



CORNERSTONE

Journal of the Accredited Gemologists Association

Technology Today

SPECTROPHOTOMETRY IN GEMOLOGY

Focusing
on the Future

By John Allaman
Osprey, Florida

We have the ability to differentiate among crops growing in fields from over 1000 miles up in space. We can identify single plants in a forest that is otherwise impenetrable. Analysis of chemicals with concentrations as low as one part per million are detected quickly and accurately, providing evidence strong enough to stand up in court. What does this have to do with gemology? *Everything*. These technological advances depend upon spectral analysis.

The next generation of gemology is upon us. Technology, not only allows, but is requiring us to utilize its many benefits to our advantage. Gemological Sciences as founded by Archimedes, Bauer, Anderson and Webster will never be abandoned, but today we can accomplish things that the founders could scarcely dream. Integrated hardware and software can now accomplish in a matter of seconds what once took hours of intense scrutiny. Gemology has met the race-horse of the information age.

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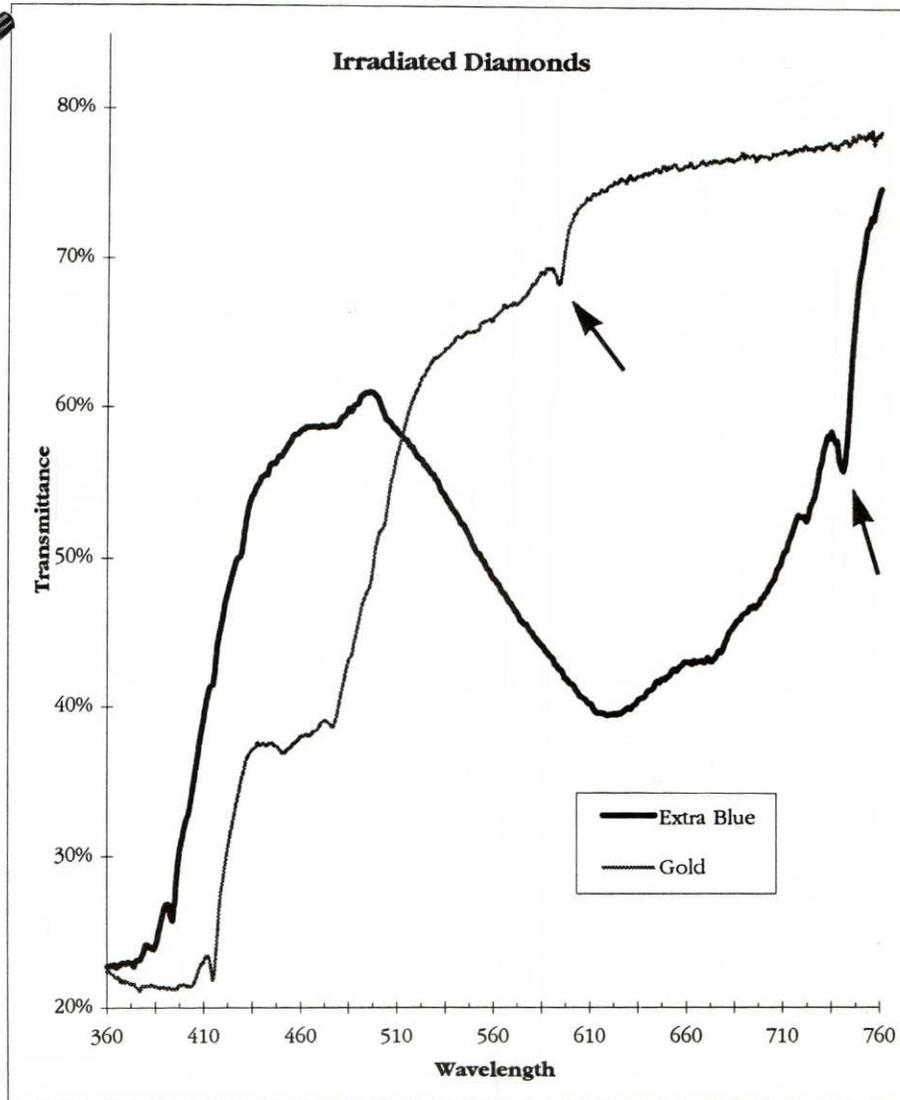


FIGURE 1. *Irradiated Diamonds.* At room temperature the 594nm line is visible on the Gold diamond, while the 741nm line is readily visible on the Blue diamond measured here.

