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FURTHER NOTES ON SYNTHETIC RED SPINEL

By W. F. EPPLER

MUCH has been written about synthetic red spinel,[1] yet there are still no red-coloured synthetic spinels on the market. Recently another piece of a red synthetic was obtained. At the first glance it was thought that it might be synthetic corundum, but it proved to be synthetic spinel. It is possible that it might have originated in a Swiss factory. The broken piece of approximately 25 carats showed the external features of a boule from the Verneuil type. The specific gravity was determined at $d = 3{\cdot}599 \pm 0{\cdot}001$ and the single refraction $n_D = 1{\cdot}720$ on the refractometer. Compared with the values of natural spinel (3·60 and 1·717) there are no great differences. Therefore it can be assumed that the composition of this synthetic red spinel will be characterized by the ratio $MgO : Al_2O_3 = 1 : 1$, as with natural spinel.

Examination under the microscope confirmed the findings of the internal features which have been described by E. Gübelin for other synthetic red spinels. In Fig. 1a we see curved lines, which indicate growth by the Verneuil process. The lines, particularly on the left side of the figure, are not strictly parallel but appear

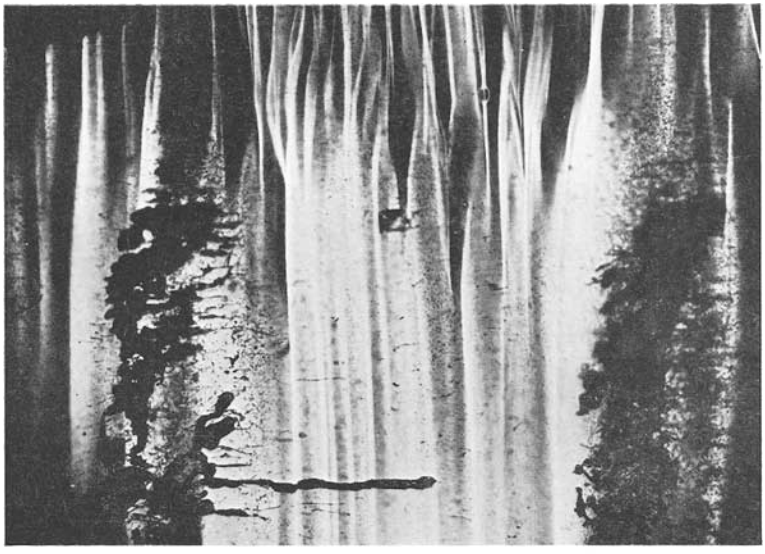


Fig. 1a and 1b. Synthetic red spinel, showing curved growing lines and gaseous inclusions. 15×.

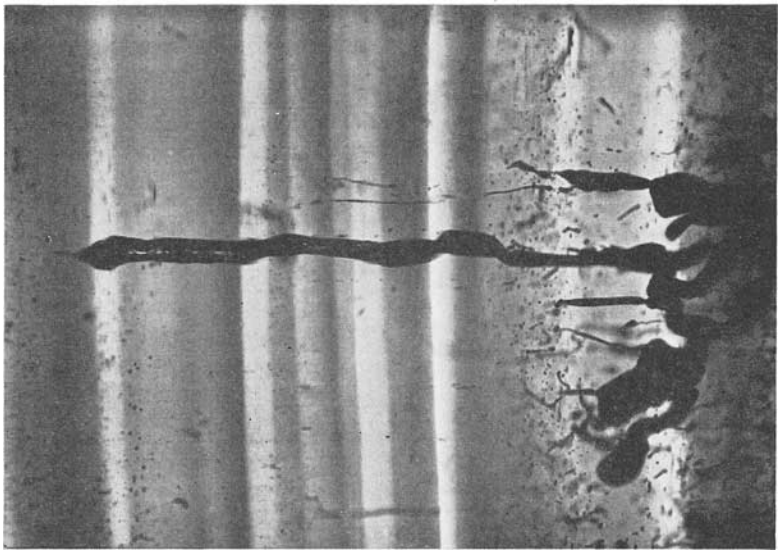


Fig. 2. Part of Fig. 1. 40 ×.

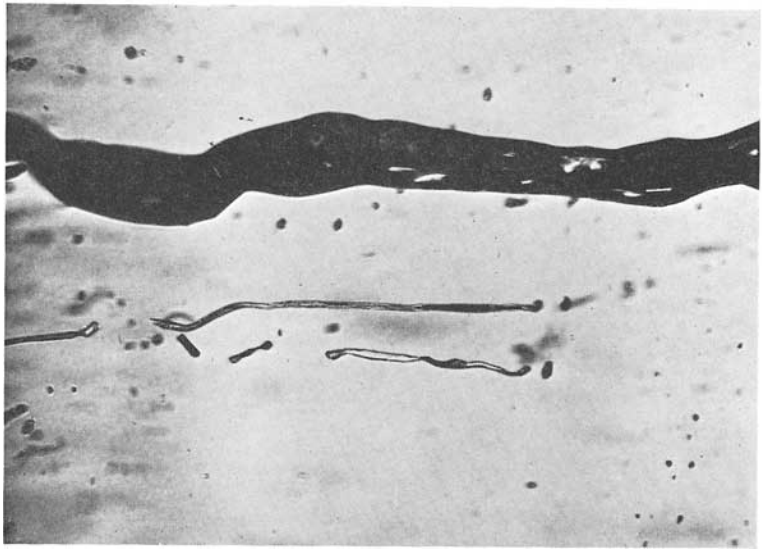


Fig. 3. Part of Fig. 2 ; tube-like two-phase inclusions. 100 ×.

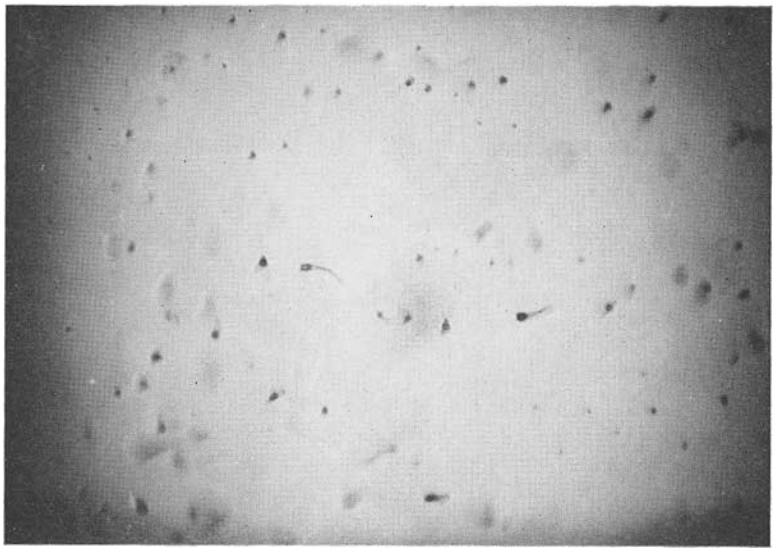


Fig. 4. Synthetic red spinel ; triangular and tadpole-shaped two-phase inclusions. 120 × .

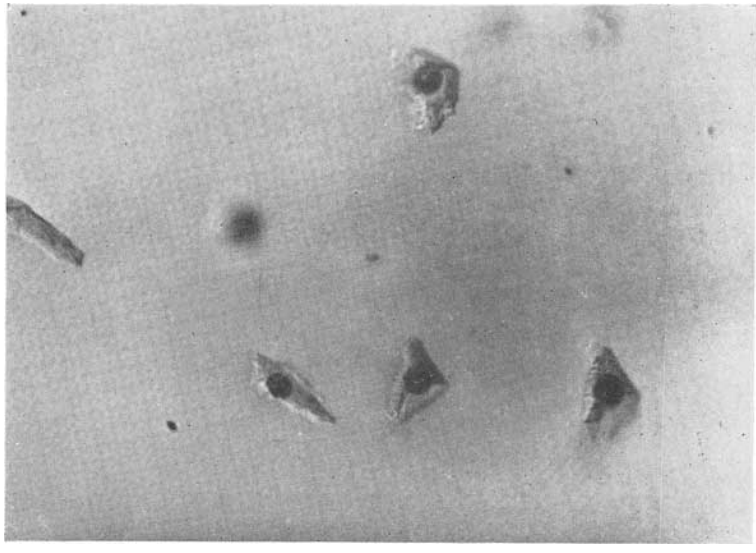


Fig. 5. Part of Fig. 4. 610 × .

distorted or disturbed. This is due, probably, to some kind of irregularity during the growing process. Fig. 1b shows the curved growth lines on the right edge of the specimen. The black spots are gaseous inclusions, very irregularly developed in the form of round-shaped cavities and hose-like channels. The long tube of Figs. 1a and 1b is shown again in Fig. 2, at a somewhat greater enlargement. Here we can observe that it is accompanied by thinner tube-like inclusions which are nearly parallel to the big one. In Fig. 3 these thin tubes appear again at higher magnification, as two-phase inclusions. It is very likely that the dark part of the small tubes is gaseous, that is hydrogen, and the bright one liquid, that is water.

Fig. 3 also exhibits a number of small black spots, which must be considered as gas bubbles (all pictures were taken in transmitted light). A somewhat greater enlargement of these is shown in Fig. 4. Here we easily recognize that the " dark spots " are two-phase inclusions, most of them in triangular forms and some almost a tadpole shape.

Fig. 5 again shows these two-phase inclusions. They represent negative crystals with a filling of hydrogen and water. Similar two-phase inclusions are known within the commercially produced synthetic spinels with the usual ratio of $MgO : Al_2O_3 = 1 : 3{\cdot}5$; but here the forms are different.

REFERENCES

(1) Gübelin (E. J.). *Are Synthetic Red Spinels Available ?* Gems and Gemology, Summer, 1950, 307-309; Crowningshield (G.R.) and Holmes (R. J.). *Synthetic Red Spinel*, Gems and Gemology, Winter, 1950-51, 362-367 ; Gübelin (E. J.). *More News of Synthetic Red Spinel.* Gems and Gemology, Winter 1953, 236-247.

