cabochon with brown spot and markings, from Blomidon, Nova Scotia.

CORNELIAN.—Red cabochon from west end of Michipicoten Island ; also others from Lake Superior (Can. side) ranging from pale rose to deep brick red.

CORUNDUM. (See " SAPPHIRE.")

DIOPSIDE.— Light green and pale green step- and mixed-cut stones ; a sherry marquise-brilliant, and a smoky sherry cabochon with blue moonstone flame ; from various places in Ontario and Quebec.

EYE AGATE.—Some of the Lake Superior agates yield eyes, and the collector has cut some of these.

FLUOR.—Some of the Madoc (Ontario (fluorspar)) is clear and brilliant enough to facet. It is usually colourless, pale green, and (rarely) pale pink and pale blue. One stone has been cut from a portion of the material in this collection. The perfectly limpid crystals from the Niagara limestone—often pale blue—are equal to any, but seldom greater in size than half-inch cubes. There are some in this collection, but not cut as yet. " Rock Candy " Mountain (B.C.) furnishes some suitable for ornamental objects. The collector has a fifteen-pound piece suitable for a lamp.

IDOCRASE (VESUVIANITE).—Amber and golden brown cabochons ; also oblong brilliant and novelty mixed-cut stones of the same colour. (From Quebec Province.)

IOLITE.—Blue, facet-cut transparent stones of very fine colour, from Great Slave Lake (N.W.T.) ; also uncut material (of faceting grade) from Ontario.

JASPER.—Red stone from New Brunswick and a cabochon or two from Ontario and Quebec provinces.

JASPER CONGLOMERATE.—Some fair material is found in Ontario, but the pattern is often so coarse that it can be utilized for large objects only, such as book-ends.

KYANITE.—Sometimes a small stone of indifferent quality can be cut from crystals found at Parry Sound in Georgian Bay.

LAZULITE.—One small cabochon. Found near Churchill, Manitoba.

MESOLITE.—A white cabochon from Nova Scotia.

MOSS AGATE.—Several cabochons from Agate Islet, Quebec Harbour, Michipicoten Island. (Discovered by the collector.) Also a round tallow-topped cabochon with good pattern against an almost transparent background. From Bay of Fundy, N.S.

NARWHAL IVORY.—One tusk from Baffin Land, about 50 ins. long.

NEPHRITE.—Some dark green pieces from the Fraser River, B.C. (uncut). These are not of good quality, however.

OPAL.—Two small and one medium size tan coloured cabochons from Partridge Island, N.S. These show a brilliant, metallic golden-green play of colour with pale mauve overtones. Precious opal from this locality is extremely rare, not more than a half-dozen pieces having been found.

PEARL.—A number of baroque white pearls from the Province of Quebec. These were collected many years ago, probably in the Saguenay River.

PERIDOT.—Two small, grass-green, triangular cut stones of good colour. Timothy Mountain, B.C.

PERISTERITE.—Several yellow-white cabochons from the Parry Sound district of Ontario. This material is less transparent than Ceylon Moonstone but has a more brilliant (yellow) flame.

PETRIFIED WOOD. (See " SILICIFIED WOOD.")

PORPHYRY.—Fine specimens.

PREHNITE.—Several cabochons showing inclusions of native copper. Often associated with zonochlorite. (Simpson Island, Lake Superior, Ontario.) Also a number of other fine cabochons from this same province.

PROUSTITE.—One ruby-red, facet-cut stone from the Keeley Mine in Northern Ontario (rare).

ROCK CRYSTAL.—Last summer several tons of the finest quality Rock Crystal were mined and stockpiled near Black Rapids (North of Gananoque, Ont.), and the owner of this collection has cut three roses from this for a set of dress studs. Crystals up to sixteen inches in length and up to four inches in cross section were taken out, many doubly terminated. This lapidary has also cut some Rock Crystal from Baffin Land.

ROSE QUARTZ.—Pale pink cabochon. Renfrew County, Ontario. This material is plentiful, but is not so fine in colour as the Manitoba Rose Quartz ; it is more translucent.

SAPPHIRE.—Grey-blue star stone, but with poor star. Also very fine blue cut stone, but showing many structure lines. North-East of Bancroft, Ontario. The grey-blue, blue and bronze types occasionally yield star stones.

SCAPOLITE.—Small, step-cut, triangular step-cut and triangular mixed-cut stones in colourless, pink, pale green and pale yellow colours. Renfrew and Haliburton Counties, Ontario. Also large fluorescent cabochon from Point-au-Chene, P.Q. Also a scapolite cat's-eye from Bancroft, Ontario. (The colourless Canadian scapolite turns a lovely amethyst colour when exposed to radium emanations.) (Experimented by the collection owner.)

SEAM AGATE.—" The east end of Michipicoten Island has agate seams running for thousands of feet in straight lines across the bare headlands, and crossing each other at angles up to ninety degrees. These seams are from one-eighth of an inch to three inches in width—widening and narrowing. In places they stand above the rock ; in others, they run down under the lake. In some instances they are in the bottom of grooves as much as ten feet deep and from one to three feet wide—the edges of the veins of agate always protruding from the bottom of the chasms. . . . Red and white colours predominate." (Priv. Comm.)

SELENITE.—The selenite crystals from Alberta are perfect and water clear and can be cut.

SERPENTINE.—Several cabochons cut from Ontario material.

SILICIFIED WOOD and DINOSAUR BONE.—Several cut specimens from Alberta.

SODALITE.—A deep blue, translucent and flawless double cabochon (17 x 13 x 8 mm.) from Dungannon Township, Hastings County, Ontario. Most of the Canadian sodalite is laced with included materials ; pure pieces are quite rare. Also a number of lovely cabochons in both midnight blue and pale blue translucent to transparent varieties. Also one facet-cut stone. All from the Bancroft District, Ontario. (NOTE: Contrary to most text-books, Sodalite is almost never opaque.)

SPHALERITE (BLENDE).—A six-carat, round, golden-brown brilliant (colour not uniform) from Bruce County, Ontario. (Good sphalerite is also found in New Brunswick.) (See Supplement.)

SPHENE.—A small golden-brown brilliant from Westport, Ontario. This stone contains several flaws.

