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IN THIS ISSUE

THE ISRAEL DIAMOND POLISHING INDUSTRY

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(Ed. note: This paper is based on Michael Szenberg's 236 page study on "The Economics of the Israel Diamond Industry" which received the 1971 Irving Fisher Award, sponsored by the International Honor Society in Economics. The Final Selection Board consisted of an eminent body of European and American economists.)

Introduction and Historical Summary

The processing of diamonds constitutes an appreciable industry in five countries: Belgium, Israel, India, The United States of America and South Africa. During the early postwar years the industry branched into several main centers, each specializing in certain lines of stones. India processes those stones that lie on the boundary between gems and industrials. South Africa and the United States fabricate big sized stones, while Belgium and Israel process mainly small stones (more than 10 stones in a carat) and medium stones – melees (from 1 to 7 stones in a carat), respectively. Thus, product competition among the international centers is indirect.

Among these centers, Israel's diamond industry alone rose to a position of significance in her economy through consistent and signal expansion since 1950. In 1965-66 it ranked third among 115 minor branches accounting for about 4% of employment, 7 and 3% of gross revenue and of value added, respectively of total manufacturing activity.

The industry is also distinguished by the fact that it is the only manufacturing industry in which Israel is a world factor (marketing about one third of the world's total polished diamonds – over $200 million, and employing a third of the world's diamond manpower – over 10,000 workers). In the case of one of its products, melees, Israel maintains a near monopoly in the world market, producing over 80% of total value produced.

As a result of this development Israel is currently the second largest diamond center in the world. Moreover, the gap between Israel and Belgium, the foremost diamond processor, is rapidly diminishing.

The evolution of the Israel diamond industry may be roughly divided into two major phases. The early phase lasting up to 1945, saw the industry emerging from a stage of isolated enterprise into a more expansive pattern. The first plants were established in 1937 by Jewish Belgian immigrant polishers in Netanya with the active help of its Mayor, Oved Ben-Ami, who furnished free land and credit on easy terms. The occupation of the Low Countries by the German forces paralyzed the traditional European diamond centers and catapulted the fledgling Palestine enterprises, reinforced by the influx of craftsmen and managers fleeing Europe to a position of prominence.

The expansive tendencies of the industry during the war were facilitated by three factors:

(a) The steady supplies of rough diamonds, provided by the London-based Diamond Trading Company (it controls over 80% of the world mining and marketing of uncut diamonds), which would normally have been allocated to the then defunct diamond centers on the European continent.

(b) The imaginative and extreme degree of labor specialization adopted by the industry, namely the chain system which shortens the training period and allows attainment of high worker efficiency levels. The principle followed is that each trainee specializes in one, and only one, of the eight phases involving the cutting and polishing of a diamond.

(c) The increased demand for polished diamonds generated by the war throughout the world and especially in the United States.

In 1946, however, the future of the industry in Palestine looked unpromising, as the European diamond centers strove to recover lost ground due to wartime restrictions and the Diamond Trading Company began to redivert the rough to Europe. Firms started to disintegrate and craftsmen to be laid off. The wartime Palestine diamond industry employment peak of 1945 (4,000 workers) gave way to an abysmal decline in the late 1940's.

The second major phase comprises the years since 1950, and is characterized by the recovery in the early years of the period and its phenomenal growth between 1955 and the present day.

Table 1 summarizes the principal dimensions of the industry's growth. The value of polished diamonds increased from $5 million in 1949 to over $200 million in 1970, a forty-fold gain. Physical output of diamonds (in carats) recorded a smaller rise amounting to only about a nineteen-fold jump during the same period of time. The same picture is provided when value added and employment figures are examined. This expansion has been accompanied by a broader distribution of the product over the world market. Although the United States continues to maintain its position as the leading importer of diamonds exported from Israel, its share in total exports declined noticeably from nearly 80% in 1950 to 31% in 1970. This signifies successful inroads made by the industry into new markets in other countries, especially in Europe and Asia.

TABLE 1: GROWTH OF THE ISRAELI DIAMOND INDUSTRY, IN SELECTED YEARS

Year	Production in Carats, (000)	Exports (in dollars, 000)	Value Added (in dollars, 000)	Employment
1949	76	5,100	875	800
1952	134	11,462	1,645	2,190
1955	231	20,616	4,370	2,720
1958	331	32,959	7,793	3,480
1960	574	56,319	7,150	5,520
1962	838	82,340	15,364	6,800
1964	1,084	118,206	15,960	9,800
1966	1,281	164,663	39,728	10,000
1968	1,472	194,802	22,752	10,455
1970	1,502	202,041	47,678	10,200

Source: Diamond Control Department, *Statistical Report* (annual), and Central Bureau of Statistics, *Survey of Industry and Crafts*

The Structure of the Industry

The Israeli diamond industry has a highly competitive structure at both production and distribution levels. We find that two basic conditions of effective competition – relative ease of entry and the presence of a large number (about 470) of independent producers (none of whom has a sizeable share of the market) engaged in competition with one another – are satisfied to a very high degree.

An examination of changes in the industry's structure during the period under discussion 1952-1970 has shown a persistent expansion of two main categories of establishments.

First, the small non-integrated units, engaging from one to four persons experienced remarkable growth. Second, the larger integrated establishments engaging between 50 and 99 workers experienced moderate expansion. At the same time findings on economies of size (the relation between average cost of production and the output of a plant) strongly suggest that the minimum optimal plant size for the polishing of melees is in the range of 50-99 persons engaged.*

That these developments are compatible is explained by the fact that, to a considerable degree, the small plants are not in direct competition with the larger ones. The small size industrial units are effective competitors on account of product

* The main sources of economies of size for large plants stem from the division, balancing, and synchronization of processes. For a more detailed examination see my "Estimating Economies of Scale in the Diamond Industry" *American Economist* (to appear in Spring, 1972).

and skill specialization. The sawing, cleaving and scaife reconditioning functions in the industry became more and more concentrated in the smallest class. Furthermore, a change in product composition was another contributing cause in the same direction. In recent years imports of particular types of uncut diamonds like spots, chips, kaps, cleavages fancies and sizes have been rising relative to the preeminent melees. The significance of this lies in the fact that these atypical types of diamonds, along with sizes, require special treatment or are not amenable to the chain type processing characteristic of melees, typically fabricated in the larger establishments. All this suggests that qualitative and quantitative variability of the rough diamonds enhances the survivability of the very small plants.

Capital requirements may pose some difficulties for the small plants, but certain ways exist whereby entry into the industry via subcontracting may virtually eliminate their significance. Subcontracting may be defined as the practice of having an outside contractor produce all or some part of a product that could be produced in the prime contractor's facilities. Generally the relationship is between a larger firm and one or more small firms. The first is the integrated manufacturer who procures rough diamonds, employs craftsmen in his own plant to saw, cut and polish them and sells the finished products. The second is the subcontractor who produces goods to specification, never takes title to the goods which he is processing, and is never involved in the marketing of the gems. Some of the subcontractors carry out preparatory steps in the processing of diamonds like scaife reconditioning or cleaving. Others engage in sawing, cutting or polishing, and still others complete the whole work from start to finish. It is estimated that more than a third of the industry's factories are engaged in polishing for others.

The economic and social patterns that have developed with the growth of subcontracting arrangements have given rise to many misconceptions about its impact, and have led to concern on the part of both governmental and industry officials. There has been a feeling that subcontracting leads to the collapse of established firms and contributes to the undermining of the industry.

Detailed surveys conducted by the writer have established that subcontracting plays rather an important role in the diamond industry's expansion and diversification. Moreover, subcontracting in the industry represents high degree of rationalization of production and the extension of the division of labor. The relationship between the prime and subcontractor was found to be, to a very large degree, complementary generating benefits to the industry as a whole.

The analysis suggested that the forces influencing the prime contractor to embark upon a subcontracting program can be classified into four broad categories: flexibility, employment relations, cost and quality. The prime contractors were found to be positively disposed to their subcontractors in all of the four areas explored, with the first two areas considered more critical than the second two.

It is suggested that industry officials explore the possibility of setting up a contracting program, referred to as "Two-Way Contracting." Under this system, each firm, for example, will specialize in one or two types of uncut diamonds and contract out other types. Thus, each firm establishes links to bring work in and to job work out simultaneously and continuously. This will certainly increase the efficiency of the industrial units.

