ACCREDITED GEMOLOGISTS ASSOCIATION NEWSLETTER

VOL. 2, NO. 1 APRIL, 1977

P.O. Box 2563 Hyattsville, Maryland 20784 JOEL E. AREM, Ed.

*TO DEVELOP AND PROMOTE PROFESSIONAL STANDARDS IN THE PRACTICE OF GEMOLOGY*

1977 promises to be an eventful year for the A.G.A. Incorporation as a non-profit organization is in progress, and some very good publicity is imminent. Specifically, a news release is due to appear in the April issue of the Lapidary Journal. In addition, Harry Wheeler of the Gemological Association of Great Britain has agreed to include a short release in the next issue of the Journal of Gemology. The GIA has a policy of not advertising anything for anybody, so it seems word of mouth may be the publicity vehicle for reaching GIA graduates.

The format of the current newsletter is both an indication of our direction and a vehicle for rapid communication among gemologists. I cannot strongly enough emphasize the need for participation by all AGA members. This organization, like any organization, is only as viable and articulate as its members wish it to be. Articles, news notes, comments, etc. for the newsletter are ALWAYS welcome, not only just before preparation of a new issue. If you, as a gemologist, run across something that might be of interest to others in the profession, write it down and send it in. If we ALL do that, the newsletter will become a vehicle for rapid, unencumbered communication among AGA members.

The EXCHANGE MART is a new feature that I hope will be increasingly used. The format is simple: if you have anything to buy, sell or exchange of gemological interest, write the information and send it in for publication. For now, we will forego costs for this service. If the mart reaches a size where additional pages have to be printed, we will probably charge a nominal (50¢) fee just to cover the additional costs of printing and postage.

We hope that as time goes on and membership grows we will be able to organize local meetings. Currently, regular AGA meetings are held in Washington, D.C. because many of the members are concentrated here. Suggestions from the membership regarding programs, meetings, trips, etc. are always welcome. Suggestions of ANY kind are always welcome.

Membership can rapidly be improved if every existing member will contact another gemologist he or she knows who is not in AGA. If this is done, successfully, on a regular basis, the growth curve is exponential in powers of 2: 28 members becomes 56, then 112, then 224, and so on. There are several thousand GIA graduates and FGA-s in the U.S. There is no single, handy listing of these people - and it's time there was, namely, the AGA membership list! Of course, this list is only available to AGA members.

The next meeting of AGA will be held on May 18, at 8 PM, in the Hamilton Room of the Sheraton Park Hotel, Woodley Road, Washington, D.C. The meeting is being held in conjunction with the International Gem and Mineral Show which begins the next morning. Many gemologists come to Washington for this show, so it was decided to hold the meeting at a well-known place (easy to find) and at a time convenient for the show attendees. The featured speaker at this meeting is Joseph Tenhagen, F.G.A., G.G., who is a leading expert on Colombian emeralds. Joe has visited all the mines, knows the localities and the stones, and is going to give us a complete update on the emerald mines in that part of the world. This will be a superb, slide-illustrated talk you will not want to miss, if you can get to D.C. on May 18. Refreshments will be served. Washington AGA members look forward to seeing you here!

J.E.A.

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<u>NOTICE</u>: Now available, SYNTHETIC GEM MATERIALS by Michael O'Donoghue. This is a 215 page, large format, soft covered book (see next page for review). It is the most comprehensive book on the subject available.

Order from: WORSHIPFUL COMPANY OF GOLDSMITHS, Central House, Whitechapel High Street, London, E. 1, ENGLAND

SYNTHETIC GEM MATERIALS by Michael O'Donoghue (1976) REVIEW

There is a paucity of information on synthetic gem materials available to the gemologist. The literature of crystal growth is very technical, and the simplifications that appear in lapidary magazines are usually too thin to be useful. Mike O'Donoghu, an Elected Fellow of the Gemological Association of Great Britain, and perhaps the leading specialist in Europe on synthetic gemstones, has produced a very comprehensive compilation of data. The information is in the form of reference cards, each listing a synthetic material, the color (where relevant), the manufacturer, growth data and a summary of properties where these have been reported, plus the original reference in the literature. The book consists of offset images of these cards, laid out 10 to a page, so there are nearly 1,800 references included. The arrangement is alphabetical by name of the substance described.