AGA is a nonprofit research, education and ethics organization, benefiting professional and avocational gemologists as well as the consumer interest. Membership programs include advanced gemological education seminars, professional computer software reviews and workshops, and the AGA-Certified Gemological Laboratory Program.



CORNERSTONE

is a quarterly publication of the **Accredited Gemologists Association**. Paid for through membership dues, this publication may not be purchased commercially. The opinions expressed within are those of the individual authors. AGA can assume no liability for these statements, which are offered entirely for the purposes of informed professional discourse and education.

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With this issue of *Cornerstone*, the Editor offers her sincere thanks to friends and colleagues in AGA. The Editorial position is now open. To apply, contact Leo J. Schmied, 615/966-0580.

President's Corner

Leo J. Schmied, AGA Acting President

I wish to thank everyone for their hard work during my term of office as your First-Vice President and Acting President. I believe we have made significant progress this year and will continue to do so.

AGA is a volunteer, nonprofit organization whose success depends on the activity of its members. Those members who support AGA with long hours and hard work deserve our thanks. They provide our membership with a truly independent voice in the gemological community.

AGA has established a solid track record of accomplishments in the last few years. When consumers were flooding our offices with bogus gem certificates, we brought together divergent industry groups to focus on remedies for individual consumers. When claims were being made of "undetectable" diamond in-filling or "undetectable" synthetic ruby, AGA lost no time in finding out the truth. How accurate are your Master Diamonds? We continue to inquire.

Final preparations are in progress for the 1995 Tucson Gemological Conference. It has become tradition that "cutting edge" presentations are the mainstay of our annual Conference. This year will follow in that tradition with demonstrations of advancement in gemological technology and free discussion of controversial topics.

As your Acting President, my first decision was to appoint the right person to direct our Education Committee. This post has been vacant for too long. Therefore, I am proud to announce the appointment of Anna Miller as Chair of Education. Anna has agreed to undertake the task of building the Certified Master Gemologist program into a certification that is distinct from the many industry designations already offered. The CMG program was first envisioned by Past President Cortney Balzan. His premise was that a need did exist for continuing education beyond the Graduate Gemologist level. Gem sciences are expanding at a rapid rate. If we do not learn and grow as professionals, we will be left behind.

Why pay your AGA dues; why read *Cornerstone*? To support an independent voice that has no financial stake in the outcome of asking difficult questions. Someone once asked me who received the most benefits from AGA. The person who receives the most benefits is that member who works on one of the various Committees. This is one of AGA's best kept secrets which I share with you. If you want to be on the cutting edge, join one of our Committees and become involved. You will learn more helping AGA than you will learn by sitting passively as information flows past. The secret is out, join us today.

Help Wanted

Volunteers are needed to staff the AGA booth during the AGTA Gem Fair, February 1-6. It's a great opportunity to get involved, meet fellow members, and promote our organization. And, because of our up-front booth position, you will get to meet many people in the industry.



Call Membership Chair Stanley Cohen, 817/346-2611, or fax 817/370-8720.

[continued from page 1]

Gemological Spectra & the Spectroscope

In 1866, A.H. Church was the first to note that Zircon absorbed bands of light when transmitted through the stone¹. Prof. Webster, who was color blind, used a spectroscope to assess the "true" color of a gem. Through his familiarity with this instrument, Webster laid the ground work for many generations. A gemologist who uses the spectroscope only occasionally can seldom become truly familiar with the individual nuances associated with absorption lines. In practice, comparing lines we see in the scope against limited reproductions in a book, is both time consuming and limiting.