Government Policies Toward the Diamond Industry

If the imaginative division of labor and the innovative organization of production facilities furnished an internal impetus for the establishment of a modern small scale diamond industry, then the governmental assistance programs furnished an external impetus for the rapid advance of the industry.

In the first place, the government displayed vigor and imagination in seizing opportunities on the African continent by establishing crucial contacts with independent diamond mining centers, in the late fifties, and thus pressuring the Diamond Trading Company to provide Israeli producers and dealers with wider access to the required raw materials.

Second, the government provided generous credits at relatively low interest rates that made it possible for the industry to compete successfully with its international rivals. It recognized the large amounts of working capital required ($5,000 – $7,000 per worker), slowness of building up capital from retained earnings after taxation, and the fact that all diamond producers are proprietorships, partnerships or small family-held corporations. All these factors place the industry at a great disadvantage relative to other larger industries in short term export financing.

Other serious impediments to the accelerated development of the industry have not escaped the attention of the authorities. They were instrumental in setting up the Diamond Institute, in 1965, in order to promote intra-industry cooperation in respect to innovation and export promotion.

Under the provision for technical advance an experimental polishing plant was set up for the purpose of practical experimentation in trying out tools and running in equipment developed in the diamond laboratory headed by Professor I. Yarnitzki of the Israel Institute of Technology. The research facilities and technical assistance have already led to some achievements. It is responsible for introducing a new machine for the cutting of girdles, a new polishing scaife (wheel) and polishing powder, new balancing equipment and a cutting vibrator which accelerates the girdling process.

It is worthy of note that the pilot diamond plant provides an advisory service accessible to both local and overseas producers.

Of special importance are the

gemological courses organized by the Institute in cooperation with the Gemological Institute of America. The courses cover theoretical information combined with practical work on the physical structure of gems, and methods of polishing, grading, and evaluating of various categories of precious stones.

Concluding Remarks and Future Prospects

Although the Israel diamond industry witnessed a rapid rate of growth during the last twenty years, this growth has been based mainly on one product – the fabrication of melees. This achievement has created a new problem. It is obvious that unless the industry broadens its base and diversifies into other categories of rough diamonds like smalls and sizes, its expansion will depend solely on the world's demand for melees. Yet, considering the character of recent growth, the industry appears to be entering a new phase that may help it to extend the total foreign market.

Perhaps the most notable trend is the expansion of the service function in the industry. A new, most modern and the world's largest Diamond Exchange has been constructed whose purpose it is to make Israel a world diamond trading center in addition to its being a production center. Furthermore, certain long term projects initiated at the diamond laboratory carry with them high hopes for the future. These involve efforts at discovering the best metallurgical composition of the materials of the scaife (wheel) and their behavior during polishing.

It is hoped that new methods in the future will be innovations involving fully automatic processes rather than mechanical adaptations of existing processes.

The strong performance of the industry stems from three main sources:

(a) The sharp division of labor which was beneficial from the standpoint of increasing both productivity and earnings of young recruits.

(b) The pressures of competition which contributed to a high degree of technical economies in the use of labor and equipment within the plant and among the plants.

(c) The government programs which were wisely conceived in the spirit of fostering change rather than of sheltering existing producers.

They furnished a positive directing force which the industry, given its atomistic structure, would have been unable to provide by itself. In other words, pernicious excessive competition which could have easily developed was avoided, thanks to these specific actions.

Developments and Highlights at GIA's Lab in New York

by

ROBERT CROWNINGSHIELD

Synthetic Quartz

We were very pleased to receive a telephone call some time ago from Dr. Baldwin Sawyer, Executive Vice-President of Sawyer Research Products, Inc., Eastlake, Ohio. Dr. Sawyer mentioned that their firm is one of the, if not the largest, producers of synthetic quartz. They concentrate on the electronic quartz resonator applications and have developed specialized grades for various uses.

Since 1959 Dr. Sawyer has experimented with doping quartz, with various impurities during the growth of the crystals which have, in turn, been the subject of research in laboratories around the world. In the course of this work, several potentially commercial colors have been produced including blue, purple and green. None of these colors is yet commercial, mainly because of difficulties in duplicating color from one run to the next. However, one color, an excellent yellow- to yellow-brown citrine, is beginning to be commercial and, true to his word, Dr. Sawyer sent us a large crystal, a transverse section and a handsome emerald-cut stone (*Figure 1*). The crystal is shaped the same as colorless synthetic quartz crystals that we have. The rather intense and pleasing color is banded parallel with the colorless seed (*shown in Figure 2*).

By chance, we received for identification at the time we were studying these specimens, a large natural citrine which had angular banding. Since the seed wafers, or tablets, are all oriented in the same manner so that a large group of crystals can be grown in close proximity without interfering with one another, the relationship of color bands to the optic axis should prove a reliable means of identification.

Figure 3 illustrates typical bread crumblike inclusions of possibly iron hydroxide, according to Dr. Sawyer.

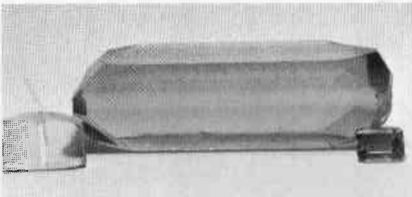


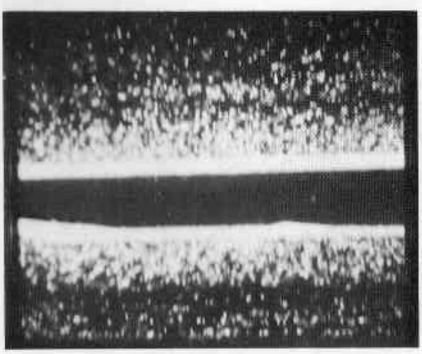
Figure 1

These seem to be concentrated near the seed. In the cut stone they are randomly oriented and may be absent entirely, though Dr. Sawyer indicated that most stones, at present, have them. *Figure 4* shows some of these bread crumblike inclusions in a cut stone. Off the end of the pointer one can be seen in focus.

Our testing, which included all normal gemological tests available to us, disclosed no differences in properties from natural quartz. That is, we cannot distinguish this new material from natural by spectroscope, ultraviolet, X-ray, refractive index, specific gravity or any tests other than magnification and observation for optic orientation.

By coincidence, we received for testing a light cobalt blue emerald-cut stone that proved to be synthetic

Figure 3



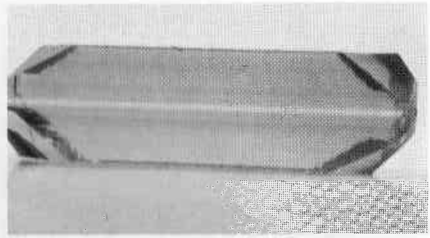


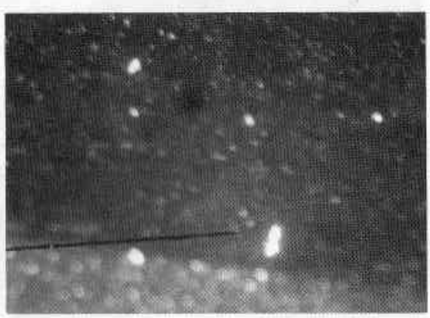
Figure 2

quartz. The absorption spectrum indicated that the color is in fact due to cobalt. Like similar colored synthetic spinel, the stone appeared red under a color filter.