The only possible objection to this work is the cost, which was apparently elevated due to technical problems in layout and printing. The price of £ 12.00 (about $20) is steep considering the lack of illustrations and soft cover. But, if you really have to have a very complete guide to the literature on synthetic gem materials, this is the only such book available. It is well done and packed with information.

When ordering (see page 1 for address), include the following for postage:
in England: Parcel Post = £ .75 Europe: Letter post = £ 2.80, Printed Matter = £ 1.20
Other Areas: Surface Printed Matter = £ 1.20, Air Printed Matter = £ 4.00

(JEA)

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MINUTES OF AGA MEETINGS Dale E. Farringer, G.G., Secretary

A special meeting of AGA was held on November 11, 1977 at the residence of Sonja Schwartzman, to tally the ballots received in accordance with election of officers. Sixteen (16) ballots were received, and the following persons were duly elected:

Joel E. Arem, Ph.D., F.G.A. - President
Sonja S. Schwartzman, F.G.A. - 1st Vice President
Tomiko S. Butler, F.G.A. - 2nd Vice President
Dale E. Farringer, G.G. - Secretary
Carmen Gianforte, G.G. - Treasurer

There was a discussion of suggested changes in the By-Laws. The principal change, executed by a majority vote, was related to membership. In addition to Graduate Gemologists (GIA) and Fellows of the Gemological Association of Great Britain, membership is now open to holders of the GIA "Gemologist" diploma (these people have completed all requirements for the GG, but have not completed the two-week "in residence" training at GIA labs).

The President appointed a Membership Committee, to consist of: Tomiko Butler, Dale Farringer and Gene Rooney.

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A regular meeting of AGA was held at the George Mason Regional Library, Annandale, Va. on March 2, 1977. The meeting was called to order by President Joel E. Arem at 8:15 PM. Fourteen persons attended, including 5 visitors.

The Treasurer, Carmen Gianforte, reported a balance of approximately $200 in the AGA account. Joel E. Arem announced that several applications for membership had been received. Also, he urged members to send in contributions to the AGA newsletter by March 25. One excellent article on the Tutankhamun exhibit at the National Gallery of Art, had already been received. The President also informed the group that correspondence had been received from Harry Wheeler of the Gemological Assoc. of Great Britain and Richard Liddicoat of the GIA regarding publicizing the existence of AGA. Some publicity appeared in the February, 1977 issue of the Lapidary Journal. Additional publicity is scheduled for the April issue.

The evening's study program related to the use of the spectroscope in gem identification. (an excellent summary of the work session by Mary Helne appears later in this issue).

The meeting was adjourned at 10:15 PM.

NOTES ON GEMSTONE HOLDERS by Louis Harris, Gemologist

Many of us have used gemological microscopes made in the U.S. and Great Britain, and have, at times, been frustrated by the inability of the gemstone holder provided with the microscope to properly grip a faceted gem at the girdle. The inside contour of the holder is smooth metal; lack of friction causes the stone to slip and sometimes even to fly out of the clamp. This recurrent frustration, plus the experience by the writer of losing a stone on the GIA Final Exam, prompted some thought on the matter. It would be of considerable help, it seemed, if the manufacturers could mold a cross-hatch pattern on the inside surface of the gem holder, much like the design of diamond tweezers. Unfortunately, this would take some expensive tool reworking to accomplish. Perhaps such a change will be forthcoming when present dies have to be replaced.

In the interim, the writer has been experimenting with simple modifications of the existing holder to improve its "hold". Various materials have been glued or epoxied into the holder so that stones do not come into direct contact with the curved metal surface. The simplest materials seem to work the best. Strips of rubber bands, bits of woven material and even small swatches of steel wool all do the job. Even epoxy glue itself has just enough resiliancy to allow the girdle of the gemstone to "bite" into the holder rather than slip.