Beyond the Spectroscope

Today we are blessed with advantages that can take us beyond traditional capabilities. Using smart systems and a large database of known stones, a computer can compare the absorption spectra of a specimen gem and render results in a few seconds. This same effort toward positive identification can take years of learning. Quite possibly, species determination might never be made through the traditional gemological procedures of observation, text research and personal experience. Information systems paired with analytic science allow the gemologist quick access to data that previously took years, if not a lifetime, to master.

Spectrophotometry & Computers: Reins of Power

Spectrophotometers are different from the common gemological spectroscope in that they not only indicate the wavelength of an absorption or emission band, but also give the user amplitude of this characteristic for practically every nanometer. Absorption lines alone can and do give the experienced gemologist useful facts – but with the addition of amplitude data, a whole new realm of information can be utilized.

Spectrophotometry has been used in chemistry for decades to analyze composition. Most systems require a dedicated lab technician to assess the results. The won-

ders of the modern computer allow comparative analysis that would be otherwise impossible. Computer speed is not the only advantage: information sharing has never been simpler. It once took an entire career to accumulate well-written books on gem identification and spectra. Updates to a computer database can be distributed via CD or floppy disk and utilized instantly. Measurements can now be made and distributed via modem in real-time. Today, we can quickly analyze stones sequestered in collections unavailable for lengthy public scrutiny. Results may be shared in minute detail. This data can be compared quickly and a determination made if a similarity exists.

Gem Identification

Spectral analysis, as currently practiced in gemology, is definitive for most gemstones. For these gems, the major advantage of spectrophotometry is speed and simplicity of use. For other species, amplitude measuring ability will prove to be a vital benefit. African emeralds will likely be separated from Colombian stones with one brief test. Coupling test results to an appraisal certificate will give substance to any report. And, the ease of inserting this electronic information into word-processed documents is obvious. Possibly an algorithm can be written to observe the difference between Colombian Muzo emeralds from those originating in Brazil – and likewise from synthetics. A printout or color monitor display illustrating this difference can be prepared for the customer, thus building confidence in the gem merchant.

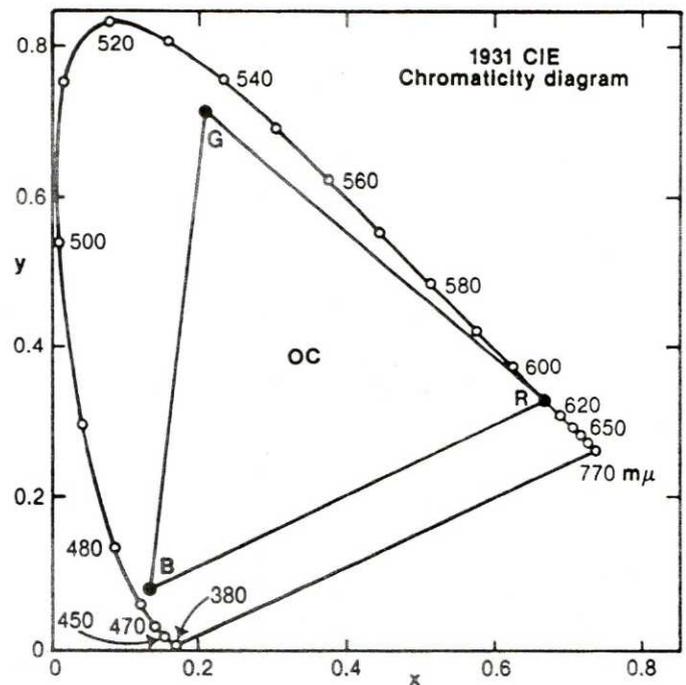


FIGURE 2. 1931 chromaticity diagram showing limitations of Red, Green, Blue filter primaries (the tristimulus triangle), versus the overall color space. Numbers on the curve represent the wavelength from 380 to 770nm.

Diamond Analysis

For most fancy color diamonds, spectrophotometric analysis can give positive determination. This need is most often acute when identifying natural versus irradiated diamonds. To detect diamond irradiation we look for absorption at 594 and 741 nanometers (nm). In green diamonds heated between 500–550°C, the color stains can turn brown, yellow or even blue. Usually the 594 nm line is well defined, but sometimes further annealing causes this line to fade at room temperature. Further cooling the gem with refrigerants can intensify the lines momentarily for analysis. Both these 594 and 741nm lines are documented as occurring in natural diamonds only rarely². (See Figure 1 – Irradiated Diamonds.)