Gemmological Abstracts

BANK (H.). *Reiseeindrücke von Brasiliens Edelsteinlagerstätten.* (A traveller's impression of Brazilian Gem Deposits.) Zeitschr. d. Deutsch. Gesellschaft f. Edelsteinkunde, No. 16, 1956, pp. 3–8. A continuation of an article in Zeitschr. d. Deutsch. Gesellschaft f. Edelsteinkunde, No. 14.

The article lists and describes localities in Brazil where beryls (aquamarines and " Brazilian emeralds "), tourmalines, amethysts, citrines and agates are found. The author, who is connected with the Idar-Oberstein industry, stresses the importance of geological and mineralogical training for prospectors as opposed to the " mere chance " method. W.S.

BOLSCHE (R.). *Ueber das Smaragdvorkommen im Habachtal.* (On the emerald occurrence in the Habach valley.) Zeitschr.d. Deutsch. Gesellschaft f. Edelsteinkunde, No. 16, 1956, pp. 19–23.

Two sketches (maps) give a clear impression of the geographical conditions. Of special interest are the profile sections showing the altitudes of the occurrences. Previous literature is mentioned. The author describes the way to and the position of old galleries. (To be continued.) W.S.

PLATE (W.). *Die synthetischen Steine.* (The synthetic stones.) Gold und Silber, Vol. 9, No. 8, 1956 (August), pp. 22–24.

A popular review of the history of synthetics and a description of the Verneuil process lead to the listing of the characteristics of synthetic corundum (also star corundum), spinel and rutile. The author stresses the necessity of careful microscopic investigation to differentiate between genuine and synthetic corundum ; the use of a hand lens is not mentioned. Synthetic emerald is to be discussed in a future article. W.S.

BANK (H.). *Reiseeindrücke von Brasiliens Edelsteinlagerstätten.* Impressions from a journey to Brazil's precious stone mines Zeitschr. d. Deutsch. Ges. f. Edelsteinkunde, No. 14, 1955/56, pp. 2–9.

The article starts with a general geological survey and points out that in most cases the gems in Brazil are not mined systematically.

Often a stone is found by coincidence, then a " run " sets in and many people come to try their luck, mostly to give it up again. The zone of Teofilo-Ottoni is described in some detail. There one finds aquamarines, and tourmalines, various beryls, i.e. white, green, yellow and also pink morganite. Occasionally one finds chrysoberyls and chrysoberyl cat's-eyes. Andalusite, brazilianite and spodumene are also found. The next place the author visited was Santa Maria de Itabira, well known for its intensely blue aquamarines. Also some emeralds have been found there. In Rodrigue Silvas and Dom Bosco precious topaz of good quality used to be found together with euclase. At the time of the author's visit, these mines were not worked. Caetite-Brumado-Brejinho (state of Bahia) is well known for amethysts, which are found with quartz. (To be continued.) E.S.

ARENA (P.). *Os Satelites do Diamante.* The subsidiary minerals of diamond. Gemologia (Brazil), No. 3, pp. 1–8.

Brazilian diamonds are found in secondary deposits of gravel (cascalho). This diamantiferous material consists of some fifty or more different minerals, many of them in gem varieties, the waterworn pebbles being often sufficiently characteristic in appearance to have acquired picturesque names among the native miners.

The deposits have from time to time yielded important specimens of gem andalusite, chrysoberyl, epidote, euclase, spinel, spessartite, topaz and tourmaline. The writer describes stones in some detail, often in colours which are not necessarily found in these localities. Some surprising finds are reported, such as specimens of alexandrite, a cymophane of 400 carats, and an 80 carat red spinel. Both sapphires and rubies have been found but apparently not in cuttable sizes.

2 illus. R.K.M.

LOEB (M.). *Algunas notas sôbre clivagem.* Some notes on cleavage. Gemologia (Brazil), No. 2, pp. 13–18.

A summary of the best known facts of the difficult subject of cleavage. The property is classified under system headings and under method of production : pressure—gypsum ; impact—calcite ; thermal shock—quartz. It is further defined under (1) the face to which it is parallel, (2) facility of production, (3) nature of the resultant surface. Parting is mentioned in connexion with twin planes and also with zoned structures and with

layers of inclusions. The last two are less usually recognized causes.

Several possible conditions required for cleavage in different minerals are given. Mention is made of an apparent connexion between rate of growth and cleavage, but the writer does not appear to have made it clear that he means the relative rate of growth between the different faces of one crystal and not the rate of growth of the whole crystal.

2 illus. R.K.M.

ANDERSON, (B. W.) ; PAYNE (C. J.). *The spectroscope and its applications to gemmology.* Gemmologist, Vol. XXV, Nos. 299/300/301, pp. 101–104 ; 115–119 ; 143–144. June/July/August, 1956.

This very complete research paper continues with further discussion of the spectra of rare-earth-containing gemstones. Reiteration of the reasons for the fine-line nature of rare-earth absorption spectra are made, and the minerals which give a didymium absorption spectrum noted. These are yellow apatite, which shows the strongest didymium spectrum, danburite, sphene, idocrase, scheelite and fluor in which the strength is very weak. In the case of the didymium spectrum any difference in the measurement of the lines with the different species is too small to be observable with the standard spectroscopes used. The spectrum of blue apatite, ascribed to unknown rare-earths, is seen in the ordinary ray of the mineral, and consists of a band of moderate strength at 6310A (in the orange) with weaker bands at 6220 and 5250A ; a strong narrow band at 5110A at the end of the green ; a broad weak band at 5070A followed by a strong broader band at 4900A, with, finally, a vague weak band at 4640A. Although the refractive indices of the yellow (Mexican) apatite are much the same as for the blue variety (Burma) the density of the yellow stones is 3·213, which is slightly higher than for the blue which approximates to 3·184, suggesting some difference in composition. Mention is made of the bands seen in the blue beryl from the Maxixe mine of Minas Gerais, Brazil, which may be ascribed to uranous uranium. The bright green andalusite, probably from Brazil, shows a rare-earth absorption spectrum of bands in the green. This spectrum shows a graded absorption band ending in a knife edge at 5535A followed by lines at 5505, 5475, 5180 and 4950A. There is also

a band at 4550 in the rather strongly absorbed blue-violet part of the spectrum and there is sometimes a narrow band at 4360A.

This series (Part 35) continues with the absorption spectrum of diamond. Diamond absorption spectra are ascribed to structural irregularities and are in two main groups. The main line in the " Cape " series of stones is at 4155A and varies in intensity with the strength of the yellowish colour. With this 4155A line are secondary and weaker lines at 4785, 4650, 4520, 4350 and 4230A. Such stones show a blue fluorescence. Brown-coloured diamonds and other tinted diamonds which show a green fluorescence show lines at 5040, which may be strong, and weaker lines at 4370 and 4080A. Stones exhibiting both series of absorption spectra and a combined fluorescence are not uncommon. The 5040A line has been observed in some but not all bombarded diamonds. Experiments by R. A. Dugdale on neutron-irradiated diamonds have shown that controlled heating of such stones at 350 degrees C. brings out the 5040A line and a green fluorescence which disappears on heating to over 400 degrees C. The authors continue with notes on the miscellaneous spectra and mention the bands seen in zinc blende (sphalerite). They are a strong band, which is fairly narrow, at 6650A, another at 6510A and a broader band, which is not very easily seen, at 6920A. Sodalite shows a rather strong and broad band at 6800A with weaker bands at 5950 and 5400A. The cause of these bands is not known. Fibrolite shows bands at 4410, 4100 and 4620A, the 4100A band being the strongest.

4 illus. R.W.

WEAVIND (R. G.). *Simplified manufacture of diamond tools.* Gems and Gemology, Vol. VIII, No. 10, pp. 310–319, Summer, 1956. (Reprinted from OPTIMA of March, 1956.)

A survey of the uses of industrial diamonds in precision engineering is first given. Reference is made to the work of the Diamond Research Laboratory (South Africa) in investigating the possibilities of simplifying manufacturing procedures by the development of semi-automatic machinery for shaping industrial diamonds and to the institution of training courses for factory workers with little or no knowledge of diamond, so that they can quickly learn how to make and service diamond tools. The cleaving and sawing directions of octahedral and dodecahedral crystals

are explained in the text and by illustrations. One of the semi-mechanical tangs developed by the Research Laboratory is fully explained.
11 illus. R.W.

BROWN (J. COGGIN). *Sapphires of India and Kashmir.* Gemmologist, Vol. XXV, Nos. 298/299/300, pp. 77–80 ; 97–100 ; 129–132, May/June/July, 1956.

Indian jewellers divided precious stones into two main groups, the great gems—*Maharatani*—into which they placed diamond, pearl, ruby, sapphire and emerald, and the secondary gems called *Uparatnani*. The blue sapphire (*nilamani*) was divided into two varieties, the rare and more precious being called *indranila*, and the poorer quality *mahanila*. The Indians knew that the ruby and sapphire answered the same physical tests and that no other stone except diamond would scratch them. The unpredictable effect of heat on sapphires was also known. Earliest Sanskrit writings gave only Ceylon as a sapphire source, but later Kalinga and Kalpur were mentioned. The first was identified as lying between the Mahanadi and Godavari rivers in the north-east of the Indian Peninsula, while the latter formed part of Central India. No sapphires are found there to-day. Kashmir sapphires are not mentioned in ancient writings. The Kashmir stones were first found in 1880 in the Zangskar Range, near Sumjum in Southern Kashmir. The history of the mines from their discovery, due to a landslide in 1880, to the present day is given. At an elevation of some 15,000 feet the mine was difficult to work and with the attacks by bands of robbers the mine was abandoned in 1887. In 1888 some 23,000 carats of sapphires were obtained from the detritus of the old mine. No systematic mining was carried out until 1906 when a lease was granted to the Kashmir Mining Company, but the endeavour lasted only till 1908. The mines were practically dormant until 1924 when the Himalayan geologist Pandit Labhu Ram Badyal discovered new sources from which a licensed prospector in 1926 removed a hundredweight and a half of sapphire crystals, but his licence was revoked owing to the irregularity of his working. The sapphires were obtained from lenticles of tough china clay associated with a little tourmaline and garnet. Some remarks on the geology of the region are given. The sapphire crystals are bipyramidal with no prism faces and the faces of the

pyramids are horizontally striated. Kashmire sapphire is not prone to " parting." Some crystals show an unusual feature in that in cavities in the centre of the crystal lie crystals of dark brown tourmaline. The crystals of sapphire are usually coated with a white skin which needs to be washed off before the colour of the crystal can be seen. Parti-coloration is common. Experimental working of the mine was carried out in 1927 and, after a scheme of development made in 1928, private enterprise worked the mines in succession from 1933 to 1951. The mining area is now said to be worked out but further deposits may be found. Mention is made of a source of sapphire crystals on the moraine of a glacier on the southern ascent of the Hagshu-la pass at 16,600 feet.
3 illus. R.W.