I suggest that if you try any of the above materials, you prepare the inside of the metal holder by scratching it in several places with a knife or other sharp tool. This will help the glue adhere to the metal surface.

Perhaps another gemologist reading this article has solved the problem in a better way. Suggestions and solutions to this and other gemological problems should become a regular feature of the newsletter.

(ED. NOTE: I agree! One other related problem should be mentioned here. I have found that the rough metal inner curve of the GIA microscope gem holder throws reflections into a diamond. These are extremely annoying, and make imperfection grading much more difficult. I would suggest that the surface of the holder be smooth and nonreflecting, as well as having good gripping qualities. I would suggest that the ends of the stone grippers be coated with silicone rubber, available in tubes. This will stick very well to metal, not require gluing, and harden to a smooth but very resiliant surface that will easily grip a stone girdle. Further comments and suggestions are welcomed from readers of the newsletter. We would like to see regular contributions to the newsletter on the subject of gemological instrumentation.)

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MAXIXE TYPE FADEABLE BLUE BERYL by Helen MacLeod, F.G.A.

There is generally a time lag between the discoveries made by the scientific community and widespread awareness of the implications of these discoveries on the part of the jewelry industry. This is certainly the case with Maxixe-type, fadeable blue beryl, which is still being sold at rather high prices.

A deep blue colored beryl, with a color tending toward indigo or sapphire-blue, was first found in 1917 in the Maxixe Mine, southeast of Arassuahy, in northeastern Minas Gerais, Brazil. However, it was found that the color faded rapidly on exposure to light, and the mine was abandoned and the location lost. In 1972, Robert Crowningshield of the GIA labs in New York reported a beryl with similar characteristics to the Maxixe beryl, that was appearing in the gem trade. This material was intensively investigated, and the nature of the coloring mechanism eventually determined. Details of the work were published by Dr. Kurt Nassau and his associates at Bell Telephone Laboratories in New Jersey.

The coloring mechanisms for the original Maxixe beryl differ from those present in other dark blue fadeable beryls. The absorption spectra are slughtly different. One key characteristic of Maxixe beryl is that the intense blue color is carried by the ordinary ray, while in aquamarine the blue color is in the extraordinary ray.

(Maxixe beryl - continued)

Maxixe-type blue beryl is distinguishable from aquamarine by its dichroism. Aquamarine displays a blue and a white window representing dichroscope windows of opposite polarization. In Maxixe and Maxixe-type beryls a blue color is seen in both windows of the dichroscope. In addition, the specific gravity of Maxixe-type beryl is 2.8 as opposed to the 2.7 of aquamarine. Spectroscope examination may be helpful, but is not advised as the heat of the spectroscope lamp could fade the blue color of Maxixe-type beryls.

It has been discovered that beryls containing certain chemical compositions can be made a dark blue color through irradiation with gamma rays, as well as X-rays and neutrons. A percentage of all pale colored beryls can be so treated, but morganite seems especially susceptible. Irradiation may produce a dramatic color, resembling fine sapphire, tanzanite, synthetic blue spinel, or top color aquamarine. Ultimately such irradiated beryls fade back to their original pale color, but the blue coloration can again be restored by irradiation. Maxixe-type beryl can be distinguished with the dichroscope from tanzanite, because of the unique purple color displayed by the latter. In sapphire the extraordinary ray will have a blue-green color.

The Jewelers' Vigilance Committee now advises that Maxixe-type beryl can no longer be sold as aquamarine. The treated morganite is currently being marketed as "Halbanita", a name derived from the company producing the material. It is important for the gemologist to be aware of these fadeable beryls, and to be suspicious of any stone that checks out as beryl but has a blue color different from that of normal aquamarines.

REFERENCES:

Nassau, Kurt et. al.(1976) The deep blue Maxixe-type color center in beryl. Amer. Mineralogist, 61, 100-107.
(additional references are found at the end of the above article)
Gems and Gemology: Winter 1972-3 (R. Crowningshield)
Spring, 1975 (Nassau - origin of color in gems)
J. Gemmology: Oct.,1973 (p. 293: A.E. Farn, Blue beryls which are not aquamarines)
Lapidary Journal: Aug., 1964, p. 589 (Nassau - color centers)
April, 1974, p. 20 (Nassau - effect of gamma rays)

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GEMOLOGICAL NOTES AND NEWS by Joel E. Arem, Ph.D., F.G.A.