Piggy-Back Settings

Recently, we were asked to observe a large diamond with a flaw that could have been due to damage since the ring was badly bent. We were too busy to tackle the job right away and asked if the jeweler could remove the stone for better viewing. The jeweler returned with the ring and a puzzled expression – the diamond was a "piggy-back." That is, it was made up of a large flat marquise with a very large culet mounted above a smaller marquise brilliant. When set, they do not touch, but the dead central area of the large stone is filled with the brilliance of the

Figure 4



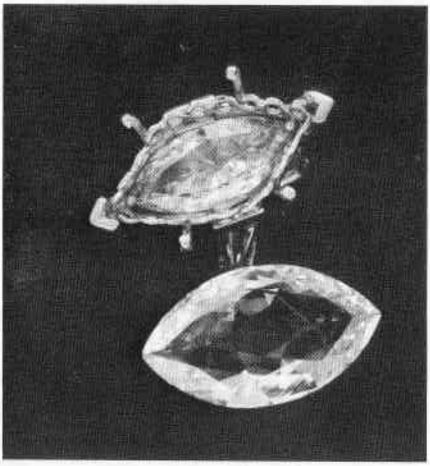
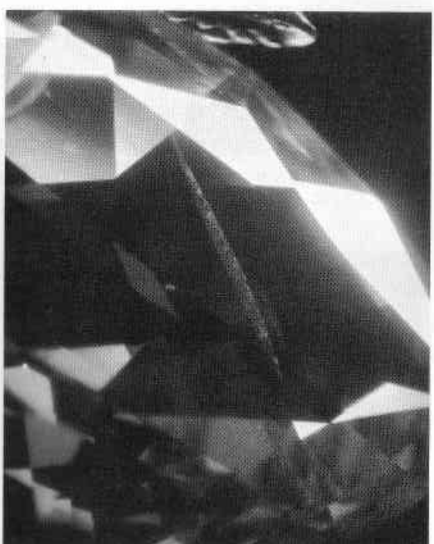


Figure 5

smaller stone. *Figure 5* shows the larger stone unmounted while the smaller stone is still in its deeply buried setting.

We have encountered this type of setting before after a dealer had gauged such a stone to be approximately 12 carats. In actuality, it consisted of two very flat stones totaling little more than 5 carats. One such ring we saw had three flat stones cleverly mounted to look like one stone. One of the flaws in the top part of the piggy back shown in *Figure 5* was as close in appearance to the fingerprint type of inclusion in corundum as any that we have seen *(Figure 6)*.

Figure 6



Rare Natural

In *Figure 7* may be seen a square pit, indicative of the cubic crystal

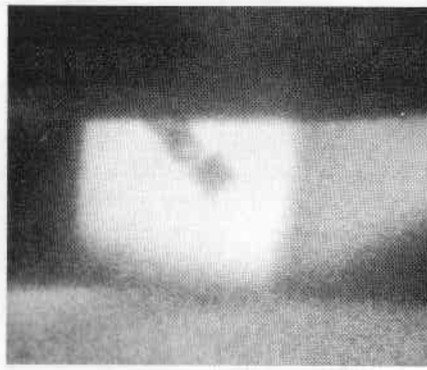


Figure 7

surface marking rarely seen in a finished diamond, especially in the polished girdle of a round brilliant.

Nonfluorescent-Synthetic Emerald

We have been seeing more synthetic emerald with higher refractive indices and no ultraviolet fluorescence in the past few months. Cabochon quality stones, which formerly we saw only in articles purchased in the Far East, have been offered for sale at the wholesale level in New York. Invariably, they have a strong iron line at

Figure 8

approximately 4300 Å as did the two faceted pear-shaped stones shown in *Figure 8.* These stones were obviously replacements because the earrings were not new and the prongs showed evidence of reworking.

Three-Phase Inclusions

Although we tend to think of natural emeralds as the only stone in which three-phase inclusions are seen, we have mentioned them in

Figure 9

connection with fluorite. A very large fluorite, resembling a fine emerald in a lady's ring, was peppered with them. The cavities seem to be cubic and the gas bubbles often "backed" into a corner. Another unusual stone to feature three-phase inclusions was a fine purple sapphire. The inclusions were both stubby and rod shaped as indicated by the arrow in *Figure 9.*

Two-Toned Diamond Crystal

In *Figure 10* a black ink line separates a colorless section from a blue-gray section of a flattened 28

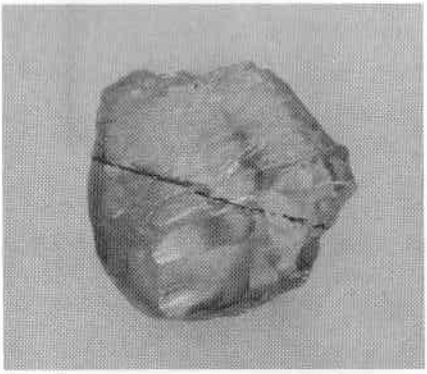


Figure 10

carat diamond crystal. As we expected, the blue area proved to be semi-conducting indicative of Type IIb crystal structure. We are indebted to Lazare Kaplan and Sons for showing the stone to us.

Surface Graining

Figure 11 illustrates an especially hard-to-polish facet which shows that

Figure 11

the reason was internal graining. Although the stone was otherwise free of imperfections, we could not give it a flawless grade since the graining caused a misty appearance in addition to poor polish on several facets.

More on Deceiving Doublets

Since the last issue we have been asked to identify several more doublets consisting of natural corundum tops (usually greenish-yellow Australian material) and synthetic ruby or blue sapphire pavilions. In many cases, the cement layer is very free of bubbles or separations, in other cases, the cement has separated producing the effect seen in *Figure 12.*

As mentioned before, jewelers must be very thorough when identifying mounted rubies and sapphire, since a casual glance at the angular banding in the crown or even a spectroscope test on blue stones could be misleading.

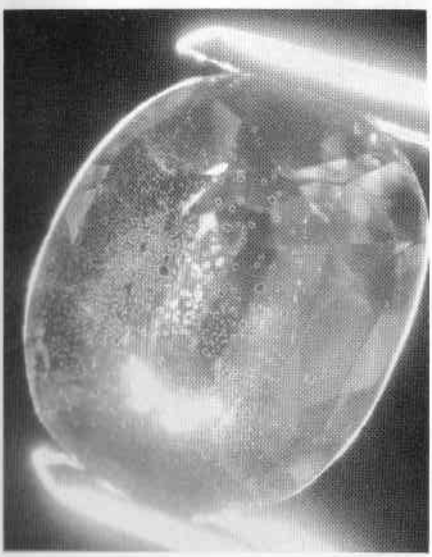


Figure 12

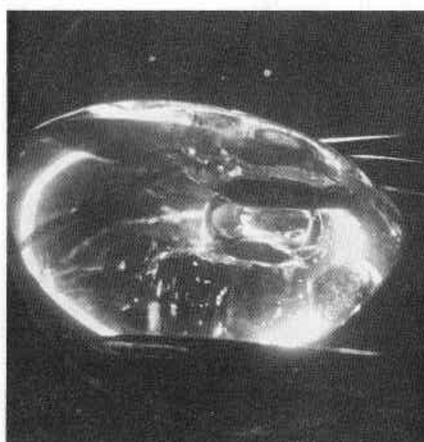


Figure 13

Acknowledgements

We wish to express our sincere appreciation for the following gifts:

To **Nat Klarsfeld**, New York City, for a good example of Queensland gray boulder opal.

To **Marcus Jewelers**, Rutherford, New Jersey, for a good selection of both natural and imitation stones for use in colored-stone identification classes.

To **Jerry Call**, ex-GIA instructor and NY staff member, for a 10 carat square-cut chrome diopside and fine-blue pear-shape aquamarine, both of his own cutting.

To **Adir Ascalon**, sculptor, Mexico City, for a most unusual amethyst cabochon with a very large two-phase inclusion in which the gas bubble moves (*Figure 13*). We are also indebted to Mr. Ascalon for the opportunity to see several other unusual Mexican minerals including a nearly chrome-green transparent idocrase crystal cluster and transparent yellow-green grossularite crystal group.

To **Andrew Heinzmann** of H.R. Benedict and Sons, for an important gift of many cut stones that will be of great value in our courses.

To **Melvin Strump**, Superior Gem Co., New York City, for a selection of natural pink spinels which will be of value in identification classes.

To **Dr. Ed Borgatta**, Rupert, Vermont, for a nice selection of natural stones including garnets, kunzites and peridot. These will be put to good use in our classes.

DR. A. E. ALEXANDER

REVIEWS

THE TIFFANY TOUCH

THE TIFFANY TOUCH by Joseph Purtell. Published by Random House. 309 pages. Clothbound. 209 illustrations. Price: $10.00.

