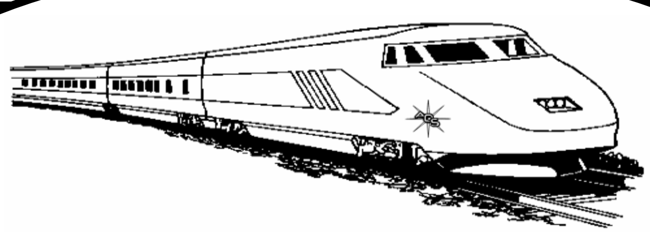
The Opal Express



Published monthly by The American Opal Society

February 2008

Volume 41 Issue 2

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President's Message

By Gene LeVan

My time is up!

Dear AOS members - time just goes by fast when you are having fun.

Well the last two years serving the membership has been fun and some work too.

I have learned a lot from all of you, the opals of course are the finest and most unusual gem on earth with all the bright colors and shapes.

Most of you know my story of how the opal members and opals have given me life, something not only to do, but are always interesting.

I am planning to go for my first time to Australia in 2008 to see opal mining and have fun too.

We have a new lineup for nominees for 2008 are as follows: Jim Lambert for President, Stan Mc Call for Vice President, Show Chairman Gene LeVan and two assistants. Our Editor Jim Pisani wants to keep our Bulletin active with his writings and finally Russ Madsen our treasurer will remain doing his great work.

We need to start calling friends to join in to see what we do. I want to thank everyone for assisting me during my elected term.

Yours Truly,

Gene LeVan

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February Meeting Demonstrator – David Kramer

David Kramer, long time AOS member and one of our area's foremost jewelry designers, will demonstrate his technique on how to cut small opals. David states that typically, the available, affordable opals are usually small. Being small, however, is not less beautiful, valuable or useful. These small opals are the standards of our jewelry that we wear, where large opals are uncommon.

Being small, however, require more skill and different techniques in cutting than large opals. David will bring his lapidary set and will allow the audience to watch his cutting from a close distance.

In addition, he will show his techniques on how to set these small opals in jewelry.

I believe David's lecture will be very useful to our hobbyist members who cut their own opal. Don't miss it!

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AOS Election and Ballot Information

The AOS will hold elections at the next AOS General Meeting in Garden Grove. The offices to be voted on will be President and Vice-President. Please attend the meeting to vote. The current members of the Board of Directors are as follows:

Current AOS Board of Directors	
*President	Gene LeVan
*Vice-President	Jim Lambert
Treasurer	Russ Madsen
Show Chairman	Jay Carey
Newsletter Editor & Webmaster	Jim Pisani
Last President	Pete Goetz
CFMS Representative	Fran Todd
Member At Large	Dr. Walt Johnson
Member At Large	Stan McCall
Member At Large	Mike Kowalsky

*Position Up for Election

Here is the ballot for the election.

2008 Election Ballot	
President – Jim Lambert	
President (Write in Choice)	
Vice President – Stan McCall	
Vice President (Write in Choice)	

Opal Society Workshop

The American Opal Society's workshop is open in February, starting Jan. 7th. The shop is located at Ball Jr. High School and will occur every Monday from 7:00 to 9:30 p.m. The school is located at 1500 W. Ball Road in Anaheim. If you are traveling east on Ball Rd. the parking lot entrance you need to use is just before the railroad tracks Room 37 is in the center of the campus.

Instruction will be given in cutting opal, wax models, lost-wax casting, fabrication, and setting stones. The workshop will furnish machines to cut and polish stones as well as a centrifuge for casting and a kiln for burnout. Please bring a roll of PAPER TOWELS with you for clean-up as the room is a science lab and needs to be kept spotless.

To attend, membership in the American Opal Society is a must due to insurance. A nightly fee of $2 is asked to help keep the equipment in good running condition. Please contact Pete Goetz at (714) 345-1449 if you have any questions.

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Members Only Website Password

To log onto the website's members only area at: http://opalsociety.org/aos_members_only_area.htm type: Name: "member" and Password: "opalglow".

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What You Should Know about Buying Opal

Jewellery is special. It can last a lifetime. It can be an emotional and sentimental experience that evokes wonderful memories while still giving pleasure for years ahead. When buying for yourself or for others, it helps to have an understanding of the qualities and characteristics of jewellery, which is why the Jewellers Association of Australia (JAA) has produced this brochure.