ANON. *Extension of Diamond Coast.* Gemmologist, Vol. XXV, No. 299, p. 107, June, 1956.

In 1909 diamonds were discovered on the coastal lands of what was then German South West Africa, and in recent years the area has been extended southwards along the coast almost to the mouth of the Orange River. The diamond-bearing gravels vary in thickness from practically nothing to about four feet and are covered by sand and conglomerate which may reach thirty feet in depth. This overburden is removed by mechanical excavation and then the diamondiferous gravel removed, the bedrock being scraped and brushed so that no loss occurs. Land Rovers have replaced horses for transport. No information is given as to the methods used in the recovery of the diamond from the gravel. The mines are operated by The Consolidated Diamond Mines of South West Africa, who recovered some thirteen million pounds worth of diamonds in 1955, of which 95 per cent were gem quality.
1 illus. R.W.

GÜBELIN (E. J.). *The emerald from Habachtal.* Gems and Gemology, Vol. VIII, No. 10, pp. 295–309. Summer, 1956.

A comprehensive survey of the Habachtal emerald mine and the characters of the crystals from this locality. The script closely parallels the author's article on the same subject published in Volume V, No. 7, of JOURNAL OF GEMMOLOGY, except that many of the illustrations are different.
14 illus. R.W.

WEBSTER (R.). *Nigerian topaz.* Gems & Gemology, Vol. VIII, No. 10, pp. 291–294. Summer, 1956.

A description of the topaz found around the tin-mining area of the Bauchi district of Nigeria. Crystals are colourless or with a pale greenish or bluish shade. They have a short prismatic habit with two prominent dome faces forming a chisel-shaped termination. Most are singly terminated with the basal cleavage at the end where they have been detached from the rock, but some doubly terminated crystals have been encountered. Most of the topaz found in Nigeria is in the form of rolled pebbles. Three refractive indices and ten determinations of specific gravity are given. The refractive indices agree to the values 1·61–1·62—with a birefringence of 0·10—and the density varies from 3·549 to 3·572. Thus Nigerian topazes are of the fluorine-rich type. The inclusions are described as being two-phase cavities, sometimes with two immiscible liquids and irregular cavities. In one case cubic crystals, which may be fluorite, were seen. The luminescence observed with long and short-wave ultra-violet light, and X-rays, is given. The effects are said to be weak. The story is told of some pebbles which had been sold as blue topaz, but which on investigation proved to have the colour on the surface due to an external application of indigo dye.

5 illus. P.B.

FARN (A. E.) : WEBSTER (R.). *Massive pink grossular garnet.* Gemmologist, Vol. XXV, No. 300, pp. 122–124. July, 1946.

Describes a pink and greyish massive grossular garnet probably from the same locality as the massive green variety miscalled " Transvaal Jade." The material has a density of approximately 3·4 and shows on the refractometer a vague refractive index of 1·72. Like the green variety the pink material shows an orange fluorescence when irradiated with X-rays. The material is said to be a nearly pure grossular with a trace of zoisite, and the colour is understood to be due to manganese.

1 illus. P.B.

MARCHER (G. H.). *Redondo " moonstones."* Gemmologist, Vol. XXV, No. 229, pp. 108–109, June, 1956.

Tells of the milky chalcedonies found on the beach at Redono, California, in the early part of the century, and of the commercialization of them by the local lapidaries. Cut chalcedony from Germany

were sold as Redono stones, and the knowledge of this did much to destroy the interest of the public in the beach chalcedonies, the choicest of which are clouded with a pretty translucent mottled appearance, rather like the fair-weather clouds known as mackerel sky.

R.W.

MacLeod (Helen). *The adulteration of turquoise.* Gemmologist, Vol. XXV, No. 229, p. 110. June, 1956.

Turquoise is reported to have its colour " improved " by oiling or dyeing. Recent " waxing " methods, involving the boiling of turquoise in paraffin, is said to give a false polish to chalky material. Much turquoise is fashioned by the " tumbling " process producing baroque shapes. Some " waxed " material may have been strengthened with colourless plastic, such as leucite (perspex), in order to withstand the tumbling operation. The colour of turquoise is often intensified to a shade which is " too good " ; and " matrix " may be imitated. It is suggested that turquoise powder formed into a paste and bonded in plastic has been used to produce " turquoise." An alternative suggestion is that the powder of chrysocolla may be used instead of powdered turquoise. Another type of turquoise imitation may be produced by using a type of Portland cement coloured by powdered chrysocolla. Rough seam turquoise can usually be considered genuine.

R.W.

Anon. *Hardness numbers of minerals.* Gemmologist, Vol. XXV, No. 301, pp. 149–150. August, 1956.

A table showing for comparison the hardness numbers of some forty gemstones and minerals as found by the Knoop and Vickers systems. Mohs's scale numbers are not included.

Robb (C. J.). *Ecclesiastical and Classical pearls.* Gemmologist, Vol. XXV, No. 301, p. 151. August, 1956.

A note on the origin of the name *pearl ;* on its use in church ornaments and classical anecdotes. Some Irish book shrines were set with Irish river pearls.

R.W.

JADE STORY — EUROPEAN

(The fifth part of the Story of Jade in Europe)

By ELSIE RUFF, F.G.A.

" THE term jade has been supplied to nearly all greenish, translucent stones which are susceptible of being wrought into ornamental objects and for which there was no other well defined name . . . therefore I venture to recommend that *Jade* be used as a generic term. . . . Jade is either a generic term or it is nothing. If it is not used generically, it must be dropped. . . ." Dr. Thomas Wilson, Curator of Prehistoric Archaeology (U.S. National Museum) made this statement during 1900 in his paper *Jade in America.* And the statement is still tenable, except that to-day we confine the word *Jade* to two distinct minerals, jadeite and nephrite. Though suspected on more than one occasion these two minerals were not scientifically separated until 1863, by Damour. Since chloromelanite is a jadeite containing iron which renders it a very dark green—at times almost amounting to black—there is no problem concerning this word. The Latin term for nephrite, *lapis nephriticus*, was used largely as Dr. Wilson defined the word *jade*, roughly between the period of Monardes and Damour.

Nevertheless, these terms, perfectly clear to us to-day, represented only a small part of the jade terminology. To attempt a list is to discover that it is almost inexhaustible. There are many lists of jade-like stones or stones imitating jade, but the following collection covers the names most commonly used for the substances mentioned by Thomas Wilson in the paragraph above :

Agate Verdâtre.
Amazon Stone or Stone of the Amazons, or *Lapis Amazonicus.*
Chalchihuitl.
Circoncision Stone.
Divine Stone or *Lapis Divinus.*
Fibrolite.
Green-stone.
Jaspachates.
Jasper or *Jaspe* or *Jaspis* or *Jaspis Viridis.*
Kidney-stone.

La Pierre des haches.
Oceanic Jade.
Piedra de los riñones or *raines.*
Piedra ijada or *yjada* or *hijada.*
Pierre néphrétique, also spelt *pierre néphritique.*
Pounamu.
Prase or *prasius.*
Saussurite or jade tenace.
Smaragdus.
Spleen stone or spleene-stone.
Steatite.
Yü.

This list, formidable at first sight, may be quickly reduced. *Yü*, *Chalchihuitl*, and *Pounamu*, representative of countries, that is, China, South America, and New Zealand respectively, may be dismissed. In no way do they confuse the European issue. The Spanish equivalent of *lapis nephriticus* has already been discussed.[1] Amazon stone refers, as the name indicates, to the jade, or jade-like stones, coming from the precincts of the Amazon river in South America. Divine stone covers the same substance, though not necessarily from the Amazon river area. It is a translation resulting from the miraculous qualities attributed to this stone.[2] Circoncision stone again refers to similar material and was so-called because used in this rite, as indeed a stone is still sometimes used. These three terms, all referring to South American jade, will come up for discussion at a later date. Jaspachates has been mentioned earlier.[3] Saussurite, or what seems to be an older term, jade tenace,[4] was named after the Frenchman H. B. de Saussure, and is material familiar to every gemmologist as decomposed feldspar. Also well known is prase corresponding to the Latin *prasius*. *Smaragdus* was the Latin term for emerald.[5] Fibrolite and Steatite may also be dismissed. Most gemmology text-books define these minerals. Greenstone, a very loose term, is discussed at length in *Jade of the Maori*. It is a word, surely, never intended to be other than an initial description, that is, some kind of green stone. Captain Cook, in his journals dealing with the discovery of New Zealand during the second half of the 18th century, makes this crystal clear. " Many of the Indians," that is, Maoris, he wrote, " wear pieces of greenstone round their necks which are transparent,

and resemble an emerald. These being examined appeared to be a species of the nephritic stone." (This statement alone should rank him among the early gemmologists.) From time to time one finds the word greenstone used in the same way in connexion with South American material.

From this long list, therefore, we are left with Agate Verdâtre, Spleen-stone, Kidney-stone, and Jasper, with its foreign equivalents. Here Agate Verdâtre presents no difficulty. It is a French term literally meaning greenish-agate. Agates are always banded, with curved layers, and because of this they are not easily confused. If the term covered what we now know as jade, as it seems to have done, it was very loosely applied. Jade may be mottled, or speckled, but is never banded in the way that agate is. Spleen-stone and kidney-stone may be grouped together. One was a curative for spleen trouble, the other for kidney disorders. As mentioned in an earlier article, the connexion between these two states is so subtle that either term might be used for a disturbance or trouble in that area. There have always been fashions in diseases or, for want of more knowledge, certain symptoms have frequently been grouped under a few fashionable headings. Which of these two terms is the older is difficult to say. In 1734, E. Milward, an M.D., published a work entitled *Trallianus Reviviscens* (revised). It was a small volume in the form of a letter to Sir Hans Sloane, for whom the author had a great regard. Trallianus, or Alexander of Tralles, was a Greek physician of the 6th century B.C. He travelled widely —through his own country, through Spain, Gaul, and so on. The Greek text of his work *Βιβλια Ιατρικά* was printed in Paris during 1548 and his *De Lumbricis* at Venice in 1570. Milward wrote : " He is excellent in distinguishing the *stone* from the *Colick*, which have so near an affinity in their signs to each other, that they often-times impose upon the unwary practitioner." After suggesting various medicines in such cases, he goes on : " . . . and it is very observable, that he mentions a large cupping-glass to be applied to the Region of the Navel, which, he says, will dissipate the pain with such amazing expedition, as to make the bystanders believe the cure has been performed by *Art Magic* or something supernatural." Here we have an acknowledgment between one medical man and another of this constant interchange of *stone* and *colic* over a very long period.