It was obvious that sooner or later the Tiffany story would reach print in book form. In 1953, the late Henry LaCossitt wrote a two issue article on Tiffany & Company for the old *Saturday Evening Post,* which was the first time Tiffany lent its name and documents to anyone for public consumption. These articles had body and substance enough to indicate that eventually a book on the prestigious retail jewelry establishment would be written. The man I thought qualified to do the job would be none other than Tiffany's unofficial historian, William J. Fielding. The undertaking was assumed by a former *Time* magazine editorial writer, Joseph Purtell. You will not find Fielding's name in *The Tiffany Touch.*

Joseph Purtell was given the facts and has handled the subject matter very well. Tiffany today is still staffed with family who are in a position to furnish all kinds of data on the store: Farnham Lefferts, current president, whose father was long an executive of the firm; La Bar Hoagland, executive vice-president who married S. Hinman Bird's daughter – Bird being, during his lifetime, a senior vice-president and member of the board of directors, and finally, Henry Barstow Platt, vice-president and also member of the board of directors, whose great, great grandfather, Charles Lewis Tiffany, was founder of the store. Platt's uncle, William T. Lusk, was a one-time president of the firm, succeeding Louis de Bebian Moore, who resigned at the time of the Walter Hoving takeover in the Fall of 1955. Not only could these staff executives supply excerpts from the Tiffany archives, but equally important, furnish numerous photographs and lithographs which lend so much interest to Joseph Purtell's book.

Tiffany & Company was founded in 1837, but under the name of Tiffany

& Young. (For the record, the leading retail jeweler during this era was Marquand – the predecessor of Black, Starr & Frost.) Charles Lewis Tiffany, who began the partnership with John B. Young, shortly thereafter brought J.L. Ellis into the firm. The Company was then to be known as Tiffany, Young & Ellis. The year was 1841. Young and Ellis left the firm in 1853. It was this year that the store first became known as Tiffany & Company. In 1868 the store was incorporated.

A parallel development involved America's leading silversmith, John C. Moore. He was unofficially associated with Tiffany from the start, for he already had a factory in operation in 1837. Eventually, he became a full-fledged member of the store. In 1868, John C. Moore's son, Edward, was made a director and the Moore silverware factory, in Forest Hill, New Jersey, became part of the Tiffany & Company organization. John C. Moore, in his lifetime, was a master at his craft, and his beautiful handcrafted silverware could not be resisted by the discriminating patrons, long used to purchasing nothing but English silver.

One has only to read the first chapter of *The Tiffany Touch* to realize that the story of Tiffany is also the early history of New York. It makes fascinating reading. The entire era was characterized by periodic riots (it was the Irish in those days). Panic, disastrous fires, and riots prevailed, often all three at the same time. It was during these parlous times that Tiffany opened his store – small though it was. The success of the enterprise from the start revolved around Tiffany introducing Chinese and Japanese merchandise to the New York trade. The novelty of the stock intrigued New Yorkers and sales were brisk.

An entire chapter is devoted to Dr. George Frederick Kunz, Tiffany's first gem expert and distinguished scientist who possessed a Ph.D. in mineralogy. Throughout his lifetime he was the most authoritative practitioner in the world of gems and jewels. Dr. Kunz, never one to hide his light under a basket, maintained, at his own expense, a staff of researchers who for years funneled data on gems and jewels to his attention. He quickly proceeded to put all the information into book form, and his numerous publications are collectors items today. All his publications are now out of print. His *Book of The Pearl* (co-authored with Charles H. Stevenson) is a classic of its kind and will remain so for centuries to come. Dr. Kunz died in 1932. Tiffany did not acquire another Ph.D. in mineralogy until 1949, when this reviewer joined the firm in an executive capacity. Louis de Bebian Moore, then president of the store, was the individual who made this appointment possible.

As a result of this prestigious association, many fascinating contacts were made and unusual situations encountered. My files are replete with data, most of which will not be found in Mr. Purtell's book. To cite a case: One day during the middle 1950's, I received a telephone call from Myron Taylor's secretary (as you will recall he was our Ambassador to the Vatican). Mr. Taylor wished to set up an appointment which was duly arranged. Several days later, Mr. Taylor came in with a shoebox under his arm. He insisted on seeing me behind closed doors. Charles L. Tiffany II's office was then unoccupied, and it was there that the meeting took place. When the box was opened, dozens of pearl necklaces were noted. It seemed that his wife, Anabel, loved pearls. What made the whole collection unique was the fact that the pearls were a mixture of imitation, cultured and oriental – all jumbled together. One necklace he had purchased for $800,000, another for $1,000,000 – at a time when a dollar was worth a dollar and taxes were practically nil! Mr. Taylor wanted the pearls separated and appraised. This was done. It required one month to do the job. Mr. Taylor would have been given every consideration in any event, despite the fact that the $1,000,000 oriental pearl necklace had not been purchased from Tiffany.

An intriguing chapter in Mr. Purtell's book is devoted to Louis Comfort Tiffany, and rightly so. This talented genius was a true artist in every sense of the word. His fame, of course, rests on his creation of Tiffany Favrile glass. L.C. Tiffany had his own manufacturing facilities which were not a part of the jewelry store operation. These glass works of art must have been considered far out when they first were brought into Tiffany. Far out or not, sales over the years proved sensational.

Louis Comfort Tiffany built, in the vicinity of Oyster Bay, Long Island, what must have been in his time the most elaborate living quarters ever constructed in this country. He named the place "Laurelton Hall." After his death, the huge place became an artists' colony, and suitably endowed. Not too long ago, the famous Hall was destroyed by fire and many of the wonderful works of art went up in smoke.

Mr. Purtell naturally discourses, at some length, on the Tiffany take-over. This was the start of the Walter Hoving era. The famous retail jewelry establishment is not what it was but if the merchandising policies seem radical by comparison, the change has been one of expansion and growth. The entire success story today is the success of the chief executive officer, Walter Hoving, who has managed the operation since 1955.

Errors in the book are relatively few. William Tants, who retired in 1971 after 66 years of continuous service with the firm, was associate-buyer of gold jewelry – not a member of the diamond office. Another statement is erroneous. It pertains to the Arkansas diamond crystal. "The story did not come out until years later under a new regime." The reviewer published an article about the diamond crystal in the British journal, *The Gemmologist,* in 1950, during the regime of Louis de Bebian Moore which was five years before Walter Hoving took over the management of the store. The statement that Henry LaCossitt, the author of the *Saturday Evening Post* articles ". . . could not publicize any officer of the store," is not correct. The reviewer's name appeared in Part One of the article.

Joseph Purtell concludes his Tiffany story with Harry Platt's interest in the new, blue Tanzania gem that started out in life as the mineral, Zoisite, and which now has been given the name Tanzanite. Through extensive *Time* and *Life* magazine publicity, the unusual gem became famous overnight. It is truly attractive, and will continue to grow in importance with each passing year. Tiffany's talented designer, Donald Claflin, has created a number of superb jewels around the gem, with the result that many fine sales have been made.

It all seems a fitting conclusion about a remarkable retail jewelry establishment that the public continues to look upon as the foremost of its kind in the world – and rightly so.

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1. *Treasure House on Fifth Avenue,* Henry LaCossitte, *Saturday Evening Post,* Part I – January 24, 1953; Part II – January 31, 1953.

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Developments and Highlights at GIA's Lab in Los Angeles

by

RICHARD T. LIDDICOAT, JR.

Synthetic Opal

On recent visits from Pierre Gilson, Sr. and Pierre Gilson, Jr., we were shown the experimental synthetic white opal they plan to start marketing in the Fall. The pieces we have seen are very attractive. They tell us that a black variety will soon follow. The texture of the white material is reminiscent of tapioca pudding. The play of color is a harlequin type.

Those we tested had an R.I. of 1.44 and an S.G. range of 2.02 to 2.08. We noticed that the hardness is only 4 1/2 on the pieces tested, distinctly lower than the 5 plus of natural opal.

Robert Earnest, of our staff, seems to have found another and safer means of separation. He noted that the white Gilson product phosphoresced for a much shorter period of time after the long-wave ultraviolet light source was turned off. This was in direct contrast to the natural white opals of similar appearance which phosphoresced for a considerable length of time after the ultraviolet was turned off.