STAUROLITE.—" The staurolites from Snow Lake, Manitoba, are sometimes huge. Good masses are obtainable, and I have the fragments of a big crystal ($\frac{3}{4}$ x 3 inches) that have some transparent regions. This will definitely yield cabochons, and perhaps a facet-cut stone. It is a rather dark reddish-brown, but no darker than my facet-cut Swiss specimens." (Priv. Comm. Collection Owner.)

SUNSTONE.—Several nice cabochons, some of which show a moonstone effect—and even a cat's-eye effect—in addition to aventurescence. Haliburton and Renfrew Counties, Ontario.

THOMSONITE.—Large, red-brown cabochon, showing typical pattern but lacking contrasting colours. Michipicoten Island.

TOURMALINE.—Mixed-cut stones from Wilberforce, Ontario, and Wakefield, Quebec. These are very dark green and crimson and good green respectively. The colour of the former is similar, but darker than the andalusite-like tourmaline from Ceylon, while the lighter green matches good Brazilian tourmaline. Also a golden brown, triangular mixed-cut stone from Enterprise, Ontario, duplicating best Ceylon material.

TREMOLITE.—A number of small brilliant- and step-cut stones (emerald green, grass green, deep blue, brownish-lavender, etc.). Also some fine cat's-eyes in various colours. the best of which show a razor-sharp line of light. This material comes chiefly from Haliburton and Renfrew Counties, Ontario. (Colourless facet material in collection, but not cut as yet.)

(continued on page 187)

ELUSIVE SPECTRA

by

R. Keith Mitchell, F.G.A.

ONE of the initial difficulties experienced by students when confronted with the spectroscope is to reconcile spectra seen with those very excellent but idealized versions illustrated in current text-books. These " gongs," as one ex-Service student has dubbed them, are extremely useful so long as the practical discrepancies of observed spectra are recognized and expected.

Spectrum colours are, of course, pure, and direct photographs by the normal three-colour process are precluded by the obvious limitations of the method. Therefore the illustrations are photographed from paintings and are idealized and, so far as possible, perfect representations.

It is difficult to devise an easy to use set-up for obtaining unblemished spectra. The microscope-spectroscope method gives suitable out-of-focus light which is normally free from transverse lines, but the spectra are usually less well defined than in the so-called " scattered light " method, and in both methods care has to be taken to avoid masking the effect by undue glare. In either case it is essential to ignore all transverse lines, which may be due to irregularities in the light reaching the slit, or to dust, and to keep the slit as narrow as possible. A wide open slit does not give a stronger absorption spectrum, it merely lets in more light to overlap and obscure the fine lines for which we are looking.

Probably one of the major differences between the illustrated and the observed spectrum arises from the fact that the illustrations are of equally spaced spectra as seen with the diffraction grating instrument ; while the instrument recommended and provided for students' use is usually the Beck 2458, a prism train instrument giving a clearer spectrum but with greater spread in the blue and considerable bunching at the red end. In other words, the wavelengths in the illustrations are spaced on a regular arithmetical scale, while those in observed spectra, with this instrument, increase in accordance with a geometrical progression.

The increase in the dispersion angle of glass prisms is unfortunately not completely rational, and in some instances the spread of the blue, although greater than for the red, is actually less than for an equal wavelength range in the yellow-green. It is therefore difficult to draw an exact picture of the spectrum as seen with a prism-train instrument. With the Beck 2458 something near a true geometrical progression is reached, however, and I have found the following method a good way of obtaining an approximate wavelength scale upon which to draw the absorption bands seen with this instrument.

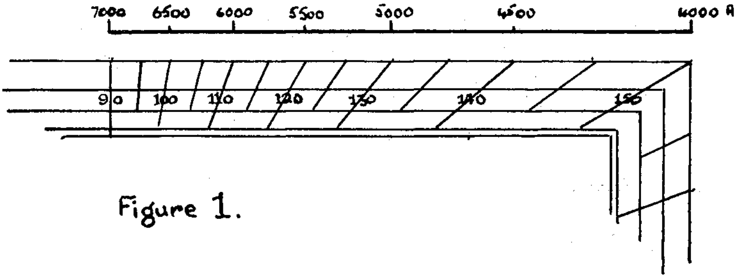


Figure 1.

On an ordinary 6 in. x 1¾ in. rectangular protractor, use the 90° mark to represent 7000Å and use each further 10° marking to represent 500Å as shown in Figure 1. An even more accurate scale can be made by projecting these measurements from 0, as in Figure 2, and using their points of intersection on a line PQ inclined at about 20° to the original base line. This provides a scale which gives reasonably accurate visual comparison, although it exaggerates the extreme blue. Within the limits of B—G, the normally visible spectrum, the degree of error is small. Points of intersection on any line parallel to PQ will give an equivalent scale of any convenient size. These scales are arrived at empirically but are sufficiently near for the purpose of illustration.

Another difficulty lies in the immensely variable spectrum of zircon. In a few very rare cases magnificent spectra of some 30 to 40 lines have been observed. But in the vast majority of zircons used in modern jewellery even the ten or so lines shown in textbook illustrations will not be seen. The only line which can be relied upon to turn up with almost infallible regularity is the famous one at 6535Å. Most specimens will show two, three, four or more other lines, in varying degrees of clarity and fineness ; but

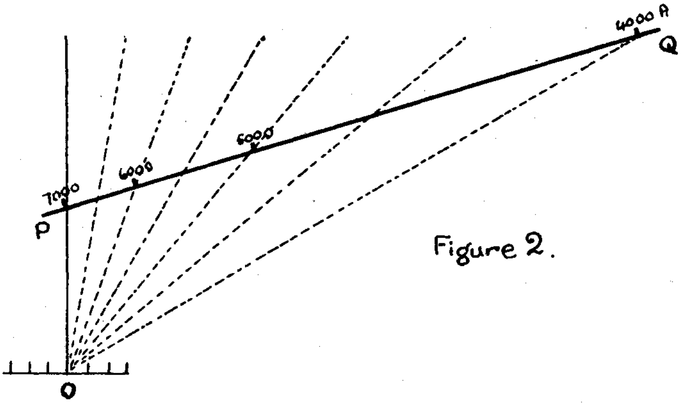


Figure 2.

stones showing spectra even as well defined as those of the textbooks are exceptions rather than the rule.