The only disputable term that emerges from this long list is, as we see, the word Jasper, or the French *jaspe*, or the Latin *jaspis*. Or there is *jaspis viridis*, as used by Sir Hans Sloane and others. In this case the term would seem to differentiate between green or greenish jasper and jasper (or jade) of other colours. Certainly the term jasper sometimes covered the material we know to-day as such. It also covered other substances.[6] Without question it covered jade, often describing it as a kind of jasper, as we might say that jadeite is a kind of jade. Was this too a generic term ? Was this the jade of the ancients, the term largely displaced when *lapis nephriticus* came into use ? It is possible, though unlikely, that a well known mineral may not be mentioned for a number of centuries, perhaps due to a lessening popularity, and bearing in mind the limited (and even more limited as we dig back) literature of the times. It is possible too that this paucity of the written language is the explanation. The Chinese were the first printers, printing from movable type in the years 1041 to 1049 by one Pi Shéng. The European invention, which is believed to be completely independent of the Chinese discovery, took place around 1440 A.D. It was not really before the 16th century that knowledge was able to circulate more freely among those who could read, when a printed book was more available than a hand-written copy. Hand-written copies were either the work of individual scholars or were sponsored by influential men of the day. In either case the book was precious. This means that Monardes' book might never have had a chance of circulating, except among the few, had the information it contained come a century earlier. And the chances of an English translation would have been more limited still. Another point emerges here, which has a bearing on man's very early use of jade. This is the fact of rare independent invention. Four hundred years separated the two printing inventions, and about 1,500 years of European development was to elapse, before the printing press. Scholars there have always been, in plenty, but up to the advent of the printing press no one had thought up a way of making knowledge as easily available as it later became.

The question that comes to mind as a result of all this is, if jasper was not a generic term, could the substance we know as jasper to-day be mistaken for jade ? A few lines from modern authorities

describing this material will answer the question :

> " *Jasper* is an impure variety of quartz. It is compact, and being very hard it takes a fine polish. It occurs in many colours—dark green, brown, yellow and sometimes blue and black. . . . Unlike chalcedony it is opaque, and does not possess a splintery fracture. The term jasper is now restricted to opaque stones, but the ancient *jaspis* or ἴασπις was at least partially translucent, and probably included some chalcedony and chrysoprase. . . ."[7]

> " Jasper consists of a compact aggregate of finely granular quartz mixed with impurities in large amount which act as the colouring matter. There may be a wide range of bright colours, and the material takes a good polish. It is often rather of the nature of a metamorphic rock formed by the baking of mudstone and shale."[8]

(Here this is the whole of the quotation.)

> " Jasper is a chalcedony coloured blood-red by iron oxide, while bloodstone is a green chalcedony spotted with jasper."[9]

(There is no mention here of green jasper.)

These three excerpts, taken at random, suggest that, whatever the ancients thought of jasper, the modern world has very little interest. The most obvious point of differentiation between jade and jasper is of course its polish. The description of a greasy or wax-like polish immediately releases jade from any confusion with modern jasper since, as the first two quotations point out, jasper takes a fine polish.

Sir James Walton,[10] writing of jasper, says : "The very impure form *jasper* which contains up to 20% of impurities occurs like agate in many different colours, e.g., red, brown, green, bluish or black. . . . Unlike agate, all the varieties are opaque." The Rev. C. W. King[11] wrote : " Thus it appears that the ancient idea of the *Jaspis* was exactly the opposite to the modern of the Jasper, the latter being our term for a class always opaque." Right up to recent years the separation of jasper from jade was causing concern. G. F. Kunz[12] wrote : " The real separation of jasper and jade seems to have occurred about the end of the 16th century." But, as we have seen, in the 17th century there was still a great urgency to do just this and evidently the term jasper had such a foothold that it continued to be confused right up to the 19th. And as late as

the 19th century the jade tomb of Tamerlane or Timur in Samarkand was described as jasper. (*Journ. Gemmology*, Vol. IV, No. 8.) Why ? Because custom and habit die hard and those who called it jasper were really thinking in terms of jade and not the compact quartz material just defined.

Valmont de Bomare, in 1762, made a note at the base of his very able list. (The list occurs in the *Journ. Gemmology*, Vol. V, No. 3.) " The nephrite stone which many of these authors recognize to be the green jasper of the ancients. . . ." Ancients, to this author, would surely mean some period ante-Monardes. Biron (quoted earlier), in 1703, said that it was not easy to distinguish jasper from nephrite, especially as many of the nephritic stones were of various colours. He cites yellow, white, and black. Sydney H. Ball[13] wrote : " Our word jasper comes to us through the Latin from the Greek, the word being evidently of oriental, but otherwise unknown, origin." Schliemann, in his *Ilios*, tells us that *jaspis* is of Semitic origin.

In the Archaeological Journal for 1888, Vol. XLV, pages 187-205, is an interesting contribution by James Hilton. It is called *Remarks on Jade*. He writes : " The word ' jade ' is regarded as a corruption of an old Spanish expression, signifying the supposed medicinal properties of the stone we are now considering. The Spanish appellation seems to have been a corruption of the Chinese name passing through a Dutch pronunciation of it . . . until we get 'jade' as the English word, which I find in use in 1730 to indicate the mineral substance ; but certainly the word in our language had a very different signification 200 years ago." In 1883 appeared *The Middle Kingdom* by Samuel Wells Williams. On p. 308 we find : " . . . Jade has long been known in Europe as a variety of Jasper, its separation from that stone into a species by itself being of comparatively recent origin. Since the third edition of Boetius in 1647, the two minerals have been regarded as entirely distinct." In the 9th edition of the Encyclopaedia Britannica, published in 1881, F. W. Rudler was writing : " In Turkestan jade was known as YASHM or YESHM and a word which appears in Arabic as YESHB is said to be cognate with *ἰασπις* or jasper. Indeed, by early mineralogists the jade was often described as ' jasper viridis.' "

A letter to *The Times* dated 15th January, 1880, was written by F. Max Müller. It ran : " Throughout the thousands of years

of human history until the discovery of New Zealand, the only known worked mines of pure jade were on the river Kara-kash in the Kuen Luen Mountains. . . . Jade is found, however rarely, among the ornaments of Roman ladies. . . . As the enquirer advances into the domain of history, jade advances with him. But the secret of its presence in Assyrian and Greek and Roman palaces is no more plainly solved than among stone pile hovels. The ancients, though they esteemed it very precious, had not even a distinct name for it. They called it *jasper*, though jasper it clearly is not. The Middle Ages of Europe valued the stone, but had no more understanding of the process by which it came into their hands than Greeks and Romans. India itself, while it made much account of it, received it as something strange and mysterious . . . there can be little doubt that *ijada* is derived from the latin *ilia* . . . it can only be an accidental coincidence if there existed in Sanskrit Buddhist texts the word *yeda* as a name of a material out of which ornaments were made." (The word *yeda*, referred to by several writers, should be mentioned here to include all the evidence. Another rendering seems to have been *Yada-stone*, coming from Central Asia and thought to have powers of producing rain—which they no doubt badly needed. Again, from further west in Asia, the *bejadah* was another stone said to have been mined there.)

One of the ablest contributors to the Jade Question was Jean Pierre Abel-Rémusat during the 19th century. We benefit by his translation from the Chinese of *A History of the town of Khotan in Chinese Turkestan.* In this we find *Researches on the mineral substance called by the Chinese Pierre de IU (YU) and on the jasper of the Ancients.*

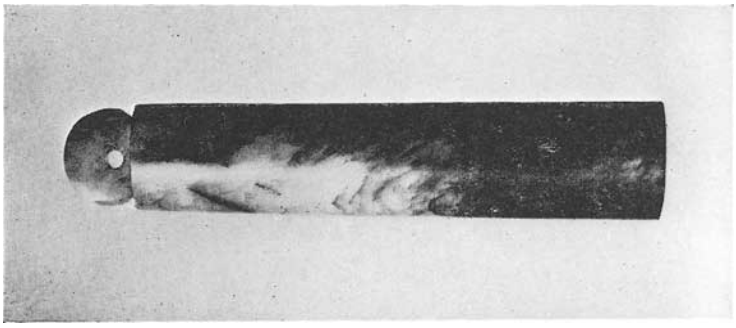
Monsieur Rémusat goes into great details describing the various gem substances and their names in this part of China. And further, he shows that jade, known as *kash* (see river) to the natives of Eastern Turkestan and the Western Mongols, was the *Yeshm* of the Persians and peoples of Western Asia. This word, he tells us, written *Yeshb* in Arabia, is synonymous with the Hebrew *Yeschfe* (Exodus XXVIII, 20), from which were derived the Greek ἰασπις, the Latin *jaspis*, and the French *jaspe*. He refers also to Pliny's green jasper that resembled an emerald (certainly no modern jasper does) and was worn as an amulet throughout the East. This, he suggests, was probably jade.