A Guide to Opal

Nature has captured all the colours of the spectrum, displaying them in an infinite variety of shades, patterns and brilliance and locked them into this rare stone. Opals lie dormant in the earth until a miner clips the edge and light reaches the gem exposing the most beautiful dancing display of colour.

Since an cient times opal has been sought after by many famous collectors including Mark Antony, Pliny and Queen Victoria. This precious gem was even included in the crown of the Holy Roman Emperor. Australia produces at least 95% of the world's precious opal which, with its increasing scarcity, is amongst the most sought after and precious of all gems. Quality black opals can fetch prices equivalent to a good diamond on a per carat basis.

Boulder Matrix Opal

History states that Ancient Romans cherished opals above all other gemstones – not just because they were rare and beautiful gems – but because they were thought to bring good fortune. Indeed, fortunes were paid for these gems. Mark Antony offered Senator Nonius 100,000 sesterces for a brilliant opal (AUD$1,000,000 in today's value). Nonius, however, would not part with his talisman, his own personal rainbow ensuring his lucky future.

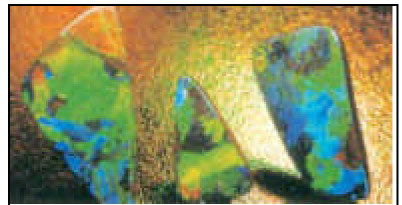
Play of Colour: An opal's beauty is unique and made from the amazing 'play of spectral colours' in the gemstone. This originates from the breaking up of white light due to the three dimensional spherical shaped microstructure of the silica particles inherent in the opal (these can only be detected with an electron microscope). Similar phenomena of colour hues can be observed when oil lies on water, or in a rainbow.

Formation: Opal occurs where silica gel fills small fissures or voids in the earth. A large portion of Australia's inland was once covered by a sea, leaving deposits and creating an environment suitable for the formation of opal.

Types of Opal

Natural Opal is divided into the categories of black, dark, light, boulder and matrix opal. The classification of black, dark and light is determined by the body tone ie. the degree of darkness in the background.

Black Opal is the most valuable and comes mainly from Lightning Ridge. High quality stones are very rare; this type is easily distinguished by the blackness of the base or background 'body tone'.



QLD Boulder Opal.

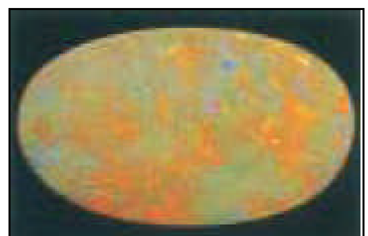
Black Crystal Opal is mainly mined at Lightning Ridge. These black opals show a degree of transparency, the colours are often brilliant and can appear to come from within the depth of the gemstone. Good black crystal opals are very rare.

Dark Opal comes from all fields and is desirable because the colours are generally more brilliant, due to the dark background 'highlighting' their colours. This type of opal mainly comes from Mintabie (SA) and Lighting Ridge (NSW).

Light Opal is usually found at all opal fields but the bulk of the material has come from the South Australian fields of Mintabie, Coober Pedie and Andamooka, although the first material was mined at White Cliffs (1887). This opal has a light body tone.

Crystal Opal: This variety embraces opal which is transparent or very translucent and in the better qualities shows a distinct and very bright play-of-colour. This type of opal is found in most Australian opal fields.

Boulder Opal: This type, composed of opal naturally occurring on its host rock, is mined predominantly in Queensland. It is easily identified because, when cut, the host rock (a brown ironstone) is left on the back of the opal. Boulder opal may be light, dark or black. In the last twenty years this type of opal has become extremely popular as it can display the same darkness and brilliance as a high quality black opal.



Light Opal.

Matrix Opal: There are two common types of Matrix Opal in Australia:

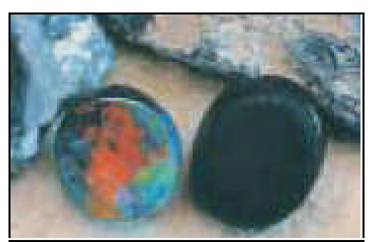
A. Boulder Matrix Opal is usually found in Queensland. The opal is intimately diffused with the host rock, (usually ironstone). The host rock is quite obvious in the presentation face of the stone.