Noteworthy Inclusions in Natural Emeralds

We have encountered quite a number of interesting emeralds, both natural and synthetic, in the period since the last lab notes went to press. *Figure 1* shows a rather strong heat wave effect in a natural emerald that was widespread throughout the stone. Inclusions which we believe to be calcite sometimes seem to cause this

Figure 1

Figure 2

effect in natural emeralds, but this was more highly developed than we usually find. Another interesting group of inclusions in a natural emerald is shown in *Figure 2.* Here you see a six-sided platelet that is very thin, and which we assumed was probably mica, although it could be calcite. Another natural emerald showed a rather interesting saw-toothed pattern of color distribution. It is seen best just below the girdle area in the stone shown in a cross-section view in *Figure 3.*

Unusual Inclusions in Synthetic Emeralds

If the inclusion shown in *Figure 4* were in a hydrothermal synthetic

Figure 3

emerald, it would excite no curiosity or comment. However, this is in a flux-melt synthetic emerald, accompanied by the usual inclusions of flux in veillike patterns throughout the stone. This was the only inclusion that bore any resemblance to those that characterize a hydrothermal synthetic emerald. Apparently, we have gas bubbles in solid flux material.

One often examines the inclusions in synthetic emeralds to note anything that bears a resemblance to the three-phase inclusions of the Colombian natural emeralds. Again, in

Figure 4

a flux-melt synthetic emerald that showed many veillike inclusions, these needlelike inclusions shown in *Figure 5* were noted. In the photograph, just above the end of the pointer, one of the veillike inclusions is seen from the side. Just below the line, crossing at the end of the pointer, is seen what appears to be a three-phase inclusion. This was not a three-phase inclusion, but at first glance it certainly appeared to be. The tiny squarish space in one of the tubes was accompanied by, what appears to be, a bubble toward the pointer from the lighter "crystal." This photograph was taken at 126X.

Transparent Pakistani Diopside

Our good friend, Edward R. Swoboda, brought in a typical batch of interesting items for us to examine. Among them were the rodlike diopside crystals from Pakistan shown in *Figure 6* at approximately 3X. These were a pleasing green in color and much more elongated and pencillike than any

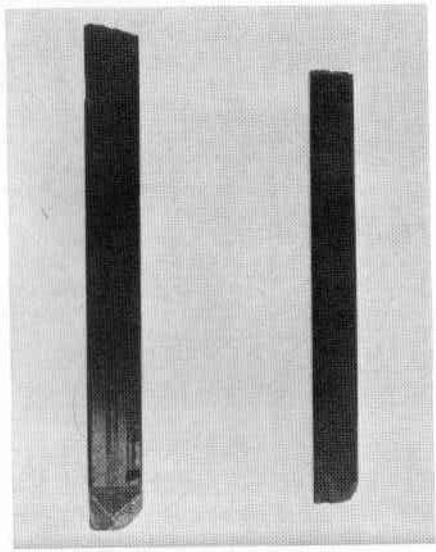


Figure 6

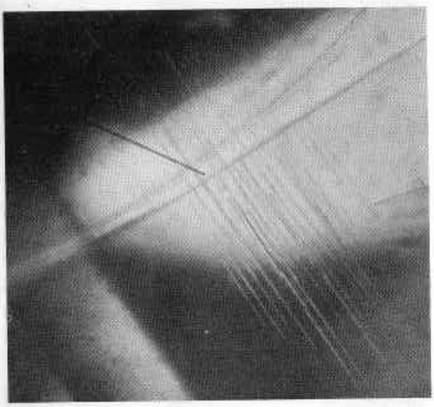
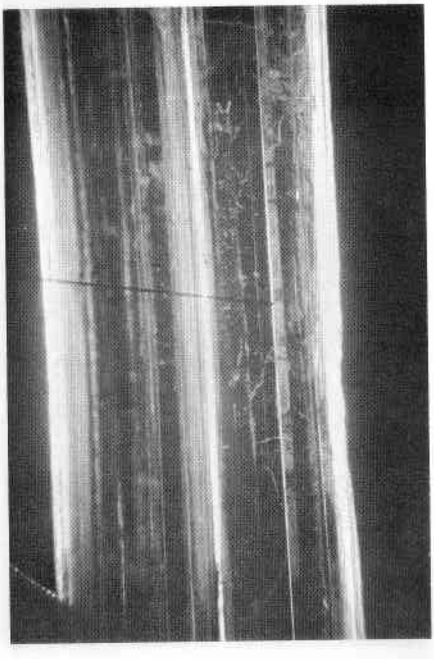


Figure 5

diopside crystals we recall. The longest of the two crystals was 32 millimeters in length.

He also had a large clinozoisite crystal from the same country. It contained some negative crystals that extended the entire length of the crystal. One is shown at the end of the pointer in *Figure 7*. They were rectangular in shape and the largest was close to a millimeter wide.

Figure 7



Sugar-Treated Black Opal

We were interested to have the opportunity to examine a broken sugar-treated black opal, because the break showed clearly the depth of penetration of the black coloring matter. This is shown, both in cross section and from above, in *Figure 8.* The magnification in this photograph is about five times.

Pearl Wear

We received a ring, set with cultured pearls and diamonds, for identification that was of interest because of the tremendous wear to which the cultured pearls had been subjected. They are shown in *Figure 9.* You can see that the erosion has removed the nacre all the way down to, and past, the top of the pegs on which the cultured pearls were mounted. We have seen many worn pearls, but never with such extensive evidence of wear.

Laser Drilling

Despite the advertising and the conversation within the industry that has been devoted to laser drilling techniques to reach and bleach black inclusions, we see few examples in the laboratory. The reason is that most of the diamonds sent in for quality analysis are in the upper 3 or 4 clarity grades. In the low end of the clarity grades, in which laser drilling techniques are useful, there is usually little point in sending them in for analysis. We did receive a marquise for quality analysis recently and noted two parallel laser drill holes on the pavilion. The pointer, in *Figure 10,* marks the surface of the diamond at one hole. The hole starts at about the

Figure 8

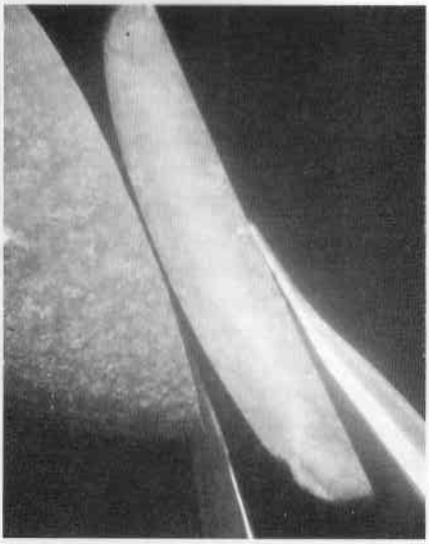
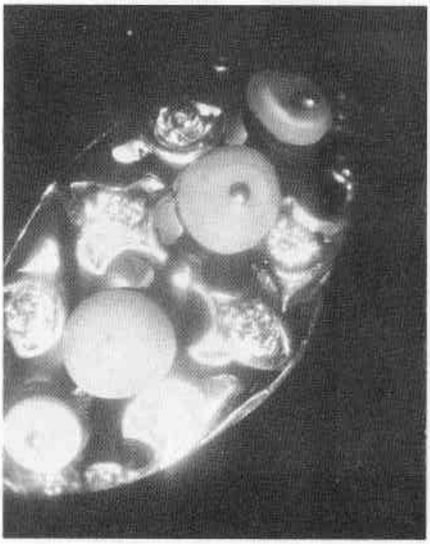


Figure 9



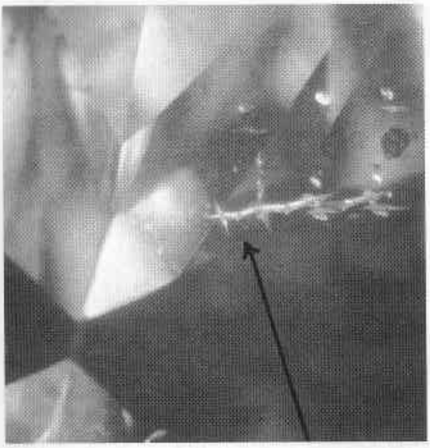


Figure 10

pointer, going in to the left. The apparent hole in the other direction is a reflection. A second drill hole appears to the right of the first, and its reflection is to the right of that.

Table Reflection

Recently we had in for identification an old European-cut diamond that was quite battered, so apparently there was some question as to whether it actually was a diamond. We noted an interesting reflection pattern and a table reflection that was so sharply etched that we photographed it (*Figure 11*). It was the unusual clearness of the edges of the table reflection that led us to take the photograph. You will note that most of the brilliant is out of focus, but only the reflection of the table and stars, well down in the diamond, are sharply detailed at the center of the photograph. Note, also, the eight reflections in the bezels.