Dr. Rudler writes of Rémusat : " He describes with great erudition the meaning of the word, and refers it to great antiquity. In the province of Yunnan, a particular kind of jade, to be hereafter noticed, is known as FEI-TSUI, while in Turkestan the jade-stone is called YASCHEM, a word which is also found in the form of YESCHL, and is said to be cognate with *ἰαοηις*, and therefore our jasper."[14]

In 1783-88 appeared five volumes, published in Paris, by Le Clerc (Georges Louis), Count de Buffon. It was called *Histoire Naturelle des Mineraux.* On page 44 is the sub-title *Jaspe* : " . . . It is found in many parts of the Grande Indies, also in China. Jasper is much sought after in China . . . where they make vases of it . . . and different forms of jewellery. This jasper is named THUSF in the country. One distinguishes two species—the one that is precious is a heavy and large pebble which is fished in the river Kotan, near the royal city (town) of Kashgar. The other . . . is taken from quarries to be cut in pieces about two inches large . . . they have seen the same in somewhat large quantity and of many different colours in the high mountains of America (contrary to the minerals of New Spain, they praise a species of jasper which the Mexicans call EXTETL, the colour of grass with spots of blood. . . . A third is named TLIAYCTLIC, the colour more obscure and without spots, but more presentable, which, applied to the navel, cures the most painful colic, this is likely jade, which they name Nephritique stone)."

Here is another author who, to some extent, has drawn on the early writers, perhaps Laet. Still another kind he mentions is IZTLLIA, YOTLI, QUATZALITZLI. Nevertheless, his interpretation of what to-day we spell Yü is interesting and THUSF (pronounced) is not so wide of the mark.

In an entry of Captain Cook's Journal, on his first voyage to New Zealand, Maori jade is referred to as *jasper*, and in the same paragraph the axes made of this very material as *Green Talk* (Talc). Here is material, without any question nephrite, referred to as two distinct substances. Thus, in 1768, to Captain Cook, an intelligent and competent man, jade or *pounamu* or nephritic stone was jasper. (He was evidently misled by the axes he saw, some of which are very dark and therefore unlike the semi-translucent or translucent ornamental Maori jades.)



Sir Hans Sloane, Bart., a President of the College of Physicians and a President of the Royal Society, seems to pass in and out of these pages with great regularity. And deserves to do so. Part of his jade collection may be studied to-day in the British Museum (Natural History). Among the identified specimens of nephrite (tremolite) are a " loving-cup " from Surat, Bombay, India ; a mirror and a bowl, both probably Chinese ; a beautiful thumb ring in whitish-green nephrite, side by side with a jasper thumb ring with a white band (an excellent comparison to prove that these two substances *could* be mistaken) ; a small double box in leek-green nephrite, probably Chinese ; and not least in importance, the greyish veined pendant of jade from Guiana, South America, illustrated here. It is tubular and beautifully polished. This cylinder comes from the locality mentioned by Sir Walter Raleigh in 1596. It arrived in the British Museum in 1753 with the general collection of Sir Hans Sloane. Sir Hans Sloane's own entry (No. 223) describes it : "A pale nephritic stone from Guiana with a hole in it to hang to the body by a string for the cure of diseases." The shape of these tubular ornaments was well known. We may recall that Gesner wrote : " . . . The Indians like to make from Beryls cylindric ornaments as Pliny states."

Langius (or Lange) who, in 1704, contributed so ably to the jade subject had also something to say of the substance called Jasper. Under the heading *Lapis Nephriticus* was a sub-title : *A Species of Jasper.* " Now by reason of the varying colours which are mixed with green in this stone, some affirm, and not without some justification, that it belongs to the family of *Jaspis*, as in fact it is possible to be compared with it in the way it is coloured, and so it is

found, nature made it in this way. See Boot de Gemmis, p. 259. . ." Lange also introduces the first reference thus far for the *Internal Use* of this material, and writes : " Internal use is made of powder or pills. However, this refers mostly to stones of this species which are administered not so much as a remedy but to fill the patient with some hope, which has an incomparable effect. In this instance the stone which is as green as *jaspis* and marked with white spots, has the greatest appeal. If, however, this has not the desired effect we must consult Laet and find a more efficacious stone."

The very fact that Lange must go back some fifty years for a medical remedy is further indication not only that authorities were fewer, but that the written word was scarce in the 17th century.

Regnum Minerale . . . Metallorum, Lapidum, etc., appeared in 1686, by Emanuel the Elder, or Koenig. He too had a few words to say of *Jaspis*. " *Jaspis* has a variety of colours as well as many species, among which are *Heliotropius, Lapis Nephriticus*, and Malachite. *Lapis Nephriticus* is most often green and if we may say so, oily, and it does not vary in colour as *jaspis* does. Thus also the best informed say that green has an apparently black base and is not transparent. Its power is proved very great to liquidate *calculus* ; if applied to the region of the loins it has effect inside the body where the *calculi* are gathered. If the effect is lacking it is introduced into the body by mixing it with the food. See Wormius and Boyleus (Robert Boyle). The channels and openings of the body are so affected that the obstacles in the circulation are ejected, especially if it penetrates into the spaces of the kidneys." Here we find another internal use, 18 years earlier than Lange.

In the Journal of the Geological Society of London, Vol. XXX, p. 568, Dr. F. Stoliczka writes, in 1874, of a translation in two large folio volumes of a work by J. Nieuhof, published in 1673. This describes the Chinese Yü and the conditions of its occurrence in the mountains of ' Caskar.' It runs : " The translator applies to it the names used by traders, *jasper*, and *marble* : he does not use the word ' jade ' which probably was not then known. He says, however, that the stone was ' no jasper '." Another writer who should be recorded is Thomas Nicols. In 1652 he published *Arcula Gemmea* or *A Cabinet of Jewels*, in London. As an example of further confusion in nomenclature he writes of the " Emerauld "

(p. 93) and says that it is called " Green Stone, Emerauld and Smaragde." The " Praſius, Smaragdite, and Chryfoprasius " he apparently links together, saying ; " . . . the transparency of it is through a cloud : it is sometimes found to have reddish, whitish, or blackish specks of colour, by reason of its growing to a Jasper, or Crystall, or to some other jewell." To add further to the confusion he continues, p. 98 : " They are found both in the East and West Indies and in Europe, and in Germanie, and these are fairer than the Orientall ones, but somewhat softer. They are found in Bohemia. . . . It is said to be of the nature of the Smaragde or Emerauld, but of somewhat more remiſſe (remiss) power and faculties." On p. 101 he writes of the Smaragdo-Prasius and gives to this the curative properties that have all along been associated with *lapis nephriticus*. Of jasper the author seems very sure. He refers it to Holy Writ and says it is diaphanous and perfectly transparent. He quotes others liking it to an emerald. Yet of *Lapis Nephriticus* he says it is a hard semi-transparent " gemme of a white greenish colour," and gives as his authority Boetius. He goes on : " Anselmus Boetius and others reckon both the Heliotrope, and also this stone (that is, *Lapis Nephriticus*) amongst the Jaspers. . . . They are sometimes found growing to a Jasper and Prassius. . . . They are found in Spain and New Spain." There were, doubtless, so many of these stones in Spain, as a result of South American interests, that it was generally believed they were a product of Spain itself. John Wittich, Bericht von Wunderbaren bezoardischen Steinin, in 1587, wrote of " kidney-stones " (griesstein) that could be purchased for sufficient money from the Portuguese in Antwerp.

Francis Bacon also mentions these stones from the Indies. His *Sylva* or *A Naturall Historie* was published in London in 1627, a year after his death. In it he writes : " . . . It is likewise Received that a kinde *stone*, which they bring out of the West Indies, hath a peculiar force to move Gravell, and to dissolve the *stone*. In so much as laid but on the wrest (wrist), it hath so forcibly sent down Gravell as they have been glad to remove it ; It was so violent." Here again we see that a famous writer and thinker is indebted to Monardes. Perhaps in those days acknowledgement was neither given nor expected.

Father Benedict Goez was another valuable contributor to the jade story. After a great deal of time spent in Turkestan

he was able to give a first-hand picture of conditions there. Quoting Goez from Williams's *The Middle Kingdom* we read : " There is no article more valuable than the lumps of a certain transparent kind of marble, which was, from poverty of language, usually called Jasper . . . Out of this marble they fashioned a variety of articles. . . . These marbles (with which the Empire is now overflowing) are called IUCE. There are two kinds of it, the first and more valuable is got out of the river Khotan, almost in the same way in which divers fish for gems, and this is usually extracted in pieces about as big as large flints. The other inferior kind is excavated from the mountains." Benedict Goez, or Goes, who reached Yarkand in November, 1603, found himself marooned there for many months. IUCE or, since I and J were one in those days, JUCE, is another rendering of what this material sounded like to European ears, the modern way of expressing it being Yü.[15]

In 1570, that is between the two Spanish versions of Monardes, Joannes Ferrandus, a senior medical practitioner, published, in Paris, a Latin volume called *De Nephrises*. He does not mention *piedra de ijada*, nor does he use the term *lapis nephriticus*. But he does write of jasper, and quotes Galenus. On p. 100 he says : " The Jasper which is called *Judaicus* is a greenish jasper. It has a more efficacious faculty for dissolving the kidney stones on account of which the Moderns call it Tricholiton." This reference is a particularly valuable one, for here we have jasper, described by a medical man, in use as a medical stone for the alleviation of nephritic pains during the period of Monardes. Surely this suggests that the Spaniards who brought jade stones back from South America were introducing no new-fangled ideas, whether or not the natives of that country used the stones in the same way. It would seem that up to this time jade, or what the Spaniards knew as jasper in Europe, was a curative for kidney disorders. A further point of interest is the word *Judaicus*, which we come across for the first time. The word is an adjective meaning *Jewish*, and scholars are agreed that the word jasper has a semitic origin.

Georg Fabricius (1516-1571), the German poet, historian, and archaeologist, was writing in 1565 of Galenus, the much-quoted medical authority (130-200 A.D.) : " Galenus confirms these to be of medical use," he says, in reference to jaspers, " which a certain king has had made from *jaspis* in such a way as to have it attached

to his neck that he made it touch his stomach ; he affirms to have witnessed with his own eyes a form of dragon : the king Nechepsus had ordered it to be sculptured as told by Galenus."

Another writer, the Father of mineralogy, frequently quoted in gemmological literature, was Georgius Agricola (1494-1555). His publications covered several large volumes and appeared in the 16th century. One, in 1556, an enormous work, was entitled *De Re Metallica*. Here *jaspis* is translated (in the English version by Mr. and Mrs. Herbert Hoover of the U.S.A.) as part coloured quartz and part jade, meaning, it would seem, that the term covered both jasper (quartz) and jade. In *De Natura Fossilum*, a later edition of which appeared in Basel in 1646, the author uses the term jasper to cover various minerals, as well as a variety coming from abroad which, he says, is " like to grey fat, or greenish, sprinkled with milky " and " like grey-green fat." Gesner also mentions jasper, as well as jaspachates " which combined seemed to have health-giving utility."