Color Analysis

While spectrophotometers are capable of color analysis, colorimeters are used solely for determining color. Colorimeters based on the use of selective filters have been available to gemologists since the late 1950's. These older filter

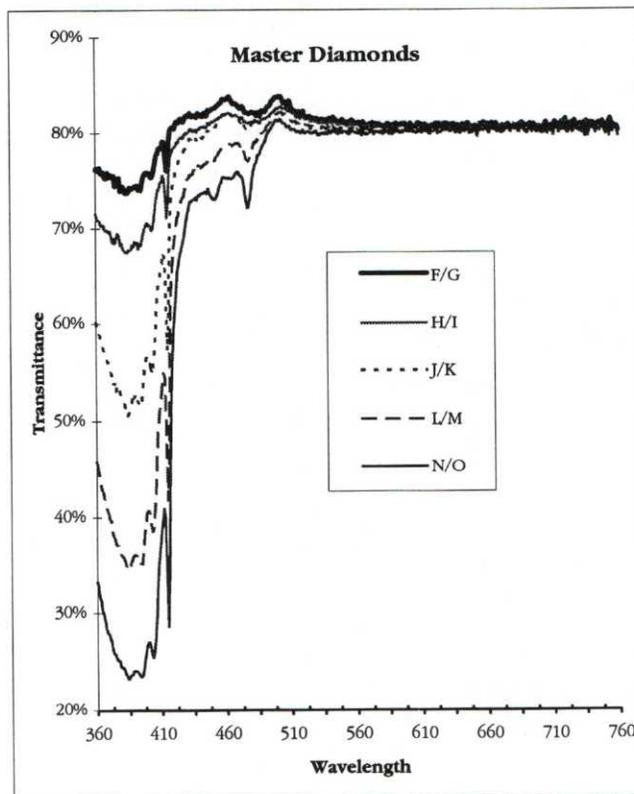
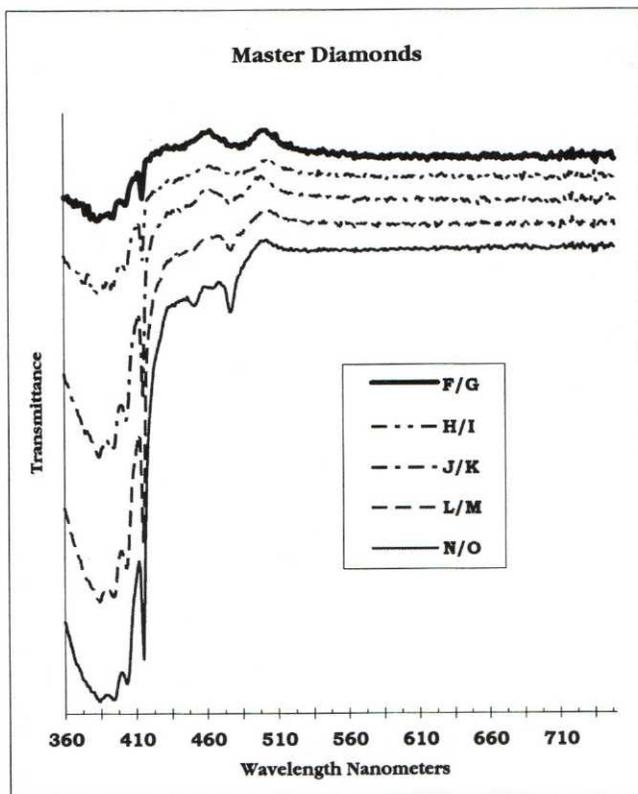


FIGURE 3. Master diamonds and their related blue absorption verses color grade. The greater the absorption in the blue region below 490 nm, the more yellow the stone appears.