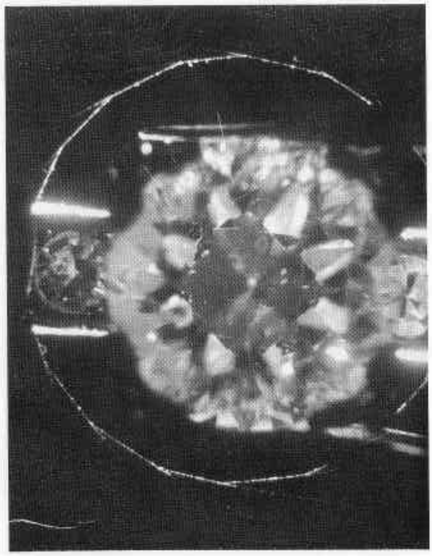


Figure 11

Grain- and Growth-Lines in Diamonds

When grading diamonds for clarity, there is often a tendency on the part of the owner of the diamond to dispute a clarity grade involving growth lines within the diamonds. Such a diamond graded recently showed internal growth lines from which light reflected rather prominently, which is shown under 5X in *Figure 12.* The arrow points to these inclusions which are visible under this magnification in a pavilion facet near the arrow. Since they obviously affect the passage of light, there is no choice but to give them consideration in a clarity grade. There were many others, visible in other directions in the stone, but these were easily photographable and had an effect on our decision.

Emeraldlike-Inclusions in Glass

Figure 13 shows some very angular-looking inclusions in heavy glass that resembled an emerald. This material had a refractive index of 1.67 and a very high specific gravity. There was no question but that it was glass on the basis of spherical bubbles, a singly refracting condition and other factors.

Figure 12

More on Glass Imitations

Another glass imitation is pictured in *Figure 14.* Here we see a number of crystallites in the glass. This had rather low properties that are more common in glass than those of the specimen shown in *Figure 13.* Apparently, this was the result of incipient crystallization in the imitation.

Serpentine Disc

Another item in for identification was a very large disc of serpentine, 11

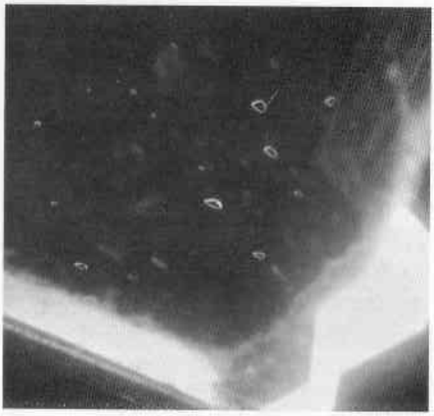


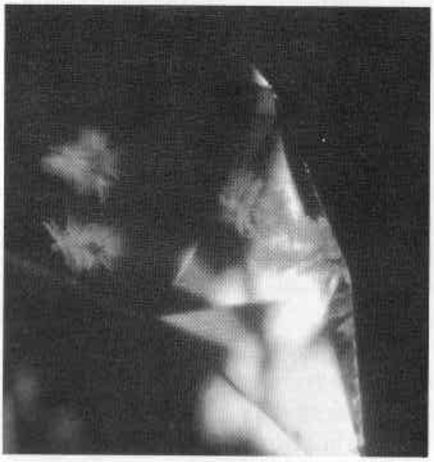
Figure 13

3/8 inches in diameter (shown in *Figure 15*). The floral design on the surface was appliqued and was made up of different gem materials. The basic disc, however, was serpentine.

Another Serpentine

Another identification, that was made at almost the same time as that of the large disc described in *Figure 15,* was a bottle of a white and green

Figure 14



material. This was about 6 1/2 inches tall. The white areas in this bottle showed 4550 and 4300 Angstrom unit absorption lines, which we regarded as characteristic of the white mineral – zoisite. The indices for the white material were 1.69 to 1.70 and the green material about 1.56 to 1.57.

We have seen this green and white combination, resembling jadeite, quite

Figure 15

recently in carvings. When we first encountered it the obvious conclusions, based on the refractometer and spectroscope, seemed slightly improbable, so Chuck Fryer used X-ray diffraction powder to confirm our determination of zoisite for the white mineral and serpentine for the green. Since then, we have encountered the same material several times. The bottle is shown in *Figure 16*.

Figure 16

A Peculiar Aquamarine

Another unusual group of inclusions is shown in *Figure 17* in an aquamarine. The photograph is taken parallel to the optic axis direction and shows a multitude of tiny oval blobs that appeared in a brown color in the blue aquamarine. We have never seen such a proliferation of such inclusions in an aquamarine in the past.

Ingenuity in Testing By A Graduate

Graduate Gemologist Carl Schmieder of Phoenix, Arizona, was called upon to identify a bezel-set black opal to determine whether it was a solid black opal or a doublet. The bezel setting was such that it was impossible to examine the girdle edge. So, Schmieder hit upon the interesting idea of passing a very bright light through the back of the stone to see whether it might assist him in determining whether he was dealing with a doublet or a solid piece. He satisfied himself in an intriguing manner, on which we congratulate him.

Figure 18 shows the stone with overhead lighting. Although it is not a good photograph, it does give an idea of the appearance of the stone under this type of lighting condition. Schmieder decided, that if the material

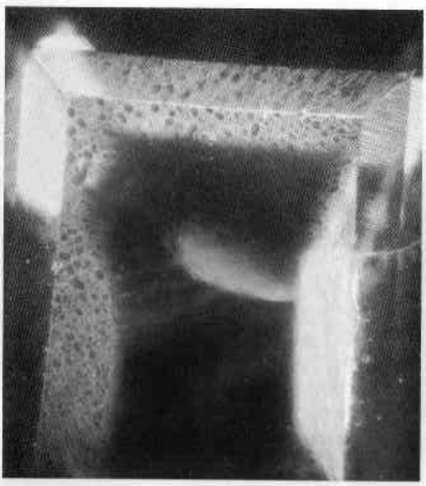


Figure 17

was actually a doublet with a black pitch cement layer – used to impart a black color to the whole – that probably there would be air gaps in the cement. Since the material was translucent, the presence of pitch should be revealed to light from beneath.

Figure 19 shows the appearance of the unidentified stone with back lighting. The white spots, representing bubbles in the pitch layer, show up beautifully. They enabled Schmieder to satisfy himself that he was confronted – not by a solid piece of opal – but a doublet. We congratulate him on his ingenuity.

New Form of Turquois Treatment

Recently, a graduate brought in quite a number of pieces of Indian jewelry many of which had turquois in them. One was of particular interest in

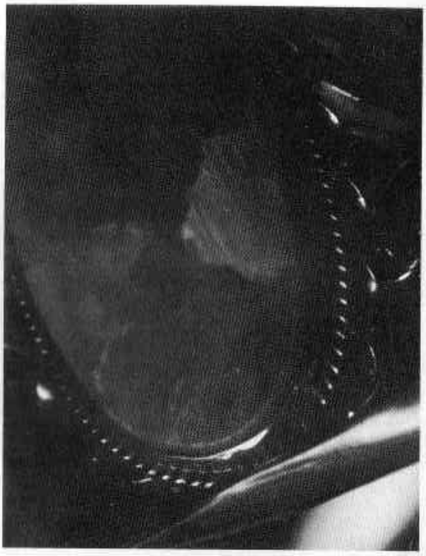


Figure 18

that it had very fine turquois that showed no evidence of treatment in the blue portion, but there were many suspicious looking intensely black areas (*Figure 20*). Our graduate informed us that the source from which the turquois was obtained contained many white areas, so the Indians had used a process to change the white to black.

Synthetic Ruby

It is not really unusual to encounter somewhat angular inclusions in flame-fusion synthetic rubies, but some that were encountered recently in a rather old synthetic ruby were photographed because they do show something that sometimes tends to confuse testers. In *Figure 21,* we see such an irregular inclusion under dark-field illumination, under the table. This is shown again in *Figure 22,* at a different angle, through the crown, against a light background

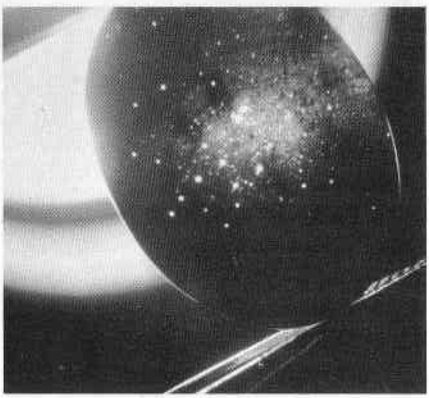


Figure 19

where slightly-curved striae are apparent.