Printed in London during 1555 was *The Decades of the Newe Worlde of West Indes*. In this volume several books were combined and published and edited by Richard Eden. Part of it is attributed to Peter Martyr of Angleria.[16] On p. 115 one reads : " . . . Especially one Gonzalus Fernandus Ouiedus beinge one of the maiestrates appointed in that office which the Spanyardes caule Veedor, who hath also hitherto entered further into the lande than any other. He affirmeth that he chaunced uppon the fragmente of a saphire bigger than the egge of a goose. And that in certeyne hylles where he travelled with thirtie men, he founde many of the precious stones cauled smaragdus, calcidones, and Jaſpers . . ." And on p. 163, amongst the presents sent to the King of Spain was " gold and silver jewellery with cleare redde stones, and yet no rubyes, a hundrethe fouve coze (fourscore ?) and three greene stones, and yet no emeralds. Nevertheless, these are in lyke estimation with them as the other are with us." (Almost certainly these green stones were jades, though the Spaniards would have preferred to find emeralds.) This again seems to be confirmed on p. 237 : " *Of Smaragdes or Emeraldes*. Smaragdes growe in the countrey of Babilon. . . . They growe also in other partes of India. They are stones of fayre greene colour, and are lyght and tender. Of these stones, many are conterfecte. . . . There is lykewyse founde an

other kynde of smaragdes, whiche are greene stones, but not so much esteemed. Nevertheless, the Indians reverence these to set them forth with other precious stones. They leave not any greene coloure uppon the touche " (touchstone).

This book was published before Monardes' venture. There is no mention here of *lapis nephriticus*, nor of any medicinal qualities attached to the stones. Richard Eden himself identified the green stones as emeralds, or something similar. He writes also of jaspers.

In Zelia Nuttall's paper, read before the Anthropological Society of Washington in 1901, she quotes the famous Friar Bernardino de Sahagun, in his Book XI (1530 A.D.), Chapter VIII: " There is another stone belonging to the species of *chalchihuitl*, which is called *tlilaiotic*, and is a mixture of black and green. Besides the above mentioned stones there are other jasper stones of many colours. . . . Some of these are white as well as green and are therefore called iztaczhalchihuitl " (literally " white *chalchihuitl* "). *Chalchihuitl* was not jasper. That we know. Yet here was the Friar calling it jasper. And white jasper ! Had he lived one or two hundred years later he would probably have referred to this substance as *lapis nephriticus*, and a few generations later still as jade.

Another author familiar to most gemmologists is Camillus Leonardus. His work, originally published in 1502, was dedicated to Caesar Borgia. The English translation, which appeared in 1750, has the attractive title *The Mirror of Stones*, or *Speculum Lapidum.* Leonardus was also a physician, and of some eminence in the ancient city of Pifaro in Italy. On page 18 of this work we read : " Neither shall we depart from the authority of that consummate Philosopher Albertus Magnus in his Book of Minerals who holds that stones are of double kind, and faith . . . and others, with a dry aqueous, but more of the Terrene, as Marble, Jasper, and the like." And on page 112 : " Ja*ſ*per, Iaspis as it is in the Greek, and in Latin, Green, varied into so many colours that seventeen species have been discovered by the Learned, and by some more. For in these times Germany is so fruitful of Ja*ſ*pers, and produces such a variety." Further Leonardus says that the green (jasper) with the red is best of all and that its principal virtue is to stop the flux of blood. Clearly here the bloodstone is intended. Apart from the seventeen species of Jasper he also mentions twelve species of smaragdus.

Fifteenth to sixteenth century Europe must have been simply humming with activity. There was the printing machine in 1440. There was the discovery of America by Columbus in 1492. In 1503 Columbus was in Jamaica and in Yucatan in 1511. The Spaniards were in Mexico in 1519. Gesner's book came out in 1565 and 22 years later Monardes was writing, for the first time as far as we know, of *piedra de ijada.* In 1595, Sir Walter Raleigh wrote in *Discovery of Guiana :* " After the death of this Morequito, the soldiers of Borreo spoiled his territory, and took divers prisoners ; amongst others they took the uncle of Morequito, called Topiawari, who is now king of Arromaic (whose son I brought with me into England) and is a man of great understanding and policy . . . the Spaniards led him on a chain seventeen days and made him their guide from place to place. . . . He was at last redeemed for 100 plates of gold and divers stones called *piedras hijadas* or spleen stones." And later : " After we had fed and drew ourselves back to our boats upon the river, and there came to us all such kind of vitual as the place yielded . . . and of these stones which we call spleen stones."

This account, which is quoted by Thomas Wilson in his paper (mentioned earlier) is followed by an observation by the author : " That Sir Walter Raleigh could, in 1595, find on the east coast of South America, and far in the interior of the valley of the Amazon, sufficient evidence of jade implements or objects to cause him to notice them. . . ."

It was in the early part of the sixteenth century that the loot from South America began to arrive in Spain. Most of it was intended for the Monarch of that country. We have read that Cortes received, on behalf of his king, jades presented by Montezuma. There are many extant lists of this spoil. One, entitled : *Historia General y Natural de las Indias* is the work of Gonzalo Fernandez de Oviedo y Valdes, and was finally published in Madrid during 1851. Another was called : *Report of the Jewels, Shields, and Clothing* sent to the Emperor Charles V by Don Fernando Cortes and the Town Council of Vera Cruz. Much of this valuable material was gold. There were many emeralds. There was also *chalchihuitl,* or *chalchihuitl* and gold. Sometimes the word greenstone appeared on the inventories, doubtless because those responsible knew that the stones were not emeralds but could not otherwise determine their

species. There were other reports also, including letters to Cortes between 1519 and 1526. These were translated by J. Bayard Morris in 1928. We know that much of the spoil never reached its destination. Recent diving discoveries from a submerged wreckage off the coast of Bermuda established a Spanish galleon with just such loot. While no jade was apparent, there was a good deal of gold and a beautiful cross of cabochon emeralds. This galleon has been dated late sixteenth century and the Christian cross tells us that Europeans were then well settled in the New World. What has happened to the spoil that arrived is anybody's guess. Since jade cannot easily be destroyed, or melted down, like gold, for commercial purposes, it must be assumed that most of it is irretrievably lost or that it has passed into private hands where it remains unidentified.

More than a century earlier, Geoffrey Chaucer (c. 1340-1400) was providing a clue for the twentieth century to the value placed on jasper. He wrote :

" What is bettre than gold ? Jaspre.
What is bettre than Jaspre ? Wisdom.
What is bettre than Wisdom ? Womman.
And what is bettre than a good Womman ?
No — thing."

We may compare this with Montezuma's " . . . each of these stones (viz. *chalchihuitl*) is worth two loads of gold " early in the sixteenth century. And the Maori's (nineteenth century) : " Let the gold be worked by the white man. My only treasure is the *pounamu* " (jade). The Maori did not suddenly adopt this scale of values. He had adhered to it ever since his arrival in New Zealand, and we know not how long before, since he arrived there with jade in his canoes. The great migration to New Zealand was a fourteenth century venture, but it has been established that there were earlier arrivals.

Chaucer was speaking for the fourteenth century, and he was not positing news. He was making a statement that was apparently acceptable to his times. (As a point of interest the Sloane collection, referred to above, contains a broken pebble of brown jasper from Egypt, with a supposed likeness to Chaucer on both its parts.)

Montezuma was speaking for the early sixteenth century and we know not how many hundreds of years before that.

Another writer of the fourteenth century was Mandeville, or Sir John Mandeville as he is sometimes referred to. Mandeville's *Travels* was printed by Wynkyn de Worde, who followed Caxton in the English printing business. (He is credited with helping himself liberally first from the Journal of Friar Odoric (c.1286-1331), a Fransciscan missionary who was sent to the East, and secondly from the travels of Marco Polo.) Whatever we think of Mandeville, he has an interest for us here in that he did not use the term *lapis nephriticus*, when referring to jade, but jasper.

Certainly our greatest witness on the subject of jade in the Middle Ages is Marco Polo, and his *Travels*, easily available, are so readable.

Marco Polo, born in Venice in 1234 A.D., set out with his father and uncle in 1271, together with two preaching friars who, long before they had reached their destination, regretted the undertaking and turned back. The Polos journeyed together for three and a half years. They arrived at the court of *Kubla Khan*, as this monarch has since been popularized, in 1275. The court was then at Shangtu, near Pekin. The Polos did not set out for home, we are told, till 1292. Father and son sailed from a Chinese port for Persia and this voyage alone accupied roughly two years. From thence the travellers rode through Persia, arriving back in Venice in the year 1295. Later, as a prisoner of war in Genoa, Marco Polo is believed to have dictated his now famous book to a fellow prisoner. Allowing for the lapse of time and Marco Polo's memory, as well as the customary embellishing, and also allowing for any mistakes or elaborations that his fellow prisoner might have made, so much of the information has since been corroborated by later travellers that his contribution to the jade question can hardly be lauded enough.[17] Writing of Peyn, he says :

" Peyn is a province of five days' journey in extent, in the direction of east-north-east." This is believed to refer to places situated on the eastern side of Khotan, in the neighbourhood of the great sandy desert. " It is under the dominion of the grand Khan, and contains many cities and strong places, the principal one of which is likewise named Peyn. Through this flows a river, and in its bed are found many of those stones called chalcedonies and jasper. . . . All the before-mentioned provinces, that is to say, Kashcar, Khotan, Peyn, and as far as the desert of Lop, are within

the limits of Turkestan." A footnote here reads : " . . . the Bukhar or Bucharian, although much mixed with Persian words, is one of these dialects—which consequently reaches to the borders of the great desert of Kobi." And a further footnote in this edition runs : " The jasper, or a hard kind of stone resembling jasper, is noticed by several writers as the production of this part of Tartary ; and Goez speaks of its being procured from the bed of the river Khoten, which may probably be the same stream that afterwards runs to Peyn." Further in the text itself we read : " Charchan is also a province of Turkistan, lying in an east-north-east direction (from Peyn). In former times it was flourishing and productive. . . . Through this province run several large streams in which also are found chalcedonies and jaspers, which are carried for sale to Cathy, and such is their abundance that they form a considerable article of commerce."