We are all aware of the incredible price rises happening in diamonds (no surprise - the Cartel specifically waits for strong markets before pushing prices up; if there is no major slack in demand, they push prices still further). Reports coming in tell of an approximately 40% rise in prices (internally) in Brazil, due to rampant inflation. It is expected that this will be reflected in a rise of about 25% in prices of all stones coming out of Brazil. I thought aquamarine just could not possibly go any higher. It seems I am wrong! Be prepared to reprice a lot of inventory just to keep up with replacement costs.

I had the pleasure of a week-long trip to the Dominican Republic. The amber is fine quality, produced in large quantity, and in large sizes. Colors range from yellow to fine deep red, some very transparent. Many pieces are loaded with insects of various types, and some of the amber displays a distinct, intense blue sheen in reflected light.

Also from this island is a unique material, sold to local tourists as "Larimar". This is, mineralogically, pectolite, and nowhere else in the world does it occur in large quantities in a form suitable for cutting. I am currently investigating this gemstone and will report at a later time. Marketing outside the Dom. Republic will be carried out by Multifacet, Inc. of Maryland.

For the rare-stone buffs: nambulite and jeremejevite from S.W. Africa, in gem crystals, have appeared on the market. The former is bright orange, the latter blue-green, both incredibly rare.

## SOME PRACTICAL TIPS ON THE USE OF THE SPECTROSCOPE by Mary Helne, GG, CG

These paragraphs are based on a demonstration given by Joel E. Arem at the AGA meeting on March 2,1977, at which time the spectroscope became a less mysterious and more potentially practical gem identification aid to all present. We were fortunate to have two GIA spectroscope units at our disposal that evening, and that is the instrument I shall refer to. For alternatives, see GEM TESTING by B.W. Anderson and Richard Liddicoat's HANDBOOK OF GEM IDENTIFICATION.

First, you must decide whether to use transmitted light, for transparent and translucent stones, or reflected light for stones which are opaque or semi-opaque. The light should be focused so that the very sharpest possible beam is reflected or transmitted through the gem. When using transmitted light you can achieve this by using the iris diaphragm, turning the light focus control, and lining up the light source so that the beam is centered just above the middle of the right angle prism surface, from which it will be reflected upward to pass through the stone. Replace the diaphragm, adjust the iris opening so that it is just a bit smaller than the stone, and place the gem to be tested on the opening. Only light transmitted through the specimen should be allowed to reach the spectroscope slit. When testing an opaque or semi-opaque material using reflected light, you should raise the light source to focus the light directly on the stone, from where it will be reflected to the spectroscope slit. Reflected light may also be used when a metal mounting makes it difficult to use transmitted light. For most gem testing the voltage selector knob may be turned to 7.5, but if the beam is too bright the voltage should be reduced. A word of caution - the light generates a great deal of heat, even though some of it is absorbed by the prism. Take care not to leave the gem in the light path for an appreciable length of time, especially if the gem is heat sensitive, or if you don't know whether it is or not! Also, overheating of some stones, such as treated diamonds, may alter the spectrum and lead to erroneous conclusions. Heat may actually cause fading in some irradiated gems. Overhead fluorescent light and other ambient light should be eliminated to avoid confused readings. A completely darkened room is best for spectroscopy.

The light being reflected or transmitted passes through the spectroscope slit, which may be regulated by a slit adjustment knob. As you look through the spectroscope, turn the knob away from you slowly and the colors of the spectrum will become visible, beginning with the red at the right side of the scale. As more light is allowed to enter the slit, the blue and violet end of the spectrum will appear. Note - the European custom is to view the spectrum with the red end at one's left. Absorption diagrams in Anderson's book, for example, should therefore be inverted to make them correspond to the image seen in the GIA instrument. When the slit is closed down completely, the spectral colors vanish, starting with the violet and ending with the red. An Angstom scale in the GIA instrument is illuminated with a switch at the right of the voltage selector. Just before the slit is completely closed, horizontal lines may appear running left-right across the spectrum. These are caused by dust in the slit's jaws and do no harm; in fact, they are a useful way of telling if the slit is open too wide. For the clearest readings, the jaws should be opened until these lines just disappear.