based systems look at a range of the visible spectrum and give a typical value for that color. This differs from spectrophotometric results, as individual absorption lines (such as the 415 or 594 lines associated with diamonds) will never be detected. The newer three filter systems, such as most industrial colorimeters now in use, describe color using triangulation. This improved method is capable of giving accurate color data, with results usually correlated to CIE. However, deep saturation of colors can be out of test bounds. Spectrophotometers have the added capability of determining deep saturations of color (e.g., fine emerald and ruby) outside the tristimulus color triangle. (See Figure 2)

Color Grading and Comparison

Colorimetric analysis of the cape series and near colorless diamonds is another application of the spectrophotometer. The yellow appearance of a diamond is due to absorption of blue by the

stone. In Figure 3 above, the absorption characteristics of a master set of diamonds is seen. The 415 and 478.5 nm cape lines are readily observed, but most significantly the *amplitude* (transmittance) of these lines shows a marked difference relating to their color grade. (See Figure 3 – Master Stone Comparison)

Conclusion

Advanced technology for gemological study has never been quite so close. As new gem treatments come in to the market, pressure increases to implement the best available laboratory resources. Overall, the spectroscope as instrument has had few peers. With the advent of computer-aided spectrophotometry, user-friendly spectral analysis is available to all gemologists and jewelers. The spectrophotometer holds greater potential for gem identification and treatment detection. Computer-aided spectrophotometry has been described here as but one technique

with which the gemologist will be able to harness the powerful information age.

Credits

I want to thank River Gems & Findings, Anne Hawken and Associates, Tom Tashey of EGL, Harrington Jewelers, Northwest Gemological Lab, and Meg Cowen for sample gemstones. Also I wish to thank the staff at Labsphere, especially Trudy Ricker, for the preliminary measurements.

1 *Precious Stones*, Dr. Max Bauer, Translated by Spencer, 1904, p. 343.

2 *Gems & Gemology*, Spring 1994, Ilene Reinitz, et al.

Nothing we are afraid
to live without can be the
source of our success.

— Guy Finley

Officer and Committee Announcements

BOARD OF DIRECTORS

Elections are now underway for AGA Executive Officers and Board of Governors. If you haven't already done so, please place your ballot in the mail. Newly elected Officers will be installed at Tucson.

EDUCATION COMMITTEE

The AGA Education Committee, under the Chairmanship of Anna M. Miller, is pleased to announce that plans are currently being drawn for an advanced, comprehensive gemological program. To members left stranded and waiting for advanced gemological credentials, Miller says.

Please be patient a little longer, you will be rewarded for your wait. A motivated and responsible Education Committee is meeting in Tucson to discuss implementing the new course curriculum, and to solve some old education problems.

Members who have suggestions or ideas for topics they would like to see included in the advanced training curriculum are invited to contact the Chairman, Anna Miller, 713/485-1606.



Special Thanks. Treasurer B. Young McQueen has issued the new AGA Membership Directory. Warm thanks to Young, for his hard work. The new indexed-binder styling allows Members to update reference files, add Conference handouts, and keep track of each other. **Tip:** take your three-hole punch to *Cornerstone*, and place it in this handy new AGA binder.

Membership

WELCOME NEW MEMBERS

- **Nancy Richardson, GG, CGA**
Perry Jewelers
850 Hartford Turnpike/Crystal Mall
Waterford, CT 06385
- **Annaliese Dahle, GG**
Journey's End
13498 Pond Springs Rd, E,
Austin, TX 78729
- **Michael Wayne Habern, Jr (Associate Member)**
411 O'Campo Ct
Waco, TX 76708
- **James R. Moormeier, GG**
Gemstones Northwest
11299 S E Valley View Terrace
Clakamas, OR 97015
- **K. Louise Crowell, GG**
Gem Evaluation
939 Thompson Rd
Unionville, TN 37180
- **Melinda J. Adducci, GG**
Michigan Gemological Services
199 N Main St, Ste 204
Plymouth, MI 48170

AGA-Certified Gem Labs

WELCOME NEW AGA-CGLs

- **Ms. Barbara L. Leal, GG**
1 Willow Walk, Short Street
Cambridge, CB1-1LA
United Kingdom
- **Ms. Brenda Reichel, GG**
1254 South King Street
Honolulu, HI 96814

Greed & Gem Scams

The September issue of *Money* magazine carried an editorial entitled "A lesson in greed for all investors." A prototypical business investment Ponzi scheme is outlined, but the story gets worse. Under US bankruptcy law, victims can be held liable to bankruptcy trustees. The theory? Victims are "liable because it should have been obvious to them from their [early] outrageous returns that they were participating in a fraud."