It will be noticed that the material Marco Polo saw mined and " fished " was not called jade or anything like it. Nor, as a member of the Latin race, does he call it *lapis nephriticus*, which he could so easily have done had he been familiar with the term. He interpreted it as we should do to-day, that is, according to the stones he knew. And, from his observations, they were either chalcedony or jasper or both. Since we know that he was seeing the jade mines of Khotan, there is hardly a doubt that most of what he saw, certainly the " considerable article of commerce " was jade. He was no mineralogist nor, for that matter, a scientific observer. He was simply a traveller and explorer, and as such seems to have been very well received. The outstanding evidence of all this is that jade, recognized by thirteenth century Marco Polo, was jasper to thirteenth century Europe. And this was approximately three hundred years before South American jade began to arrive in Europe.

During Marco Polo's period, Albertus Magnus (c.1206-1280), Bishop of Ratisbon, was wielding great influence in his time. His *De Mineralibus* was published in 1262. In 1525 a small book entitled *The boke of Secretes of Albertus Magnus, of the vertues of herbes, ſtones, and certaine beaſtes* " was translated into English and printed in London. Although he segregates the various stones for their " vertues " we learn nothing helpful concerning jasper. Since, however, he was an accepted authority for hundreds of years, it is necessary to record him here.

Another contributor who writes of a stone we believe to be our jade was the Gallic poet Marbodus, who died about the year 1123 A.D. He was Bishop of Rennes between the years 1067 and 1101, and is frequently quoted by Mediaeval writers. Lange (1704) quotes him, saying that Marbodus writes : " It is the best of the translucent green stones and that it is more efficacious, as have been proved." Cluyt (1627) wrote : " Marbodus, an old Gallic poet, gives tribute to this green and clean stone and chants of it : ' Best in green and lighting colour, And proved as great and beneficial.' " Here again we find that Marbodus drew largely on Pliny for his information, writing of " seventeen varieties of jasper."

While it was virtually impossible to record all the references to *lapis nephriticus* for the second half of this millennium, so it is well-nigh impossible to record all references to jasper for the first half of the millennium. And while *lapis nephriticus*, as its name implies, was established as a curative for kidney disorders, we cannot make this claim for jasper, though it was certainly a medical stone of importance. The evidence that it was a " cure " for kidney troubles specifically is slender. Nevertheless, it exists. In trying to clarify this subject it is sometimes necessary to forget species, or the scientific side, and concentrate on the medical stone. That is, jade became *lapis nephriticus* only if it effected a " cure " for kidney ailments. To choose such a " cure " one selected a green or greenish or yellowish-green or greyish stone—the known colours. Later, when these stones were better recognized, it was observed to have a greasy polish. These two points, perhaps plus its tough qualities, gave it species. Yet, if a stone did not work—so great was the faith —it was considered not to be the real thing. In other words, it was largely a medicine and not a gemstone. And so, on the look-out for a kidney cure, someone might pick up a stone resembling jade, such as a cloudy emerald, and if this " worked " then *that* was *lapis nephriticus*.

Perhaps the so-called Dark Ages is a difficult period for gemmological research, partly because of the scarcity of the written work and partly because much that we enjoy to-day was lying fallow. Nevertheless we are just beginning to catch up with the idea that there was a great concentration of learning and knowledge and accomplishment that was quietly kept alive. And the outstanding evidence, such as Marco Polo's and others, seems to leave little

doubt that jade was always around, always valued, and for the most part living under the generic term, jasper.

REFERENCES

1 *Journ. Gemmology*, Vol. V, No. 1.
2 C. Biron, who published a small book in French during 1703 dealing with the Indies, writes of the Divine Stone that it was a new species of *Pierre Néfrétique* and that the name *Divine* was given because of its " virtues." In particular he mentions its curative properties as it affected *les reins*.
3 *Journ. Gemmology*, Vol. V, No. 3.
4 There seems little doubt that this word has reference to *Tenacity*.
5 *Journ. Gemmology*, Vol. V, No. 5.
6 C. Biron, mentioned earlier, writes of jasper in use as an amulet in the Indies, but not in connexion with kidney trouble ; his description of it strongly suggests bloodstone, and not jade.
7 W. A. Wooster.
8 L. J. Spencer.
9 G. F. Herbert Smith.
10 *Gemmologist*, October, 1955.
11 King, C. W. *Natural History, Ancient and Modern, of Precious Stones and of the Precious Metals.*
12 G. F. Kunz. Investigations and studies in Jade. Vol. I, 1906.
13 *Roman Book on Precious Stones, p.289*
14 There are so many renderings of this old word that it is difficult to be exact. Rémusat later spells it Yeschife, including an i. The Bible gives Yâshépheh and there is an Arabic rendering Jashaph.
15 The modern use of i and j, as well as u and v was not firmly established till the first half of the 17th century.
16 According to Dr. G. F. Kunz (*Investigations and Studies in Jade*, 1906) Columbus returned to Europe with a battle-axe with which Peter Martyr experimented. Tried on a piece of iron, it was found to cut into the metal without injury to the stone.
17 Columbus is said to have possessed a Latin copy of Marco Polo's book and made his own notes in it.

LITERATURE

Magnus (Albertus). *De Mineralibus*. 1262.
Mandeville (Manderville), Sir John. *Travels*. Published between 1357 and 1371.
Fabricius (Georgius). *De Metallicis rebus ac nominibus observationes*. 1565.
Gesner (Conrad). Book particularly on Stones and Gems. Zürich. 1565.
Ferrandus (J.). *De Néphrises*. Paris. 1570.
Martyr (Peter of Angleria). *The Decades of the Newe World of the West Indies*. London. 1555.
Monardes (Nicolas). *Joyfull Newes out of the Newe Founde Worlde*, written in Spanish by Nicolas Monardes, Physician of Seville, and Englished by John Frampton, Merchant. London. 1577. (This volume covered the two books referred to and originally printed in Spanish.)
Goez (Father Benedict). *Third and Last Volume of the Voyages, Navigations, Trafficues and Disfcoueries of the English Nation*, collected by Richard Hakluyt. London. 1600.
Boodt (Anselmus). *Gemmarum et lapidum historia*. 1609.
Bacon (Francis). *Sylva or A Naturall Historie*. London. 1627.
Cluyt (Augerus Clutius). *Essay on Calsue or Nephritic Stone*. Rostock. 1627.
Agricola (G.). *De Re Metallica De Natura Fossilum*. Basle. 1646.
Nicols (T.). *A Lapidary or History of Precious Stones*. 1652.
Boyle (Robert). *An essay about the origine and virtues of gems*. London. 1672.
Emanuel the Elder. *Regnum minerale . . . Metallorum, Lapidum*. 1686.
Biron (C). *Curiosity de La Nature et De L'art. Aportées dans deux voyage des Indes*. Paris. 1703.
Langius (Lange). *Christianus Joannes*. Opera omnia Medica Theoretice-Practica. Vol. 1. 1704.
Milward (E.), M.D. *Trallianus Revivisccns*. 1734.
Leonardus (C.). *Speculum Lapidum* (Mirror of Stones). 1750.
Cook (James). *An Authentic Narrative of a Voyage performed by Captain Cook*. 1768-1771.
Le Clerc (G. L.). *Histoire Naturelle des Minéraux*. Paris. 1783-88.
Abel-Rémusat (Jean Pierre). *Histoire de la Ville de Khotan, tirée des annales de la Chine ; et traduite du Chinois ; suive de recherches sur la substance minéral appelée par les Chinois, Pierre de Iu, et sur le Jaspe des Anciens*. Paris. 1820.
Gonzalo Fernandez de Oviedo y Valdés. *Historia General y Natural de las Indias*. Madrid. 1851.
King (C. W.). *The Natural History of Precious Stones, Gems, and of Precious Metals—ancient and modern*. 1865.
Schliemann (H.). *Ilios : The City and Country of the Trojans*. 1880.
Rudler (F. W.). *Encyclopaedia Britannica* (9th ed.). 1881.
Hilton (J.). *Remarks on Jade*. Arch. Journal, 1888, Vol. XLV.
Williams (S. W.). *The Middle Kingdom*. 1883.
Wilson (Thomas). *Jade in America*. 1900.
Nuttall (Z.). Proc. Anthrop. Soc., Washington. (Printed in the American Anthropologist, N.S.3.). 1901.
Kunz (G. F.). *Investigations and Studies in Jade*, Vol. 1. 1906.
Marco Polo. *Travels*. Everyman's Library. 1932.
Smith (G. F. Herbert). *Gemstones*. 12th ed. London. 1952.
Ball (S. H.). *Roman book on precious stones*. 1950.
Ruff (E.). *Jade of the Maori*. London. 1950.

ASSOCIATION NOTICES

SILVER JUBILEE OF ASSOCIATION

Although the genesis of the educational scheme initiated by the National Association of Goldsmiths in 1908, culminated in the formation of the Gemmological Association of Great Britain, it was not until May, 1931, that the idea of a separate organization for gemmology was suggested. A resolution from the gemmological committee of the National Association was approved in June of the same year and formal inauguration took place at the annual distribution of awards in October, under the title Gemmological Association.

In 1938 greater precision was given to the title by the adoption of the form : Gemmological Association of Great Britain. A short history of the Association, covering the period 1908–1955, was issued to members earlier in this year. The Association can look back with pride and satisfaction at many years of valuable educational work.

GIFTS TO ASSOCIATION

The Council of the Association has received with gratitude the following gifts : 1·75-carat synthetic emerald from J. B. Ipekdjian & Co. Ltd. ; specimen of uncut prehnite from R. Webster, Esq.

BRITISH MUSEUM (NATURAL HISTORY) LECTURES

Lectures in the MINERAL GALLERY on Saturdays at 3 p.m.