The entire spectrum will not be focus all at once. The focus of absorption lines in different portions of the spectrum is regulated by the spectroscope draw tube. To focus at the red end, pull out the draw tube 1/8 to 1/4 inch; push the draw tube all the way into its housing to see lines in the blue and violet end of the spectrum. The scale itself may be focused with the wave length draw tube, located to the right of the spectroscope unit itself.

Some examples will illustrate the use of this instrument. In testing untreated green jadeite, you must look for absorption bands at both ends of the spectrum. All jadeite will show a line at 4370 A.U. (Angstron Units); however, some very intense green jadeite absorbs heavily in the blue, masking this line. The draw tube should be pushed all the way in and the slit opened so that the blue area of the spectrum is well illuminated. The, gradually close the slit until the 4370 line is in sharpest focus.

Spectroscope - continued

At this time the chrome lines in the red will probably not be in clear focus. Pull the spectroscope draw tube out about 1/8 inch to reveal the step-like lines at 6300, 6500 to 6600 and at 6900 A.U. in sharpest focus. Dyed green jadeite will still show the iron line at 4370 A.U., but instead of the characteristic lines in the red, there will be a smudged band between 6450 and 6800 A.U. Nephrite will not show the 4370 line, but an intense green nephrite will show lines at about 6500 and 6820. The "Imori Stone" (a clever and attractive imitation of jade made of partially devitrified glass) which we tested at our spectroscope session, showed no particular absorption pattern.

Our spectroscope study session included examination of some very interesting and rare gemstones, including sinhalite, actinolite, cuprite and manganotantalite. This latter stone, an extremely rare and beautiful maroon-red faceted gem, has a unique absorption spectrum. There is complete absorption of blue up to about 4900 A.U., and strong lines are visible at 5500, 6900 and 7000 A.U. Indeed, life would be much more interesting for the retail jeweler if his customers frequently brought him such stones for identification and appraisal. However, the spectroscope in our lab is more often used for jade identification problems such as those I have mentioned, the separation of treated and untreated colored diamonds, distinction of natural and synthetic corundum, and for quick identification and separation of large numbers of garnets and other gemstones. Once, much to our surprise, we identified a piece of synthetic blue quartz conclusively on the basis of bands, due to cobalt, at 5450, 5800 and 6350 (approximately - these are all broad bands). These lines are always diagnostic of synthetic material, since cobalt is not a coloring agent in any naturally-occurring gemstone.

One identification problem that requires some skill and care is the detection of treatment in canary diamonds. The elusive line at 5920 A.U. is an indication of treatment, while in a naturally-occurring stone a strong line at 4155 in the deep violet end of the spectrum can be seen. Some natural intense canaries show no absorption, however, and the 5920 line of the treated diamond may be lost if the stone is heated while being examined. As pointed out at our meeting, the natural colored diamonds what turn green in transmitted light can be very troublesome. The 4155 A.U. band can be lost due to overheating, and lead to the false conclusion that the stone is treated. We learned from the GIA in New York that it is a good idea to refrigerate these stones briefly or cool them on dry ice before they are tested.

Liddicoat and Anderson, in their excellent books, have done a thorough job of cataloging gem spectra. We should try to be aware of the limitations of the spectroscope, and which spectra are conclusive in gem identification. The continued progress in the area of synthetic gemstones is cause for continued alertness and reliance on powerful gem testing methods, such as the spectroscope. As additional man-made gems are produced, especially those with refractive indices above the range of the refractometer, the spectroscope will become an increasingly valuable tool to the jeweler-gemologist.