It is also well to remember that the green low-type zircon has a distinctive variation of the normal zircon spectrum. The 6535Å line appears as a much broader line than usual, and is often clear-cut on the side towards the red and fuzzy on that towards the lower wavelengths. Like most other spectra, this one is easily recognized when once seen and identified.

Even the classic example, almandine, can prove difficult to the unpractised eye. The full spectrum shows three main bands and two or more less definite ones. The latter are not always seen, while the three main bands can be so intense and broad as to merge into each other. In garnets containing only a small amount of the almandine molecule all except the third of these three bands may be missing. This one, centred at 5050Å, persists while the almandine molecule is present. In some cases the almandine spectrum is practically masked by that of pyrope, which, being due to chromium, has a broad absorption from 6200Å to 5200Å.

Peridot, in its paler manifestations, will not always give the well-known three bands in the blue which are usually illustrated. Often the only indication will be the faint suggestion of an " edge " at the beginning of the blue. If this is seen and recognized it can, however, be very diagnostic. At the other extreme is the peridot with the three bands so broad and intense as to almost merge into one.

Most other spectra can vary enormously in intensity, generally in direct ratio to the depth of colour of the gem. Colourless stones do not usually give absorption spectra, but the white zircon is an exception and almost always shows a faint trace of the 6535Å line. It is possible that some other gems normally showing rare earth spectra may still show traces of the same spectra in their colourless varieties.

An insufficient source of light may be responsible for confusion between the fluorescent line in the red in ruby and the very similar fluorescent lines in the rose-red spinel. Both are due to chromic oxide, but whereas the ruby line appears to be a clear-cut single line of bright light (it is, in fact, a pair of lines so close as to appear as a single narrow line), the spinel spectrum has a series of about five such bright lines sufficiently separated to be distinguishable if the lighting is strong enough. Inadequate lighting, however, may result in a spectrum in which only the brightest of the bunch is seen and an erroneous identity be given to the stone. Fortunately there is another check, the two lines in the blue observed in ruby (the left-hand one is, in fact, a doublet, and may be seen as such in well-defined spectra). These are entirely absent in red spinel.

The majority of students find observation of lines at the blue end of the spectrum somewhat difficult. This is due in part to an actual decrease in the sensitivity of the eye to this part of the spectrum, and in part to the spreading of the lower wavelengths by the prism instruments. Also the relatively greater intensity of the closely bunched red, orange and yellow creates glare and renders the blue obscure and difficult to see. This can be overcome to some extent by moving the eye slightly to one side until the edge of the eye-piece aperture screens the brighter part of the spectrum. After a moment or two the eye becomes accommodated to the lower intensity and details of the blue can be seen more easily.

The chief aid to absorption spectroscopy is practice. No amount of poring over text-books will replace it. When using the instrument as much light as possible, without producing glare, should be directed through the stone. *The slit of the instrument should be kept as narrow as possible,* and the stone moved to give the best possible spectrum. Very faint lines may sometimes be seen more readily if the stone is moved into position while a complete spectrum of the light source is under observation.

Finally, the absence of an absorption spectrum is not necessarily a negative test ; but if one is seen and correctly recognized it *is* an absolutely positive test.

BROADENING HORIZONS OF GEMMOLOGY

by RICHARD M. PEARL, M.A.

THE original meaning of the word *gem* as applied to a substance made of stone is lost in antiquity, though the word itself goes back to its Latin root, *gemma.* The Oxford English Dictionary says that " in Middle English the word was adopted afresh (or refashioned after) the French form *gemme* " and traces its history through the literature.

The earliest usage of which we are certain referred to a cut and polished stone, and hence it was a lapidary term. The next meaning (first recorded in English in 1638) was that of an engraved stone ; this was the chief significance of the word during recent past centuries, when it would have been redundant to speak of a carved or engraved gem. The word then reverted back to meaning a stone or related substance cut for personal adornment, and finally it was expanded to include various ornamental applications. (The phrase *gem material* suggests the " rough " from which the finished product is fashioned.) Always the lapidary use has given the cue to the meaning.

Classification is a different story, and it is here that the writer should like to express some personal opinions. The foolishness of the term *semi-precious,* which has now properly fallen into disfavour, was first unwittingly revealed in 1896 by Max Bauer, who in the first edition of his classic book " Edelsteinkunde " listed as " precious " eighteen kinds of gems, some of which were quite unknown to all except mineralogists and a few jewellers. Recent contributions to the " Journal of Gemmology " by Elsie Ruff, W. F. Eppler and others have expressed the modern viewpoint on this subject, which is also the official attitude of the several national gemmological organizations. It would be tilting with windmills to argue the matter further, though plenty of opportunity still exists for educating jewellers in this terminology.

Yet if there be no legitimate distinction between precious and semi-precious stones—and there is none—why should we continue to pay respect to a discredited idea by using classifications based upon supposed relative value in our textbooks? Now that the tenth edition of Dr. G. F. Herbert Smith's " Gemstones," certainly the best book in English, has abandoned this distinction between precious and semi-precious stones, the opportunity presents itself for a thorough revision of our approach to the subject.

In B. W. Anderson's discerning review of " Gemstones "* he reveals the hesitation which all of us, including no doubt the author, must have in accepting an arrangement of gems based upon several sorts of relative value. For it is not scientific thinking to depend upon an increasing or decreasing " importance "—whatever that means!—most ordinary jewellery stores, making up the backbone of the trade, do a larger total business in amethysts than in alexandrites.

The arrangement in the excellent standard American textbook, " Gems and Gem Materials," by Edward H. Kraus and Chester B. Slawson, though indifferently approved by Mr. Anderson, is scarcely better inasmuch as it travels the route of decreasing " value " for a while and then strikes off across country in a different direction, following the alphabet.

In contrast, my own book, " Popular Gemology," is divided first according to the major style of cutting (facet or cabochon) which is generally most appropriate for each gem ; this cutting (again a matter decided by the lapidary) in turn depends upon the inherent properties of the gem. Within the individual chapters I have adopted, as closely as possible for the mineral gems, what I consider to be a truly scientific arrangement, which is the mineralogical classification of the new Dana system ; this when completed will without question be the international authority until a drastically new method of considering minerals is discovered.