Synthetic Green Spinel

Recently we were asked to identify a material that turned out to be a synthetic green spinel. The absorption spectrum was not common in our experience, so Chuck Fryer made a diagram of the absorption spectrum (*Figure 23*). There is a faint line between 5400 and 5500 Å, a rather strong line between 5700 and 5800 Å, and a more diffused line centered at about 6200 Å. This is in transmitted light.

In reflected light, (*Figure 24*) the synthetic spinel showed a fluorescent spectrum, with a rather bright line near 6800 Å, and a sharp dark line at 6780 Å.

An Interesting Brown Diamond of Natural Color

A 6.05 carat brown diamond was tested, and found to be of natural color. It showed thin, very sharp lines

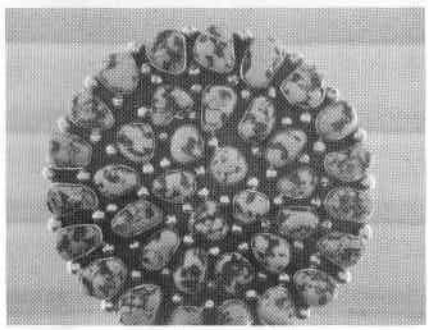


Figure 20

at approximately 5370 and 5760 Å with thin, difficult-to-see lighter lines at 4800 and 4935 Å (*Figure 25*). There was also a very faint line at about 4600 Å.

Acknowledgements

We wish to express our sincere thanks for the following gifts:

To **Marianne Shale**, GIA Resident student, of Shale's Gems & Minerals, Los Angeles, California, for three specimens of moldavite – two faceted

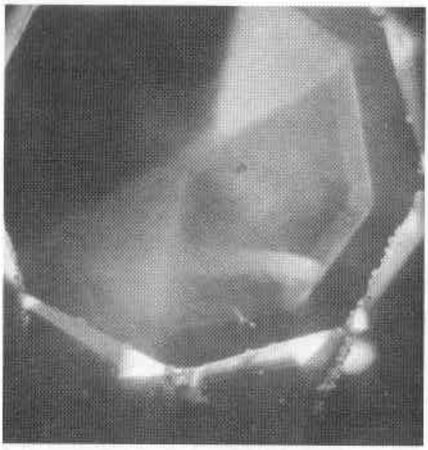


Figure 21

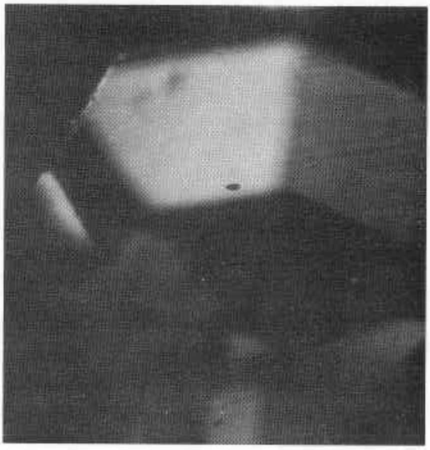


Figure 22

and one rough – from Lhenice, Bohemia, Czechoslovakia, and five transparent colorless faceted grossularites for student study use.

To **Bill Ilfeld**, Montezuma, New Mexico, for three pieces of rough opal for our display case, plus plastic-treated turquois and the type of Mexican opal used for smoke treatment – both of which we had been seeking.

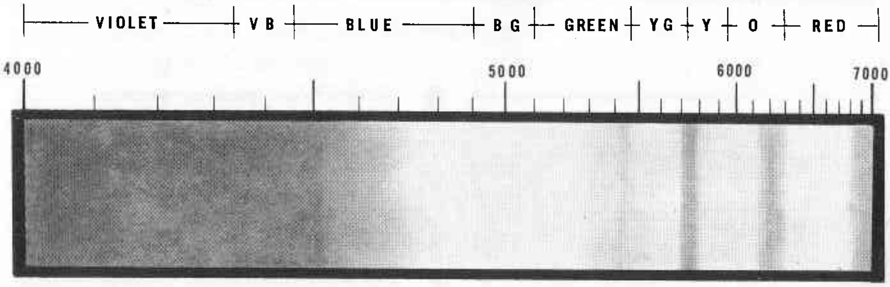
To **Mrs. Binder**, Los Angeles, California, for four stones of smoky quartz. These will be put to good use in our gem identification course.

To **Montri Bunjapamai**, recent Resident Graduate, from Bangkok, Thailand, for the following gifts: heat-treated blue sapphire, two blue natural and synthetic sapphire doublets, rough quartz, and rock crystal with dendritic inclusions. These fine specimens will be useful in our classes.

To **Charles Leutwyler**, Austin, Texas, for an unusual brown- and blue-colored glass stone for our display case.

To **William S. Preston, Sr.**, Burlington, Vermont, who, through James A. Donavan, Jr., Chairman of GIA's Board, gave GIA a fine gem

Figure 23



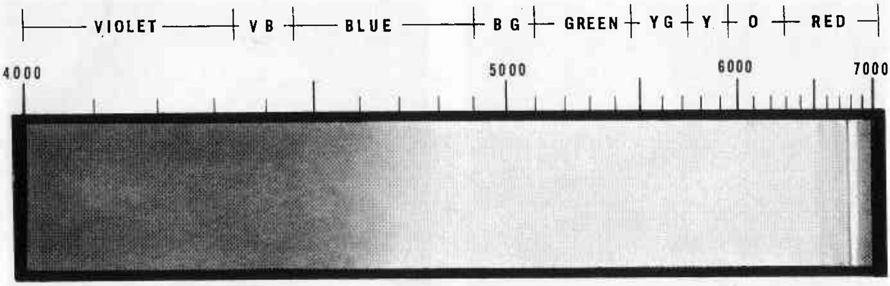


Figure 24

specimen of alexandrite chrysoberyl that will be put to good use by our students.

To **Joseph Hartstein**, Jewels by Joseph, Inc., Costa Mesa, California, for a large assortment of synthetic and natural gemstones consisting of moonstone, emerald, diamond, YAG and a number of other specimens for student study use.

To **E.S. Eastburn**, C.G., Chappell Jewelers, Inc., Wilmington, Delaware, for sending us fifteen lovely color slides of especially attractive gemstones consisting of sapphire, topaz, star ruby, opal and aquamarine.

To **Edward R. Swoboda**, Los Angeles, California, for two nice pieces of chromium sphene from Baha, California, for our display case.

To **Ben Gordon**, G.G., Gordon Jewelry Corporation, Houston, Texas, for a large assortment of synthetic and natural stones. These will be put to good use in our gem identification course.

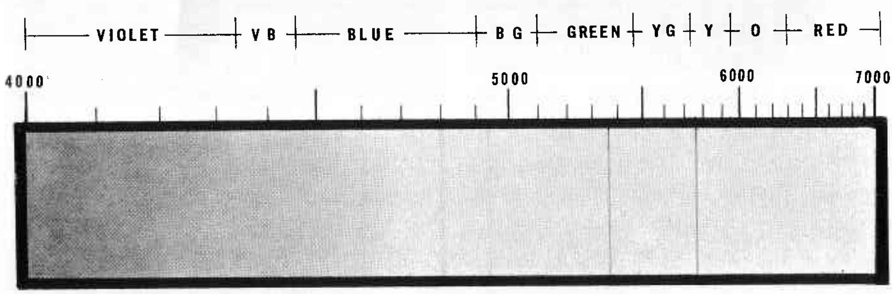


Figure 25

AN INTERESTING FEEDBACK

by I. C. Kislus

In the *Summer, 1971* issue of *Gems & Gemology* we published an article entitled *Diamond Prices of a Century Ago.* This was based on a book that was donated to our library from Bill Bolender of Rockford, Illinois, entitled *The Jeweller's Guide and Handy Reference Book,* a new edition by William Redman, published in Bradford, England, in 1883. Since this book discusses the prices of diamonds, it was possible to compare present-day figures with those that were extant at the time this book was published almost ninety years ago.