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<u>NOTICE TO ALL AGA MEMBERS</u>!! Please remember that we need your dues for 1977. The funds are our only source of revenue and make possible the printing and distribution of this newsletter, as well as membership cards, certificates, various forms and all postage costs. Please remit $15 for 1977 to:

Carmen Gianforte ,c/o Janet Post Antiques, P.O. Box 951, Columbia, MD. 21044

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Dr. Joel E. Arem, AGA President, is the 1976 winner of the Tully Memorial Medal of the Gemological Association of Great Britain. This award is presented to the person submitting the best paper in the Diploma Examination of the Association, when the examiners consider the paper to be of sufficiently high quality. Dr. Arem is the first American ever to win the Tully Medal, which has been awarded since 1930.

# TUTANKHAMUN'S TREASURES

T. F. Zook

On November 17th, the National Gallery of Art in Washington, D.C. opened to the public an outstanding exhibition which will have a special interest to those gemologists and jewlry craftsmen who have an opportunity to see it either in Washington, Chicago, New Orleans, Los Angeles, Seattle, or New York City(between now and April 15, 1979). The display is based upon fifty-five carefully selected objects from among the 5,000 found by the British archaeologist Howard Carter at the conclusion of a ten year search when he at last in 1922 discovered and opened the tomb of the boy Pharaoh Tutankhamun (TOOT-AHNK-AH'-MUN). This tomb of the XVIIIth dynasty (1570-1294 B.C.) New Kingdom Pharaoh was located in the Valley of the Kings outside of Luxor, Egypt in the Nile Valley some 900 miles south of modern day Cairo.

The visual impact of the exhibit owes much to the skilful use of photographic murals based upon pictures taken on the scene at the time of the discovery by Harry Burton and to the tomb-like atmosphere evoked by the museum's presentation which gives each visitor a feeling of standing with Carter and Lord Carnarvon at the actual moment of the opening of the tomb. Subsequent stages of the archaeological labors and discoveries in the four rooms which comprised the tomb are presented with the same impact.

Tutankhamun ruled only nine to ten years having succeded c. 1334 B.C., as a boy about nine years old, to the chaos left by the religious and administrative revolution undertaken by his predecessor and father-in-law Amenhotep IV ( AH-MEN-HO'-TEP) also known as Akhenaton (AH-KUN-AH'-TUN). Tutankhamun's rule was shared by his wife Ankhesenpaaten (AHNK-ESS-EN-PAH'-TEN), the daughter of the Pharaoh Akhenaton and his Queen, Nefertiti. Ankhesenpaaten as queen strengthened Tutankhamun's claim to the throne.

Tutankhamun, who had ascended the throne as Tutenkhaton ("Living image of Aton"), was able to keep his throne only through many compromises to accomodate to the political and religious tensions which prevailed in this period between the monotheistic elements favored by his predecessor and the polytheistic tradition supported by the powerful Theban Amun priesthood. These compromises included: the transfer of his court to Thebes after the third year of his reign; the resumption of Amun worship; the changing of his name to Tutankhamun( "Living image of Amun") and the changing of his queen's name to Ankhesenamun (AHNK-ESS-EH-NAH'-MUN) to show that they too had at least officially switched their devotion to Amun.

While the exhibit has a wealth of interesting aspects from the point of view of history, archaeology, and artistic appreciation in general, there are many elements in it which will undoubtedly have a particular fascination for those who have a specialized background in gemology and jewelry design and production. Particularly interesting to the gemologist is the jewelry found in Tutankhamun's tomb. The stones thought fit to adorn a Pharaoh included lapis lazuli (probably imported from Badakhshan in Northeast Afghanistan), red carnelian and the green feldspar amazonstone both from Egypt's Eastern desert, turquoise from the Sinai, and rock crystal, calcite and chalcedony from Egypt. Also in this display of jewelry is found evidence of the use of red cement applied as a backing on both quartz and calcite to alter the color seen through the stone. Further, we find the artistic use of imitations to simulate real gemstones. Much of the inlay work on the pectoral necklaces was composed of glass used to imitate turquoise, carnelian, jasper and lapis lazuli. Egyptian faience (FAH-YAHNSE') techniques had developed as early as predynastic times (before 3100 B.C.) when it had been discovered how to fire a powdered quartz into a compact substance with a vitreous glaze. A mixture of sodium carbonate and bicarbonate and other sodium salts (the mixture was called natron) was used as a flux or binder. Many ancient Egyptian green and blue beads were made of faience colored by copper compounds. Later faience was also made with black, red, white, yellow and lilac colors. An excellent example of turquoise blue faience is the udjat Eye of Ra Pectoral with its granulated gold and turquoise blue faience beaded necklace.