This adoption would not be justified if I did not believe that gemmology is most properly a branch of mineralogy. It is largely because they are primarily professional mineralogists that such men as Herbert Smith, Kraus, Alexander, Pough, and others of that high calibre qualify as gem experts. Otherwise the only gem experts would be practising jewellers, who, after all, were making a livelihood from their untechnical knowledge of gems long before science invaded the field.

The chief objection that has been offered to this new arrangement has been that it makes necessary the use of the table of

---

* " Gemmologist," Vol. XVIII, 1949, pp. 165-167.

contents and the index to find a given gem in the book—which is precisely why indices and tables of contents were invented: only a dictionary can presume to get along without them. In the preface to "Popular Gemology" I wrote: "Diamond, by fortunate coincidence, occupies the first position in either a commercial or a scientific succession." If I were rewriting that to-day, I might omit the subjective word *fortunate*; the book could as well begin with garnet or sphene. Aesthetically, if not commercially, all kinds of gems are equal, and any preferences are a matter of individual choice—to quote Dr. Herbert Smith, "*de gustibus non est disputandum.*"

In the same review Mr. Anderson said: "In an era when some collectors will have any mineral cut in gem form, regardless of its suitability, another difficulty facing the author was to decide which minerals to include and which to omit." This difficulty will, of course, always exist and must be resolved arbitrarily. Nevertheless, the "collectors" to whom he refers rather slightingly are effecting changes in the scope of gemmology that are as pronounced as those that accompanied the evolution of the meaning of *gem* from a cut to an engraved stone.

The conservative student of gems, particularly outside the United States, may be shocked to learn of some of these changes in usage that are now comfortably accepted by at least a few score thousand lapidaries in this country. Though originally hobbyists, they are not entirely "amateurs," for a large proportion of their product reaches the market and constitutes an increasing share of the jewellery business. They have as much right to be taken seriously as have craftsmen in the home industries of any other nation. Their viewpoint, if only because of their numbers, cannot be casually overlooked.

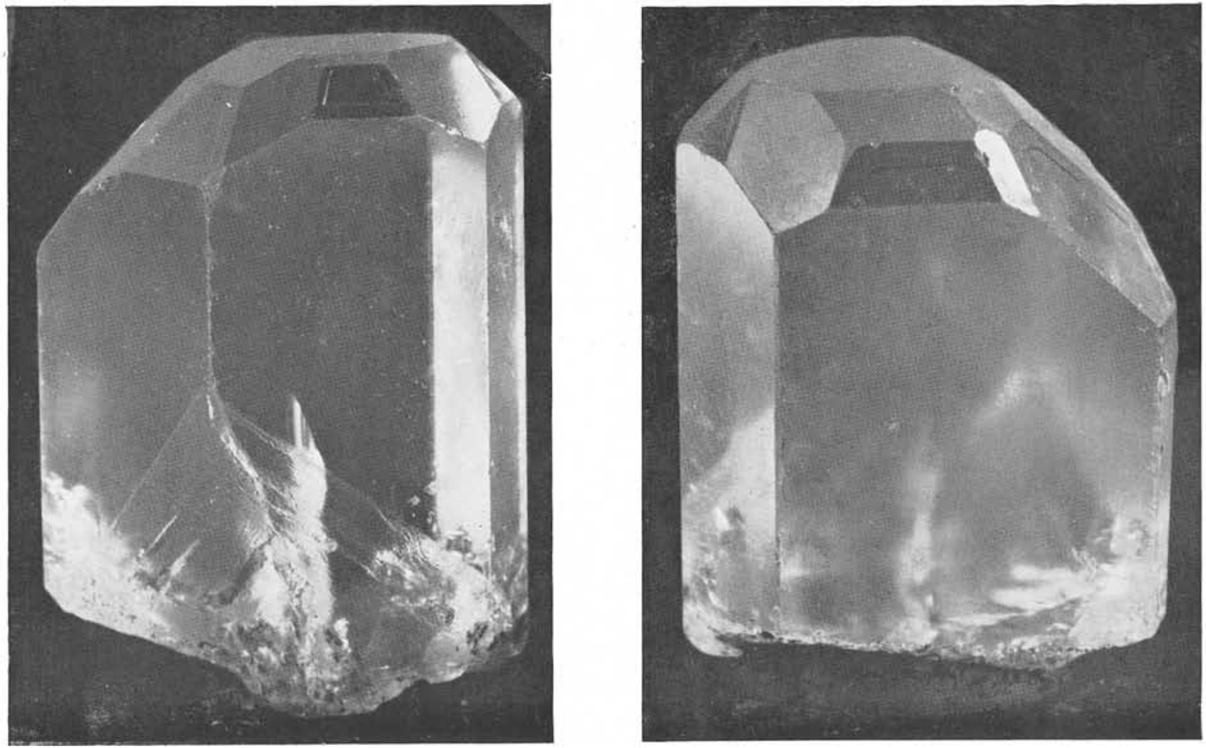
A good example of this modern American usage concerns opal. *Gem opal* has heretofore meant opal with a play of colours; specimens without this beautiful optical phenomenon were called *common opal*. Now, however, gem opal refers to pieces that are solid enough to be cut into stones for jewellery, whether they have any other attribute or not. Surely good "common opal," with its delicate bands of faint colour, is as "suitable" for this purpose as ivory, which has been given much space in recent British books and articles on gemmology. Similarly, opaque specimens of otherwise transparent minerals are regarded in these American circles as gems, if only they are not too friable to be cut and polished.

Such an expanding definition of a gem seems as acceptable as one which includes synthetic and imitation minerals. Incidentally, the declining availability of natural specimens has caused an increased interest in the United States in synthetic material, which has been given added impetus during recent months by the introduction of the new synthetic rutile.

This shortage of supply also tempts some amateur lapidaries to try their skill with plastics. Plastics have received especial attention among gemmologists lately through the diligent work of Robert Webster, and so ought to be worthy of consideration by these same lapidaries. Nevertheless, such an interest can readily get out of hand, at the expense of the natural substances that give lapidary work its real meaning, and therefore it is satisfying to state that at the annual exhibits of the California Federation of Mineralogical Societies—the largest of such regional organizations in the United States, with about 4,000 active members—competitive entries for awards are accepted only for natural materials.