Perhaps it will come as some comfort to recall that gem scams are indeed being prosecuted. A federal grand jury in Pennsylvania indicted 34 individuals and 10 Canadian-base operations for swindling more than \$35 million from U.S. gemstone "investors." Defendants are charged with 65 counts of fraud and conspiracy; potential fines are \$250,000 for each count and imprisonment for individuals, with a \$1 million fine for corporations (*NJ*, Aug 6, 1994.)

The company names are familiar indeed to AGA Members, and AGA-Certified Gem Labs. Members reported many of these firms to the National Fraud Information Center. Antoinette Matlins reports that scam activity has accelerated overseas, particularly in Europe and Asia. Typical "Phase I: Gem Investment Sales & Rebrokering" promotions promising quick 30-40% returns have been heavily reported in Germany and Japan, and may have moved into Italy.



AGA Education Conference

TUCSON CONVENTION CENTER, FEBRUARY 1 & 2, 1995

"What Every Jeweler Should Know" A Microscopic View

CONFERENCE SESSIONS

Crystal Ballroom, 8:30 am-5:30 pm

Please bring microscopes and spectrosopes for hands-on sessions

This year's concentrated education seminar will include:

- Dr. Henry A. Hanni, FGA, SSEF, with two programs. Session 1: "Origin Determination of Cut Gemstones." Session 2: "AGEE Hydrothermal Synthetic Emeralds," and "Emerald Fracture-Filling & Identification" hands-on.
 - Sharon Wakefield, GG, BS, ChE, on "Causes of Color in Diamonds - Natural vs. Treated," as well as "Synthetic Diamonds Update."
 - Gary Roskin of EGL features his newly-published diamond clarity grade book, examining photomicrographs of GIA-graded diamonds: "Photo Masters for Diamond Clarity Grading."
 - John Allaman of Sarasota Instruments will amplify "Applied Spectrophotometry - New Discoveries in Instrumentation," (see article, this issue).
 - LambdaSpec Instruments offers "Color Analysis by Imaging Spectroscopy."
 - The Gemological Association and Gem Testing Laboratory of Great Britain will present an informal slide history, "GAGTL Illustrated: Gem Education and UK Viewpoints." Also, GAGTL will offer a Practicum: "Spectroscope and Lighting Sources."
 - Alan Hodgkinson gives "A Fresh Taste of Scottish Gemology." "New Gem Finds in Scotland" will feature a 241 ct sapphire, plus new tourmaline, etc. "Affordable Gemology" demonstrates equipment *any* jeweler can use.
 - Al Gilbertson will address color grading, "Colorimeter Possibilities & Limitations."
 - Anna Miller will present a session on cameos and estate jewelry gems.
 - Richard Drucker, of Drucker Price Report, is to analyze pricing trends in colored stone markets, along with a talk on pearls.
 - Thom Underwood and Larry Phillips will host an update and discussion session, "The JVC Appraisal Task Force."
- Additional Topics To Be Announced —

Conference Fees

AGA Members \$100 per day • Non-Members, \$125 per day

Special Discounts: \$10 reduction per day

- When registered prior to January 15.
- Additional \$10 daily discount if providing microscope and spectroscope for hand-on sessions.

Information & Registration

Contact Joseph DuMouchelle
313/455-4555 voice, 313/455-2403 fax



Special AGA Events

General Membership Meeting

Thursday, February 2, 6-6:30 pm

Crystal Ballroom

Everyone Welcome. Greet AGA's new Officers and Governors.

Board of Directors Meeting

Thursday, February 2, 6:30 pm

Onyx Room

Color Vision Testing

20 minute appointments,

sign-up at AGA Booth

\$40 AGA Members

\$45, Non-Members

Results are confidential, and yours to keep. AGA certification programs, as well as some appraisal societies, require periodic color visions testing.