Another material used to imitate gemstones in beads and inlays was glass. It was highly prized in its own right as a decorative element since it was at that time relatively rare and represented a distinct advance in contemporary technology. Akhenaton had a glass factory at Tell-el-Amarna and archaeological studies by Petrie revealed that the usual method of making beads was by winding threads of molten glass on a copper wire. Petrie also found that glass was pressed into moulds. Examples of both faience and glass beads can be seen in the Flexible Beaded Bracelet which has a carnelian udjat eye (Catalogue No. 21) while polychrome inlay of glass in imitation of turquoise, jasper and lapis lazuli can be seen in the Flexible Broad Collar of the Vulture Goddess Nekhbet whose talons grasp the sign for infinity inlaid with red and blue glass (Catalogue No. 23). The golden earrings, found in the cartouche-shaped box. which had probably been worn by Tutankhamun as a child have bird heads made of transparent blue glass which show an included traditional tell-tale bubble. The bodies and wings of these hybrid birds are inlaid with quartz, calcite, colored faience and blue, red, white and green glass (Catalogue 29). The studlike earring clasps have a hemispherical button of transparent glass with a rather indistinct portrait of Tutankhamun made from particles of fused glass. Glass was often used together with authentic stones in the same piece of jewelry and another good example of this is the Necklace with Vulture Goddess Nekhbet where the golden chain has lapis lazuli inlay while the inlay on the vulture is made of blue and red glass (Catalogue No. 24). Glass making techniques declined after the end of the XVIIIth Dynasty and were not revived until after the Fourth Century B.C. when Alexander the Great had founded Alexandria.

The magnificent Necklace with Lunar Pectoral and gold and tassle beaded counterpoise (Catalogue No. 31) is a masterpiece of Egyptian jewelry. The moon and crescent were made of electrum, a gold alloy containing up to a fifth part of silver. In contrast the light reddish gold seen in the Openwork Buckle (Catalogue No. 6) which portrays Tutankhamun returning in his chariot was made of a gold which had been surface tinted by applying a thin film of either iron oxide or iron pyrites and soda and in this case scraping some of the film away (had the tint been left at full strength a definite rose red color would have been seen). The skill of the Egyptian goldsmith in applying gold granulars can be seen on the horse's blanket and bridle. This technique was accomplished over a charcoal brazier using a blow pipe and probably a colloidal hard soldering process possibly based upon copper carbonate in the form of ground up malachite. Also, be sure to note the gold work on the hinged lapis lazuli Scarab Bracelet (Catalogue No. 32) which Tutankhamun also probably wore during his lifetime. The solid Gold Beaten Mask (Catalogue No. 25) of Tutankhamun with its gold and glass striped blue imitation lapis lazuli head dress is also worthy of study.

The Egyptian jeweler had mastered the techniques of lost wax casting, repousse( REH-POO-SAY'), chasing, embossing, engraving, cloisonné( KLOY'-ZOE-NAY), and inlay. The master goldsmiths enjoyed royal patronage and some of them lived well enough to have pretentious tombs. Lasting references can be secured through the purchase of I. E. S. Edwards' pamphlet TUTANKHAMUN'S JEWELRY and the official catalogue of the exhibition TREASURES OF TUTANKHAMUN either at the exhibit or by mail from the Metropolitan Museum of Art, Box 255, Gracie Station, N.Y., N.Y. 10028. The Tutankhamun Engagement Calendar with its wonderful colored pictures for $3.75 plus $1.25 postage and handling also from the Metropolitan Museum of Art makes a nice gift.