Attempts to adhere to any rigid list of gems, established in past years and destined never to change, were shown in their ultimate absurdity in "American Gem Cabochons," by William C. McKinley. Passing from a homogeneous rock, obsidian, to rocks that are aggregates of minerals, he included granite as gem material. If granite, why not syenite, its quartz-free equivalent? Hence it was included also. Then why not any or all of the thousands of kinds of rocks as classified by petrographers? This suggestion, and the presentation of fashioned specimens of granite and syenite as gems, brought Mr. McKinley considerable ridicule, yet he was more logical than his critics, if only because he showed the impossibility of setting up an iron curtain around the field of gemmology.

It seems as reasonable for the gemmologist—the student of the *science of gems*—to consider these attractive lapidary specimens, unfamiliar though they be in jewellery stores, as it is to devote pages in his books to the superstitions of gems and other attendant nonsense. The use of the critical faculty is necessary, of course, in order to restrict the field of gemmology to practicable limits, so that we can concentrate on the most necessary aspects. No harm is done in this, so long as we recognize that all classifications are arbitrary ; Nature knows no such distinction. Above all, there is no natural boundary, either in time or place, to the study of gems.



A beryl crystal (light green in colour and transparent) from Minas Gerais, showing terminations and etch markings. Weight 248.20 grams (1,241 carats), height 78 mm.

Photos: Courtesy of Paul Bessem.

Gemmological Abstracts

" Agate and Quartz Glass." By R. Nacken. " Natur und Volk," Berichte der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt/Main, 1949, Nos. 1-3 ; " Edelsteine und Schmuck," 1948, *1*, 243-244.

Experiments with quartz glass have thrown new light on the genesis of agate. The conventional theory of the formation of agate nodules through hot aqueous solutions of silica seems wrong if one realizes that a litre (0.22 galls) of water dissolves about 2.5 g. (37.58 grains) of silica at a temperature of 500 deg. C. (932 deg. F.) and a pressure of 2 to 3,000 atmospheres (29,460-44,190 lbs./sq. in.). The formation of an agate nodule of 1 kg. (2.2 lbs.) would require 400 litres of water (88 gallons). Agate must have been formed, therefore, in a different manner. (Nacken found the first indication when investigating the syntheses of quartz crystals.) He heated quartz glass and some water under pressure to a temperature of 400 deg. C., at which temperature water has a particularly high mineralizing effect. Under these conditions the quartz glass is transformed into a mass of quartz fibres (chalcedony). The crystallization begins at the surface of the piece of glass and progresses towards the interior. Bands are formed parallel to the outer faces. When the transformation is completed, a central cavity remains which is filled with water, as seen in enhydros. The contents of the water are of great importance. Acidy solutions prevent germ formation. Alkaline solutions even of the weakest concentration favour the formation of germ crystals at the glass surface. Raising of the temperature has the same effect. The density of quartz glass being 2.2, that of quartz crystal 2.65, a considerable loss of volume must occur during crystallization, amounting to more than 10 per cent. Between the fibres capillary cavities are formed through contraction, and these allow the progress of the transformation. Additions of metals or metal oxides produce coloured bands. The quartz glass in the genesis of natural agate rose probably in the form of drops (resembling gas bubbles in shape) from the depth of the earth. This seems likely as the density is 2.2 to 2.3, whereas that of the surrounding lava must have been 2.6 to 3.

E. S.

" Oriented Zoning in Synthetic Corundum." By W. Plato. " Edelsteine u. Schmuck," 1949, *1* (12), 266.

Photomicrograph showing anomalous double refraction of synthetic corundum when viewed between crossed nicols along the optical axis, refers to earlier article on this phenomenon in " Edelsteine u. Schmuck," 1949, *1* (9), 193-194 ; " Journal of Gemmology, 1949, *2* (4), 157.

E. S.

" The Diamond Industry in 1948." Twenty-fourth annual review. " Jewelers' Circular-Keystone," New York, 1949, reprint 18 pp. (prepared from papers of the late Dr. Sydney H. Ball).

World production of diamond during 1948 is estimated at 11,859,200 carats, against 9,754,231 for 1947. Operations were resumed in several S. African mines. Further research work was undertaken by many scientists, including S. Bhagavantam—dielectric constants ; G. O. Wild—fluorescence ; and D. S. Lewis.

G. A.

" Emeralds in India." By Prof. K. Schlossmacher. " Edelsteine u. Schmuck," 1949, *1* (2), 238-239.

Prospecting financed by Sir Bagchand Soni and the emerald dealer Seth Banjilal Thulia near Kaliguman, a small village between Amet and the old fortresses of Kumargarth (in the State of Rajputana), led to the discovery of emeralds of ½ to 4 inches length and about 1¼ inch diameter. The quality is said to be comparable to Russian emeralds. The emeralds occur in layers of biotite slate sandwiched between hornblende slate. Mining to a depth of 200 ft. is envisaged. The yield contained eight stones of about 6 cts., the colour of which is said to be extremely good. On the whole, the quality is disappointing. The author, who received this information from the Geological Survey of India, concludes that most of the stones will contain biotite inclusions, and that fine stones will be scarce.

E. S.

" Zircon and its Characteristics." By K. F. Chudoba. " Edelsteine u. Schmuck," 1949, *1* (2), 235-238.

Wide variations in the physical constants of zircon ($ZrO_2.SiO_2$) are not due to isomorphous replacement but constitute particular characteristics which deserve to be reviewed. Density and colour are of special interest. The spread of *density* values led to the following terminology (after R. Köchlin, 1903): —

high types above S.G. 4.6
low types below S.G. 4.2
intermediate types between S.G. 4.2 and 4.6.