Jack McCarley of McCarley Jewelers in Mineral Wells, Texas, sent us a very interesting comparison between 1865 prices and wages for that period of over 100 years ago and todays wages in relation to diamond prices.

The following comments are from his letter:

Re: Your article "Diamond Prices of a Century Ago

1865... One carat diamond $90.00

**1865... Average work week: 72 hours (6 to 6 daily)*

**1865... Carpenter's wages: $4.50 per week or $.06 hourly*

**1865... Carpenter worked 1500 hours to get a one carat diamond. (Guess how many he bought?)*

Estimated Figures

1965... Carpenter @ $4.00 per hour – one carat diamond @ $1,600.00

1965... Carpenter worked 400 hours for his one carat diamond. (And he bought the diamonds too!)

**Source: Industrial & Social History of England, Ed. P. Cheyney, 1921.*

So, in 1965 on 1865 ratio, a carpenter would expect to pay $6,000 for a one carat diamond. Or, in 1865, based on 1965 wages, a one carat diamond would have cost $24.00 – diamonds somewhat high in 1865.

In answer to Jack McCarley's letter we note the following:

"We thank you Jack for sending us the above comparison. It was nice hearing from you. May I add, by 1982 it may only take a couple of hours per carat."

Richard T. Liddicoat, Jr.

Book Reviews

AUSTRALIAN PRECIOUS OPAL by Dr. Archie Kalokerinos. Published by Thomas Nelson (Australia) Ltd., Melbourne, 1971. 51 pages. Clothbound. Illustrated with 128 small full-color photographs. Price: $4.95.

Australian opal mining has long fascinated many adventurous individuals with countless tales of momentous discoveries, instant riches and mystery. While many stake claims and work for perhaps a lifetime, few actually strike seams worth comment.

The story behind the precious opal of Australia is told by an authority, Dr. Archie Kalokerinos, who since 1965 has been dividing his time between the medical problems of the Aborigines and opal mining. Since his first book, *In Search of Opal,* published in 1967, his interest has led him to the detailed knowledge of opal contained in *AUSTRALIAN PRECIOUS OPAL,* including evaluation, terminology, description and classification. In this study, he developed color photography techniques to capture the varied display of the play-of-color inherent in opal, creating some of the most magnificent pictures of opal in existence, (over 120 are contained in this publication). By adding a series of close-up lenses to a zoom lens and then zooming in close, he succeeded in capturing some of the movement as it shone radially from the edges.

This summation of opal mining in the areas of Coober Pedy and Lightning Ridge is a firsthand personal glimpse narrated in a vividly colorful style. Early chapters delve into the day-to-day dealings at the opal fields, providing a deeper understanding of the men behind these operations. Following are descriptive sections on opal formation in relation to the geological structure of Australia. Both surface and trench mining techniques are discussed, as well as the physical nature of precious opal with brief mention of potch and common opal. In the final sections, Dr. Kalokerinos' excellent ideas of a nomenclature based on spectral play-of-color and pattern are presented with the aim of simplifying the laymen's understanding of the gem.

AUSTRALIAN PRECIOUS OPAL is indeed a work rich in romance, technical fact and photographic beauty, destined to find a place in many gem libraries.

THE GEM KINGDOM by Paul E. Desautels. Published by Random House, Inc., New York, 1971. 252 pages. Clothbound. Illustrated with black-and-white and more than 150 color photographs. Price: $17.95.

The natural beauty of gems and minerals is a subject that has long fascinated a vast majority, and will undoubtedly continue far into the future. *THE GEM KINGDOM* by Paul E. Desautels contains general aspects of the gem world supplemented with one of the most outstanding collections of photographs assembled to date. These full-color plates are the work of Lee Boltin whose past record has established his expertise in the field of photography. Those familiar with the color of gems will be pleased and amazed with the exactitude of the photos exhibiting the various phenomena such as chatoyancy, asterism and play-of-color. The degrees of transparency and differences in hue, tone and intensity are captured with a fidelity seldom encountered in gem photography.

As in his earlier book, *The Mineral Kingdom,* Mr. Desautels has opened this with the lore that has interested mankind concerning the curative and mystical powers attributed to gemstones. Consider, for example, the following passage: " . . . From the use of malachite as a powerful local anesthetic to sapphire for curing boils, there was some gemstone or combination of gemstones suitable for treating every ailment."

In the five chapters on natural gems, both the commonly encountered species as well as those falling into the collectors category are discussed. Not only can the reader learn the mineralogical and geological facts, but the cutting and carving techniques as well. One particularly valuable chapter is that which deals with manmade and treated gemstones. With the advanced techniques of manufacture today, some very convincing synthetics are commercially available and an awareness of these stones is necessary to anyone in the stone business.

In the final chapter, an old subject is covered with new dimension, entitled "The Sometimes Green Stone." This story of jade is written in attention-arresting detail, explaining some of the mystery behind this gemstone which has been popular for more than four thousand years. From a gemological viewpoint, the definition of jade and the mineral species considered under this heading are clarified. Mr. Desautels relates the history and painstaking craftsmanship involved in the carving of this very durable material.

In short, we agree with Paul Desautels' statement in his Introduction: " . . . Wherever this love affair between man and gems may lead, the hope is that this book will be a helpful guide. The illustrations have been carefully chosen and devised to add as much of a visual dimension as possible to the survey. For those who know little or much about gems it should provide some new insight into an old but always new story."

DIAMONDS by Sara Hannum Chase. Published by Franklin Watts, Inc., New York City, 1971. 90 pages. Clothbound. Well illustrated with black-and-white photographs.

The young reader will be most interested in this work on diamonds and their many phases. Although geared to the elementary level, there is no lack of solid scientific fact and explanation providing a strong framework for the juvenile reader to build upon. Sara Chase has written an imaginative as well as informative coverage of the diamond from its formation in the earth's crust to its final stages as human adornment or industrial aids to mankind.

One chapter that is sure to hold the attention of the reader is that covering the turbulent history of three famous Indian diamonds: the Koh-i-noor, the Orloff and the Regent. There are also individual chapters devoted to the discovery and mining of diamonds in India, South America and Africa, with brief mention being made of the Russian deposits discovered in 1954.

Modern equipment and production methods are dealt with in detail and richly augmented with numerous photographs, all with excellent captions. The child will learn how diamonds are cut and polished, each step being discussed and well illustrated.

The final section of *DIAMONDS,* especially noteworthy, is a *Glossary of Important Diamond Terms.* The author may be commended on her choice of words and thoroughness contained in this diamond vocabulary.

In short, *DIAMONDS* is an exceptional publication providing a good introduction to a child whose future vocation or avocation may be in the field of gemology.

MINERALS AND GEMSTONES OF NEBRASKA – A Handbook for Students and Collectors by Roger K. Pabian. Published by the University of Nebraska – Conservation and Survey Division, Lincoln, Nebraska, 1971. 80 pages. Softbound. Numerous line drawings and six color plates. Price: Upon request from the publisher.

The University of Nebraska has compiled comprehensive, up-to-date, information on the locations of minerals in its state.

Since the principle purpose of the book is to tell the reader exactly where to find minerals and what to look for when he gets there, the main feature is a fifty-two page section including *Common Nebraska*

Minerals and *Gem and Ornamental Stones from Nebraska.* In this coverage, each mineral species is discussed from a mineralogical viewpoint and detailed location according to county is given with digging sites and sections of stream beds.

The first chapters discuss briefly but clearly some of the more useful clues for identifying gem minerals: hardness, crystal structure, cleavage, fracture, luster, transparency, specific gravity, and color and pattern. Proper tools are essential for mineral collecting and the sections dealing with these items are useful and informative.

A subsequent section gives helpful suggestions for a gem-collecting trip. Final chapters are devoted to guidelines for those minerals considered to be worth collecting and cutting with particular lapidary and fashioning information. A short but helpful glossary, sources for maps and printed material resources and a bibliography are included. The book is enhanced by six full-color plates and many line drawings. It is an attractive example of the value a good artist can add to both clarity of text and visual appeal.

MINERALS AND GEMSTONES OF NEBRASKA is a useful, practical, easy-to-understand book for the serious gem collector.