1956

Oct.	27th	How is a mineral species defined ? ...	Dr. M. H. Hey
Nov.	3rd	Sulphide minerals	Dr. A. A. Moss
	10th	Minerals of Wales	Miss J. M. Sweet
	17th	Cosmic dust—is it a cause of climatic change ?	Dr. J. D. H. Wiseman
	24th	Identifying minerals by X-rays ...	Dr. G. F. Claringbull
Dec.	1st	Ornamental stones of the British Isles...	Mr. S. E. Ellis
	8th	Preparing pure samples of minerals...	Mr. P. G. Embrey
	15th	Geology of the Antarctic	Dr. G. H. Francis
	22nd	Meteorites (I)	Dr. M. H. Hey
	29th	What are crystals ?	Dr. A. A. Moss

THIS PROGRAMME IS SUBJECT TO ALTERATION

LETTERS TO THE EDITOR

DEAR SIR,

Some few weeks ago, whilst preparing a modest gemmological display to be given in conjunction with a short talk, I happened on a device that might be of some practical help to fellow workers. Having had previous experience of the nervous strain of demonstrating the use of a spectroscope to the general public, when mounted in the " normal " way on top of a simple microscope, I tried to find a safer solution, and hit on one of those childishly simple things that are so absurdly logical we wonder why they have not been standard practice for some time.

The technique is as follows :—

Hold the spectroscope with the aperture uppermost, and lay the stone to be tested over the slit in such a way that it covers most of the opening ; now take a short piece of colourless transparent adhesive tape, and run this over the stone, pressing the ends against the " squared " portions of the spectroscope. When carefully done, the focusing and adjusting of the aperture is not interfered with in the slightest, and with the stone securely held one can pass the instrument round a group of novices with the utmost confidence, asking them merely to look through it at a strong light source.

This is a very great help at demonstrations, but to my surprise I have since found that it yields most excellent results in every-day testing, the light loss being extremely small. It has the added value that no equipment need be used apart from a strong light and the spectroscope.

Yours faithfully,

R. MUIR.

DEAR SIR,

Fiji is where most of the " black " pearls are found and when I was there recently I tried to obtain information about them. Pearl divers to whom I spoke could not explain very much and I had not time to seek other information. The area, apparently the only one, is in the Yasawa group, which lies 40 miles north-west of the main island of Vitu Levu. I was told that the shells are not stained black and there is no mud to stain either shell or pearls ; the dark shade seems to come partly from an excess of conchiolin in the structure of the pearl. It may be that the shells, although not dark inside, also have excess conchiolin outside, which gives them greater protection from erosion.

The origin of the area is " recent volcanic " and I thought that perhaps there might be a deposit of some mineral on the rocky sea-bed, but I cannot suggest any which might account for the colour of the " black " pearls, or that fraction of it which is not the result of excess conchiolin.

The sands all round Fiji are black with mica, magnetite, etc., but this applies to many parts of the Pacific where there are recent volcanoes. The problem is—why do they occur more in that area than others ?

Yours faithfully,

FRANK LEECHMAN.

1956 EXAMINATIONS IN GEMMOLOGY

The 1956 examinations of the Gemmological Association of Great Britain were held in the first week of June and examination centres included London, Birmingham, Leeds, Liverpool, Edinburgh, Glasgow, Plymouth, Oslo, Lucerne, Pforzheim, Washington, D.C., Colombo, Melbourne, Los Angeles, Zeist, Sydney, New York, Auckland, Toronto, Austin, Johannesburg.

Ninety candidates qualified in the preliminary examination and 61 in the Diploma. The Tully Memorial Medal has been awarded for the first time to an Australian candidate.

The following is a list of successful candidates, arranged alphabetically :

DIPLOMA

Distinction and Tully Medal

Marks, Percy George, Sydney.

Qualified with distinction

Brewer, George Paul Richard, Aldershot.
Chiles, Sylvia Doris Marion, Warlingham.
Gordon, Davina Beryl, Ruislip.
Longbottom, William, Hull.
Mason, Cyril Thomas, London.
Morgan-Smith, John William, London.
Muir, William Arthur, Wilmslow.
Vainer, Milos, London.

Qualified

Andersen, Arne Thorvald, Tönsberg.
Banks, Kenneth Arthur, Manchester.
Bates, Michael Anthony, Croydon.
Batt, Keith Michael, Torquay.
Bentley, Dennis Cyril, Epsom.
Bochatay, Albano, Geneva.
Bohe, Edward R., San Diego.
Bone, William George, London.
Boyd, James Gourlay, Cambuslang.
Breeze, Michael Dennis Clithero, Leicester.
Brooks, Beatrice Briercliffe, Bristol.
Burley, Walter Robert, London.
Clifford, Edwin William, Cassington.
Downing, Richard Allen, London.
Ebbestad, Jens Christian, Oslo.
Ekanayake, Brian Edmund Rodney, Colombo.
Felin, Juul, Oslo.
Ferguson, William Fleming, Alexandria.
Fortune, Kenneth William, London.
Gam-Dede, Markson Ayebatekeyo, New York.
Grounds, Walter Joseph, Birmingham.
Harris, John Smith, Glasgow.
Hewitt, Frederick Edward John, Ormskirk.
Hodgson, Edwin Stanley, Darlington.
Hopewell, Ronald Cooper, Grays.
Hoskyns, Kenneth, Birmingham.
Jeffreys, Roy Ernest Henry, London.
Kingwill, Peter Newton, London.
Kirk, Ronald MacDonald, Glasgow.
Laney, Geoffrey William, Hersham.
Leiper, Hugh, Austin.
Lewis, Emily Catherine, London.
Maxwell, John Anthony, London.
McGuigan, Alix, Bearsden.
Mendis, Clement Stephen, Colombo.
Messenger, Shirley Joan, St. Albans.
Molyneux, Frank, London.
Muscat, Bernhard, Johannesburg.
Oftedahl, Christoffer, Stabekk.
Padbury, Edna Phyllis, Birmingham.
Peplow, Sarah Alison, Stourbridge.
Peters, Brian Leonard, Camberley.
Phillips, William Howard Merrick, Ross-on-Wye.
Pollard, Frederick David William, London.

Qualified

Schoo, Johan Juliaan, Jr., Arnhem.
Selwood, Brian Leslie, Watford.
Sherrard, Julian Sigismund, London.
Sidaway, John Terence, Torquay.
Smith, Cora Ann, Grays.
Smyth, John Calvin, Baltimore.
Toms, Brian Geoffrey, Plymouth.
Tye, Leslie Herbert, Bromley.

PRELIMINARY

Rayner Prize

Jank, Robert Alexander, Boscombe.

Qualified

Anderson, Vernon David, Glasgow.
Armbrecht, Bertram John, London.
Baily, Hugh Graeme, Sutton Coldfield.
Blackmore, Howard Loftus, Caterham.
Blanshard, Christine Janet, Croydon.
Boermans, L. Th. M., Venlo.
Botting, Anthony John, Gravesend.
Brewer, George Richard Paul, Aldershot.
Campbell, Elizabeth W., Washington.
Cassarino, Joseph Anthony, New York.
Chittock, Arthur, Blackpool.
Clay, John Jeremy, Leicester.
Cooper, Colin L., Neuchatel.
Cope, John Richard, Honiton.
Crosthwaite, Norman McLaren S., Giffnock.
Davies, Margaret Valerie, Coventry.
De Silva, Lindamulage J. C., Moratuwa.
Diss, Geoffrey Dixon, Barrow-in-Furness.
Ditchburn, Michael, Birmingham.
Downing, Richard Allen, London.
Drapkin, Clive Magnus, Birmingham.
Etelman, Sol J., Stamford.
Fernando, Kurukula Suriya, Colombo.
Francis, Barry Peter, London.
Galtung, Johan D., Oslo.
Gaudernack, Lilly, Sandvika.
Gaudernack, Rolf, Sandvika.
Gerritsen, G. H. T., Arnhem.
Gillow, Harold, London.
Grimsdell, John Leslie, London.
Grude, Rolf K., Oslo.
Gundersen, Henrik O., Jr., Larvik.
Hadjizade, Ahron, London.
Hatcher, June Ann, Birmingham.
Henn, Elizabeth Rosemary, Dudley.
Hermitage, Wendy Barbara, London.
Hill, Reginald, Solihull.
Hill, Stanley George, Birkenhead.
Hinton, Vera Georgina, Staines.
Holland, Norman Alfred, Birmingham.
Hopkins, Iris, London.
Hutchins, Brian Percival, Hornchurch.
Janison, Murray E., Brooklyn.
Jones, Wilfred Russell, Auckland.
Kent, Muriel Constance, Folkestone.
Kelly, William Henry, Glasgow.
Laidlaw, Thomas Alfred J., Edinburgh.
Lauvland, Karl, London.
Leake, Douglas Michael, Nuneaton.
Lode, Georg, Egersünd.
Mackenzie, Enid Lily, Glasgow.
Marks, Percy George, Sydney.
McGrath, Robert Sterling, M.D., Washington, D.C.
McKay, Robin Ian, Thames Ditton.
Meanwell, Brian Sydney, Birmingham.
Mitchell, Peter John, London.
Neale, Alan, Berkhamsted.
Neerbye, Rolf, Gjerpen.
Oftedahl, Christoffer, Stabekk.
Parkhouse, John Richard, Maidenhead.
Pedersen, Erik M., Oslo.
Petterson, Björn W., Norway.
Phillips, Alan Lewis, Bardsey.
Phillips, Denis, Leeds.
Roach, John George, Hockley.
Rose, Jack Arthur, Newcastle-on-Tyne.
Ros, David Douglas, Ripon.
Safiyulla, Mohamed Thahir, Colombo.

Qualified

Siebenberg, Paul, Birmingham.
Skrede, Agnar, Oslo.
Smith, Clifford James, Birmingham.
Smyth, John Calvin, Baltimore.
Snow, Keith Michael, Chelsea.
Solman, Barbara, Worcester Park.
Strange, Peter John, London.
Taylor, Donald Herbert, Ipswich.
Tipping, John Richard, Edinburgh.
Walsh, Harvey L., Arlington.
Warburton, Frederick W., Toronto.
Weatherill, John, Cardiff.
Weaver, Gerald Owen, London.
Weiss, Kurt, London.
Weller, George Thomas, Tunbridge Wells.
Weller, Raymond John Howard, Croydon.
West, Gordon Francis, Mitcham.
White-Hide, Richard George, Wadhurst.
Vane, Frederick James, Croydon.
Ystad, Per T., Potsgrunn.
Zibung, Ali, Lucerne.

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Nos. 1-8

1955-1956

Names of authors are printed in small capitals, subjects in lower case and abstracts in italics