Frequently the high types are called " normal " zircons because they possess the typical crystal structure, as revealed in X-ray diffraction patterns. Investigation of a zircon of S.G. 3.945 showed that instead of crystalline $ZrSiO_4$ the products of the broken-down crystal structure were present, namely amorphous SiO_2 and amorphous ZrO_2. Intermediate types are mixtures of crystalline and amorphous zircon. Bauer, Chudoba and others also found cubic ZrO_2 whih is present before the amorphous modification is formed. Vaughan H. Scott (1945) investigated a zircon of S.G. 3.965 and showed that monoclinic ZrO_2 was present with amorphous SiO_2. This modification was also observed when zircons of various S.G.s were heated to 1,580 deg. C. and rapidly cooled. It can be assumed that the break down of the crystal lattice is caused in nature by radioactive matter in the zircon. Of great importance is the possibility of recrystallization of amorphous zircon through heating. This process is characterized by an increase in S.G.-values and corresponding change in refractive index, double refraction, and hardness. There is a connection between structure and *colour*. Low types are nearly always green, sometimes yellow-green or brownish-green. High types are never green, but mostly brown, brown-red, pink or red. When low types are recrystallized the colour changes from green to yellow, pale yellow or blue. Other types, too, change colour on heating. Brown Tasmanian zircons become colourless through moderate heating. Blue zircons from Siam are heat treated. In this case the improvement in colour is connected with pigments in the stone. Brown-red zircons are heated in reducing atmosphere to 900-1,000 deg. C. and become blue or colourless. Heating in air to 850-900 deg. C. produces colourless, yellowish or reddish-yellow crystals. When blue zircons become pale in time the deep blue colour can be restored through heating in air to 400-600 deg. C. Heating to temperatures over 850 deg. C. produces a yellowish hyacinth colour ; these stones become blue again when heated in reducing atmosphere. Some hyacinth-coloured zircons may be bleached through sunlight, but they become coloured again on heating. Not all zircons behave in the described manner.

E. S.

Dr. S. von Gliszczynski, lecturer of mineralogy at the University Muenster, Germany will lecture on gemmology during the winter term and direct practical exercises in the identification of precious stones at the Meisterschule des Gestaltenden Handwerks (Master School of Creative Arts and Crafts) at Muenster— " Juwelier," 1949, No. 9-10, p. 30 (September-October).

E. S.

The German periodical " Achat " has been reorganized and is published now under the new name of " Der Juwelier " ; its sub-title, " Zeitschrift für Schmuck und Edelsteine," indicates that it is devoted to jewellery and gems.

" New Test for Cultured Undrilled Pearls." By G. O. Wild. " The Gemmologist," Vol. 18, No. 221, p. 285, December, 1949.

It is suggested that cultured pearls may be distinguished from natural pearls by allowing a narrow beam of X-rays to brush over the surface of the pearl, which is then slowly raised into the beam. Observation, in a suitably placed fluorescence screen, of the shadow of the pearl shows, in the case of a cultured pearl, a flash of light on the screen when the beam reaches the edge of the cultured pearl core. A real pearl does not show this effect.

R. W.

" Pearls under the Microscope." By W. Plate. " Der Juwelier," 1949 (11/12), 17, 18.

Distinction between natural, cultured and imitation pearls facilitated by microscopic inspection. Eight good photomicrographs (45 to 534 x mag.) of pearl surfaces convey well the points the author wants to stress.

E. S.

" Pearl Essence Finishes: What they are and how to use them." (No author quoted.) " Product Finishing," Vol. 2, No. 8, pp. 14-18.

Although written essentially for the paint industry, there is much information of interest to the gemmologist on the history, properties and production of the iridescent essence used in the coating of imitation pearls. Fish scales for use as a pearly coating first discovered by Jacquin in France, where, up to the beginning of the Second World War, the manufacture of pearl essence was principally carried out, is an industry which has since been lost to America. The method of recovery of the scales, an offshoot of the American sardine industry, and the processing to obtain the colourless transparent guanine crystals is told. The iridescence of the pearl essence is stated to be due to the play of colour from the minute and thin crystals (0.1 by 0.02 by 0.001 mm.) and to the high refractive index, the double refraction and polarization of the light which, passing successively through two of the crystals, being broken up into brilliant colours by the twisting of the polarized beam. The density of the guanine crystals is given as 1.6 and their resistance to chemical attack is noted. Very full information is given as to the best methods of using pearl essence and how coloured finishes may be produced.

R. W.

" Problems of Colour." By M. D. S. Lewis. " Gemmologist," Vol. 18, No. 219, page 233, October, 1949.

An exposition of the theories of Prof. W. A. Weyl that colour may arise from a disturbance or lack of balance in the electric field caused by oppositely charged ions. Some five factors are mentioned and discussed as being the possible causes of the ionic distortion.

R. W.

" The Diamond Syndicate and their Successors." By R. M. Shipley. " Gems and Gemology," Vol. 6, No. 7, page 199. Fall, 1949.

A review of the history of the diamond industry from 1884 to the present day, and of the steps taken for the control of the market. A summary of the principal organizations which control the diamond market is given.

R. W.

" Aventurine: Glass, Feldspar and Quartz." By R. Webster. " Gems and Gemology," Vol. 6, No. 7, page 207. Fall, 1949.

Aventurine glass is explained as being copper crystals induced to form in a glass matrix, and not copper filings as commonly reported. The characters of the material are compared with natural aventurines (quartz and feldspar). The structure of the three kinds of aventurine is remarked upon and illustrated by photomicrographs. Polarized light proves that the green aventurine quartz has the chrome mica (fuchsite) flakes in a granular quartz matrix. The so-called sunstone from Modoc Co., California, is not oligoclase but labradorite with included crystals of metallic copper.

V. B.

" The Cause of Colour in Turquoise." By F. B. Wade and W. C. Geisler. " Journal of Chemical Education," Vol. 26, page 436, August, 1949.

A report on a series of experiments undertaken to discover the cause of the blue colour of turquoise. From chemical and isotopic analysis the colour is considered to be due to complex amino copper ions which is probably organic in origin.

R. W.

" Staining Turquoise." By F. B. Wade and W. C. Geisler. " Gemmologist," Vol. 18, No. 217, page 187, August, 1949.

The report of a final experiment of a series of researches on the cause of colour in turquoise (previous experiments reported in " Gemmologist," May, 1947, January, 1949, and June, 1949, and in " Journal of Chemical Education," August, 1949). Having found that the colour is possibly due to a complex amino copper ion, it was decided to experiment with poor quality porous turquoise to see whether the amino copper ion would stain the material to better colour. The result was successful and a good colour induced.