The Farnsworth/Munsell 100 Hue Test and Farnsworth Dichotomous Test for Color Blindness are conducted by an ophthalmologic nurse in a prescribed lighting environment. The Dichotomous Test is a series of dots arranged as numbers against a colored background; testing detects those persons who are functionally color defective. The 100 Hue Test consists of a selection of colored "caps," to be arranged in order to form a regular hue sequence. Results can indicate specific areas of imbalance in color vision across the spectrum, as well as pointing up the color zones of best and poorest color discrimination.



AGA Cocktail Reception and Awards Ceremony

Saturday, February 4, 6-8 pm

Doubletree Hotel, Bonsai Room

Industry Welcome. Buffet & Cash Bar

An evening with AGA and the Gemological Association of Great Britain, honoring Tucson Speakers.



**Education
Conference
Workshops**

**Related
Workshops &
Presentations**

Master Stone Testing

**John Allaman, at Rio Grande Booth
Idar-Oberstein Room,
upstairs Holiday Inn Broadway,
Throughout the GLDA Gem Show**

Meet the new Gem Spectrophotometer from Sarasota Instruments. John Allaman invites AGA Members to bring their Master Diamonds, colored diamonds and other significant gems to his display at Rio Grande's Booth. (Don't miss John's presentation at the AGA Conference.)

Using this newly-enhanced spectrophotometer, Allaman will analyze fine gems to produce a spectral curve plot. Also detect potential irradiation lines, and preserve a record of your findings. **Bring your gemstones, and a 3.5" data disk to record the analysis.**

Thursday, February 2

- **4 C's of Colored Stone Grading**
Antoinette Matlins
10-11 am, Mojave Room, TCC
- **Understanding Computer Lingo**
Thom & Lynn Underwood
2-3 pm, Apache Room, TCC

Saturday, February 4

- **Okanaga Opal—A New Find**
Paul Downing
9-10 am, Coconino Room, TCC
- **The Value of Price Guides**
Drucker, Geolat, Gilbertson, Hoefler
9-11 am, Mojave Room, TCC
- **Using the GQI World of Color to Describe Gemstones**
T. Tashey & G. Roskin
2-3 pm, Apache Room, TCC
- **Poking in More Gemological Corners,** *Alan Hodgkinson*
2-5 pm, Mojave Room, TCC

Member News

CONGRATULATIONS!

Members Gail Loveman and Stanley Cohen joined in marriage October 16, 1994. We wish them many joyful years together. (Now are you ready to come to conference, volunteer, and meet people?)



PUBLISHED

Sharon Wakefield, and Cornerstone: Journal of the Accredited Gemologists Association, were quoted and referenced in the latest edition of *Gems & Gemology*. Strong suggestion: read "An Update on Filled Diamonds: Identification and Durability" (Fall 1994, Kammerling, et al, pp 142-177).

A variety of detection methods are described, many readily performed with standard gemological equipment. This report offers testing results on a sample population of 67 "in the market" filled diamonds from various treaters. Additionally, untreated diamonds submitted by GIA to manufacturers for treatment, yield "before and after" studies. These, too, evaluate stones from several treatment suppliers.

Durability and stability testing results, and plentiful color photomicrographs, make this article a must-read. Congratulations are due Sharon Wakefield, for her contributions to gemological research and literature. (Available as a reprint; call G&G, 800/421-7250 ext 201.)

Martin Haske, developer of The Adamas Advantage, has seen his gemological program reviewed in *JCK* ("Software Plots Diamonds, Helps Identify Gems," October, 1994, pp 134-135.) Marty was also the first person to correctly answer last issue's trick question, "How many daylight hours tick by in 40 years?"



More News

...AND ON THE TUBE

Antoinette Matlins is featured on CNN segments November 30, 1994. Her subject: Gems & the Consumer. According to this report, GemStar of Dallas, Texas has packaged a loose stone sales scheme for charity auctions. Matlins became involved when charities in her home state of Vermont contacted her with problems. The set-up goes like this: gemstones are sold at auction, with a reserve opening bid at about normal retail value. The proceeds from sales are split 50/50 between GemStar and the charity, and everyone wins. So, what problem?