B. Matrix Opal from Andamooka has opal intimately diffused throughout the host rock, a sandstone which is often porous and can be treated, turning the material dark resembling black opal.

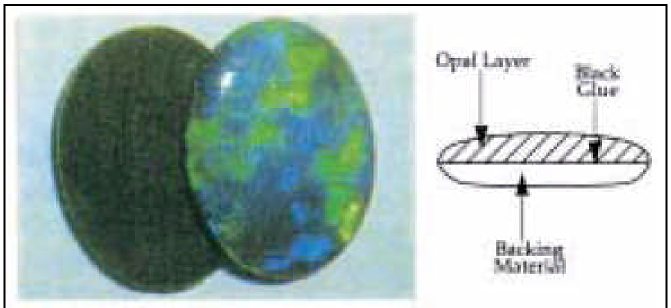
Composite Natural Opal

Composite natural opal consists of a natural opal laminate, manually cemented or attached to another material. There are three main forms of composite opal:

Doublet Opal: A composition of two pieces where a slice of natural opal is cemented to a base material.



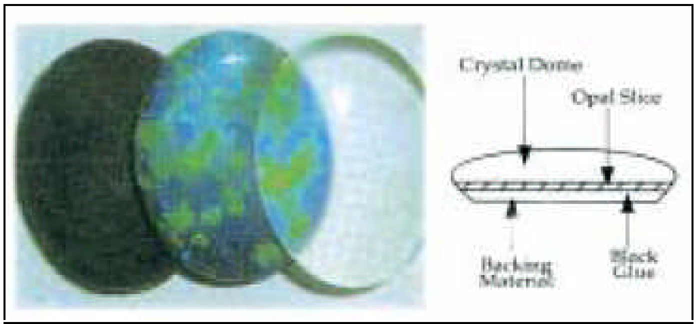
Black Opal.



Opal Doublet

Triplet Opal: A composition of three pieces where a thin slice of natural opal is cemented between a dark base material and a transparent top layer (usually of quartz or glass).

Mosaic and Chip Opal: A composition of small flat or irregularly shaped pieces of natural opal cemented as a mosaic tile on a dark base material or encompassed in resin.



Opal Triplet

Synthetic and Imitation Opal: Occasionally offered for sale; however, the laws in Australia require the retailer to inform the purchaser of this fact. Most opal sellers do not handle synthetics or imitations.

Factors determining the value of all types of Opals

The Brilliance of colours is of paramount importance – the brightness of an opal is directly related to price.

The Patterns of colours when combined with brilliance may increase value many times.

Colours: the number of different colours affects price, although this rule should be used with great care. An opal with all the colours of the spectrum is not always more valuable than one displaying red/blue or green/blue alone, because the major determination of value is brilliance and pattern.

Shape: usually cut *en cabochon*; a stone with a domed surface will be more valuable than a similar stone with a flat surface. Opal which is too thin could fracture on impact. While oval stones may show a great demand, boulder opals often cut in free shapes can lend themselves to more distinctive designs.

Marks: most opals, particularly black, have sand in the back of the stones. This usually does not affect value. However, marks or cracks that are fairly noticeable in the face of the stone will drastically affect value.

Looking after your opal

Although opals are a magnificent and unique gem, they do not have the resistance to breaking or scratching that diamonds or sapphires have. If you protect the stone from heavy blows, and abrasive materials, and don't subject it to extreme sudden heat changes, your opal should last forever.

If you have an opal doublet or triplet, never immerse it in detergent (and preferably not even water), as this may break down the adhesive quality of the glues that have been used and cause separation (or 'lifting').

Opal – an investment

Opal production has decreased over the last decade. Demand has risen. More people are working the opal fields with greater mechanisation. Opal is like other resources – we are exhausting the existing known supplies and hoping new strikes will be found. The mining of opal is done by individuals or syndicates – no large companies are mining at any of the fields. Stockpiling of the gem therefore cannot occur; this means that prices are a true reflection of market demand.