R. W.

" The Oiling of Turquoise to Deepen the Colour." " Gems and Gemology," Vol. 6, No. 7, page 221. Fall, 1949.

A résumé of the " oiling " techniques used to " fraudulently(?) " deepen the colour of turquoise. The accidental production of a " lavender " coloured turquoise owing to the stone being impregnated with red dopping wax which had not been completely cleaned off with alcohol as is customary after polishing.

R. W.

"The Transparency of Chromium Aluminium Alums and of their Solutions." By C. H. Rehberg. "Neues Jahrbuch f. Mineralogie, etc., Abhandlungen," A, 1949, *80,* 1-35.

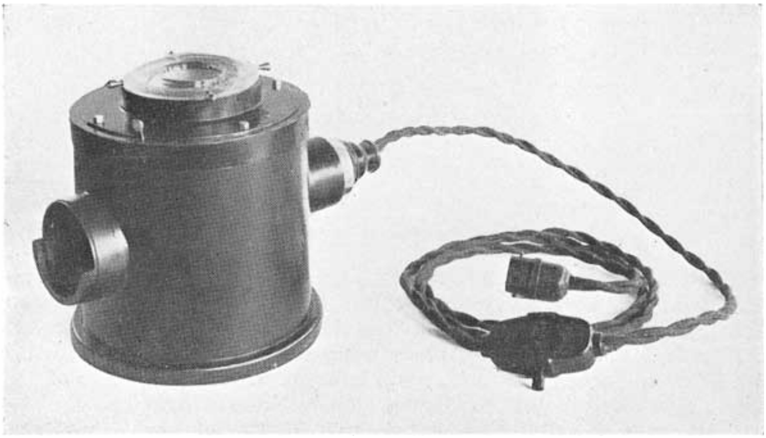
Object of the paper was to investigate the relation between transparency and colouring matter in a series of mixed crystals, and to check the application of Lambert-Beer's law. The range of potassium chromium aluminium alums was chosen. Crystals of different concentration were grown and the chromium content determined by quantitative iodometric analysis. Investigation of the light refraction showed linear relationship. The transparency (between 4,000 and 8,000 A.U.) was measured with the light electric apparatus of the Koenigsberg Mineralogical Institute (micro-selenium photo element S. 12 by Dr. Lange). Starting from Lambert-Beer's law a general formula for mixed crystals was developed and the agreement of measured values with the formula shown, thus proving the validity of Lambert-Beer's law for this case. If the formula was expressed in logarithms a linear relationship between transparency and concentration resulted. In the same fashion mixtures of colourless potassium aluminium alum solution and violet potassium chromium alum solution were investigated, and also mixtures of violet and green potassium chromium alum solution. The formula developed for the mixed crystals was applicable also in these cases. To investigate the influence of the alkali metal on the transparency a rubidium chromium alum was grown, and complete agreement was found between its transparency curve and that of the potassium chromium alum. At nearly equal mol-volume of both alums, the conclusion was reached that the transparency depends on the trivalent metal and is the same for equal mol-volumes.

E. S.

"Recognizing Double Refraction of Precious Stones by Simple Means." By G. O. Wild. "Der Juwelier," 1949 (11/12), 19, 20.

Stone is held very near to the eye and rotated whilst light source or illuminated object is viewed through it. Double refrection is indicated by doubling of part of object outline and shifting of effect when stone is rotated.

E. S.



A GEMMOLOGIST'S LAMP

A gemmologist's and microscopist's lamp has recently been produced by Chards (Reg.).

The instrument is composed of a tubular body on a solid base with an adjustable lamp holder. The front part of the lamp is for use with the microscope and is fitted with a filter carrier which is designed to take the standard Selo filters, 2 in. x 2 in., for use in connection with refractometers and other instruments needing filters.

A feature of the lamp is a circular recess at the top holding a revolving transparent optically finished 3 in. Perspex cell formed into two concentric recesses. Four small knobs are fitted to the edge to enable the cell to be conveniently revolved.

Below the cell is a large iris diaphragm controlled by a lever on the top of the edge.

The Perspex cell enables stones to be immersed in any of the liquids used by gemmologists and is an advantage when testing a number of cut or uncut transparent stones. The concentric recesses enable the recognized stones to be removed from the mass into the outer recess. The overall efficiency of the lamp is much better in a darkened room. It is attractively finished in chromium plate and cream enamel.

ASSOCIATION NOTICES

AMERICAN GEM TESTING LABORATORY

The Gemological Institute of America, Inc., and the Gem Trade Laboratory, Inc., New York, have announced the consolidation of the Gem Trade Laboratory, formerly located at 36 West 47th Street, and the Gemological Institute's Eastern Headquarters Laboratory at 5 East 47th Street, effective 5th October. The new laboratory will be operated under the name of the Gem Trade Laboratory of the Gemological Institute of America.

All equipment, including that for pearl testing of the Gem Trade Laboratory, has been added to that at G.I.A. Eastern Headquarters, where a laboratory has been operated in conjunction with the educational Institution's classes and other functions since August, 1948. The laboratory will be under the directorship of Richard T. Liddicoat, Jr., assisted by G. Robert Crowningshield, and Gilbert Cakes, of the G.I.A. staff.

The combined facilities of the Gemological Institute and the Gem Trade Laboratory, under the new name of the Gem Trade Laboratory of the Gemological Institute of America, will be made available to laboratory members, the jewellery trade and the public.

MEMBERSHIP

The following were elected to membership of the Association at a meeting of the Council held at 19/25 Gutter Lane, London, E.C.2, on Wednesday, 23rd November, 1949:—

FELLOWS

Miss W. M. M. Allan, Prestwick.
D. Blanshard, London
D. C. Blatchford, Plymouth.
T. L. Boston, Colchester.
A. Bowden, Plymouth.
Miss J. M. Butler, Greenford.
K. J. Campbell, Thornton Heath.
G. O. Cook, London.
Miss P. E. Cutts, Birmingham.
K. C. Davis, London.
R. W. Dougan, Deal.
J. S. Ewen, Castle Douglas.
J. H. Feinmesser, London.
P. Feitelson, London.
H. C. Gale, Isleworth.
E. H. Gudridge, Perranporth.
T. Harkins, Johnstone.
E. T. Hartland, London.
Miss J. Haussler, Amsterdam, Holland.
J. G. Heetman, Rotterdam, Holland.
T. J. F. Johnson, Watford.
H. H. Long, Birmingham.
R. D. Lowe, Rotherham.
E. W. Macdonald, Bearsden.
Miss T. McDonald, Edinburgh.
J. W. Miller, Glasgow.
D. J. Morgan, Corby.
R. T. Mortimer, London.
J. A. Newman, London.
H. G. Payne, Bournemouth.