Auction programs list the "Auction Value" as 4 or more times that minimum bid, and the stones are bid up far beyond their retail value. Everybody wins bigger—until the buyer takes their prize to a jeweler to have it mounted. The retail value is discovered, and "Charity Supporters" become "Charity Detractors" as the consumer's faith in the charity's credibility is destroyed. The gem vendor, of course, has made quite a tidy profit. 50/50 can be a win/lose proposition, in the long run.

TUCSON APPRAISAL WORKSHOP

The 3-day Master Valuer gems and jewelry appraising workshop is scheduled for February 3-5, at The Courtyard by Marriott/Tucson Airport. Curriculum includes in-depth analysis of markets, analysis of value factors in various gemstones and jewelry, report writing, and hands-on appraisal practice.

Tuition is \$450; AGA Members receive a special 10% discount on enrollment (\$405 tuition). As classroom seating is limited, early registration is recommended. Contact Anna Miller, tel/fax 713/485-1606.

Crystal Quest

As reported in the September issue of *Earth: The Science of Our Planet*, some geophysicists are convinced that the center of our planet is one gigantic, inclined iron crystal.

About 800 miles in diameter, and 3,200 miles beneath you now, is a mass of solid metal which exhibits anisotropy (of seismic waves, as opposed to the light wave observation familiar to mineralogists) indicating an *epsilon iron* composition. The hexagonal columns of epsilon iron are not found at Earth's surface, because of the tremendous pressure required for their growth.

Scientists have recently charted this mother crystal's orientation: the inner core's axis of symmetry. Magnetic fields may have been key to this orientation as the core grew. The theory is that an early (c. 1.5 billion years ago) metallic ocean began to cool. Great pressure (3 million kg per square cm) formed iron crystals which aligned with Earth's magnetic field. Through time, countless crystals of epsilon iron have grown together into the inner core - a solid, evolving mass with properties of a single crystal.

And it is growing still. Magnetically aligning, right under our feet. Maybe there is something to polarity therapy and crystal healing, after all. *Cool.*

And You Thought U.S. Business Was Tough...

Dallas-based James Woods, of Texas-Siberian Trading Company, narrowly escaped arrest by Russian security agents (the domestic "KGB") while seeking export permits for a stranded shipping container of gems and minerals. Russia has been reported as accusing Woods of smuggling; Woods, in return, is working on a reparation class-action suit for business ventures burned in Russia.

Taking the first available flight (and a circuitous air travel route) to avoid the imminent arrival of militia and Interior Agents, Woods claims he abandoned 10 tons of Irkutsk Charoite, as well as 400 pounds of quartz and another 400 pounds of other stones. Despite this loss of material garnered since 1991, and the regulatory complications, Woods hopes to resume business in Siberia. Woods is a *very* hopeful entrepreneur indeed: he's asking US Courts to force Russian restitution for his business damages in international trade.

Tom Chatham, we hear, is having fun there as well.

Please send me a membership application for Accredited Gemologists Association

Name _____

Address _____

City _____ State _____ Zip _____

Phone # _____

Application Guidelines

Membership with full voting privileges is available to professionals holding gemological diplomas from accepted institutions.

Associate Membership is available to students of gemology and avocational gemologists.

Supplier Membership is available to providers of goods & services to the gem & jewelry industry.

Membership Dues & Fees

\$25 Processing Fee (one-time, non-refundable) will be retained by AGA.

\$125 Initial Voting Member Dues.

\$75 Initial Associate Member Dues.

\$175 Initial Supplier Member Dues.

Make checks payable to Accredited Gemologists Association, in US funds.

Membership is renewable annually (Voting \$100, Assoc. \$50, Supplier \$150).

Return This Request To:

Stanley Cohen, AGA Membership Chair

4747 South Hulen, Ste 109

Fort Worth TX 76132

817/346-2611 voice • 817/370-8720 fax

AGA will not discriminate against any applicant based upon race, creed, color, national origin, age or gender. Applicants are required to meet substantial member qualifications, and to adhere to the AGA Code of Ethics.