Mrs. D. I. Pidduck, Southport.
R. L. Pinn, Cape Town, South Africa.
G. F. Priestley, Folkestone.
M. P. Rack, London.
M. M. R. P. Rosas, Oporto, Portugal.
J. M. S. Salloway, Lichfield (Life Membership)
E. H. S. Shearer, Edinburgh.
A. Stewart, Parkstone.
N. H. Thompson, Middlesbrough.
C. N. van Rijswijk, The Hague, Holland.
E. C. Vineall, Southend-on-Sea.
M. Waterman, London.
E. E. Webb, London.
G. M. Winnert, Edinburgh.
S. D. Wood, Glasgow.

Fellows transferred from Probationary Membership

J. Batty, Keighley.
P. Benson-Cooper, London.
M. J. C. Brocklehurst, Chorley Wood.
M. L. Butterfield, Leeds.
G. Croston, Liverpool.
N. H. Day, Salisbury.
Miss J. E. Fitch, Vancouver, Canada.
D. N. King, Birmingham.
M. Kussman, London.
J. M. Lister, Birmingham.
C. W. E. May, Ilford.
L. Penn, Birmingham.
C. A. Piek, Amsterdam, Holland
W. A. Rance, High Wycombe.
C. Robinson, Manchester.
F. C. L. Salisbury, Northolt.
L. Sanitt, Ilford.
C. K. Saunders, Sutton Coldfield.
F. Scanlon, Manchester.
T. P. Solomon, Birmingham.
S. G. Stephanides, Birmingham.
T. Stern, London.
E. W. R. Stollery, Glasgow.
P. J. Thomson, Thundersley.
G. W. Whitehead, Surbiton.
G. T. Wright, London.

Associates

R. Rillstone, West Leederville, Australia.

Associates transferred from Probationary Membership

A. H. Parfitt, Bristol.
L. Shapshak, Johannesburg, South Africa.

Probationary

G. Biörklund, Stockholm, Sweden.
K. A. Boyes, Leeds.
A. R. Cornelius, London.
K. J. Cox, London.
B. L. Davies, London.
P. J. F. Davison, Goodmayes.
T. L. R. Evans, London.
J. M. Fishberg, London.
Mrs. I. N. Gush, Johannesburg, South Africa.
Miss A. H. Hathaway, Stratford-on-Avon.
Miss J. C. Hollander, London.
F. W. Jackson, London.
R. F. King, Welling.
M. J. Kutner, Wembley.
H. M. McMinn, Belfast.
W. C. V. Pellett, London.
B. Silver, Edgware.
F. Wainwright, Hutton.

ACKNOWLEDGMENTS

The Association has received a miniature collection of rough gem specimens from W. Constantin Wild & Co., Idar-Oberstein.

TALKS BY FELLOWS

G. A. Blythe: " Gemstones." " Round Table " Club, Southend, 11th October.

J. F. Croydon: " Gemstones." Ipswich Rotary Club, 20th October; Ipswich Junior Chamber of Commerce, 10th November.

L. Penn: " Use of Microscope in Gem Testing." Birmingham Natural History and Philosophical Society, 1st November.

Harold S. Reese: " Gems." Liverpool Geological Society, December 10th.

NETHERLANDS GEMMOLOGICAL ASSOCIATION

Gemmologists in the Netherlands have recently formed the Nederlandsch Edelsteenkundig Genootschap. Membership is open to Fellows of the Gemmological Association of Great Britain and such persons as may be invited to become members. The first President of the new organization is Ing. J. Hammes, Zeist, while D. Dresme, Amsterdam, and C. A. Piek, are acting as Treasurer and Secretary respectively.

" PASTE," BY M. D. S. LEWIS

Mr. M. D. S. Lewis wishes to make a correction to his article on " Paste " (Vol. II, No. 4, " Journ. Gemm."). Views on the role of arsenic were wrongly attributed to Mr. W. B. Honey instead of another authority. The author wishes to apologize to Mr. Honey for the inaccuracy.

MEMBERS' MEETINGS

On January 17th a meeting of members was held at the British Council Cinema, 6, Hanover Street, London, W.1, when the following films were shown:—

" Looking Through Glass." The story of glass production from raw material to the cutting and polishing of lenses for scientific instruments.

" Steel." A film in technicolour showing all stages in the production of steel.

" The Story of Money." Development of the present monetary system from days of barter and the goldsmith-banker.

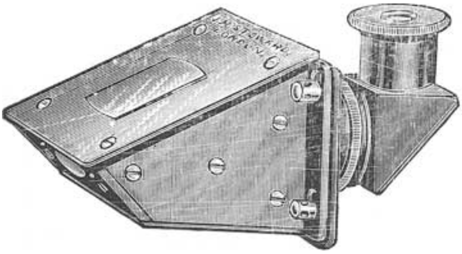
The following arrangements have been made for February and March, 1950:—

March 2nd, at 7 p.m., at the British Council Cinema. Film show which will include " The History of Man " and a film dealing with the production of Palladium for use in jewellery.

March 22nd, at 5 p.m. Annual General Meeting of the Association at the Holborn Restaurant, London, W.C.2.

March 22nd, at 7.30 p.m. Association Dinner and Reunion of Members to be held at the Holborn Restaurant, London, W.C.2. Full details of this function may be obtained from the Secretary of the Association.


Rayner
100 NEW BOND STREET
LONDON



Vol. II
No. 5
January, 1950

CONTENTS

ASSOCIATION NOTICES :—

F. J. MILNER & SONS, LTD.,
LEYSFIELD ROAD, LONDON, W.12.