This brochure has been prepared by the Jewellers Association of Australia (JAA) with the assistance of Andrew Cody, Tony Smallwood and Dr. Grahame Browne. Photographs courtesy of Cody Opal (Australia) Pty Ltd, Ruby Weber and the Australian Opal and Gem Industry Association. Email: info@jewellers.asn.au, Website: http://www.jaa.com.au

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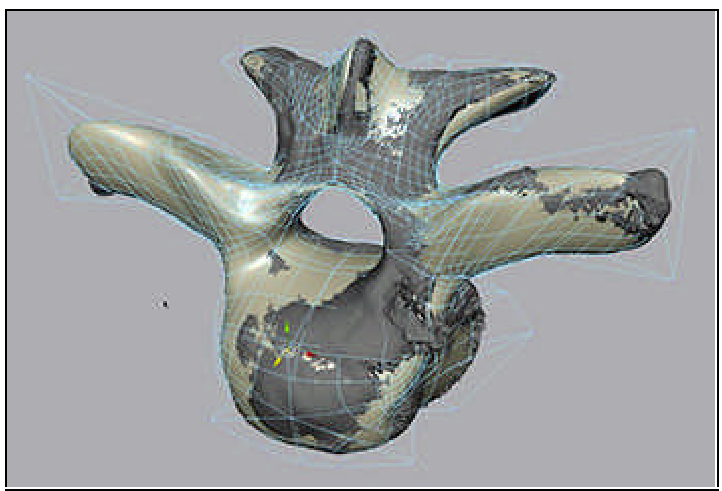
Rare Mummified Dinosaur Unearthed Contains Skin, and Maybe Organs, Muscle

By Evan Ratliff 12/03/07

Scientists have uncovered the mummy of a 67-million-year-old plant-eating hadrosaur, a duck-billed herbivore common to North America. Image: National Geographic Channel

Scientists on Monday announced the discovery of what appears to be the world's most intact dinosaur mummy: a 67-million-year-old plant-eater that contains fossilized bones and skin tissue, and possibly muscle and organs. Preserved by a natural fluke of time and chemistry, the four-ton mummified hadrosaur, a duck-billed herbivore common to North America, could reshape the understanding of dinosaurs and their habitat, its finders say. "There is no doubt about it that this dinosaur is a very, very significant find," said Tyler Lyson, a graduate student in geology at Yale University who discovered the dinosaur in North Dakota. "To say we are excited would be an understatement," said Phil Manning, a paleontologist at England's University of Manchester who is leading



The CT scan showed that the hadrosaur's vertebrae, which museums commonly stack together, are actually spaced a centimeter apart. That means we may have been underestimating the size of many dinosaurs. Image: National Geographic Channel the examination. "When I first saw it in the field, (I thought) 'Shiiiit, that's a really well preserved dinosaur.' It has the potential to be a top-10 dinosaur, globally." Nicknamed Dakota, the hadrosaur is one of only five naturally preserved dinosaur mummies ever discovered. Unlike previous dinosaur mummies, which typically involve skin impressions pressed into bones, Dakota's entire skin envelope appears to remain largely intact. "The skin has been mineralized," said Manning. "It is an actual three-dimensional structure, backfilled with sediment." The fidelity of the envelope, he said, raises the possibility that Dakota could contain other soft-tissue remnants, including muscles and organs. Then-16-year-old Lyson was fossil-hunting in 1999 in the Hell Creek Formation badlands of North Dakota when he first spotted the dinosaur's bone-like protrusion from a hill. In 2004, after Lyson returned to begin excavating the fossil and discovered skin remnants, a friend studying at the University of Manchester alerted Manning, who had the experience and resources to organize a more cautious excavation. Only after the body and a chunk of the hillside was moved to a lab did the scientists realize the extent of the discovery. "On vast areas of the tail and body," Manning said, "there was what looked to be a three-dimensional skin envelope, in the same way as a sock around your foot -- which did not make any sense at all." Manning brought on dozens of scientists and engineers -- in disciplines ranging from computer science to organic chemistry and physics -- to investigate every aspect of the find using state-of-the-art tools. "Up until Phil showed me this dinosaur," said Roy Wogelius, a geochemist from the University of Manchester studying the soil surrounding Dakota, "I had no interest in dinosaurs. As soon as I saw this specimen, I was fascinated." In North Dakota, the researchers used Light Detection and Ranging equipment (LiDAR) to develop a three-dimensional topographical map of the area where Dakota died. Manning speculated that the dinosaur collapsed in a riverbed during the late Cretaceous Period and was rapidly buried in mineral-rich wet sand, preventing bacteria from devouring all of its tissue. "There was active-enough chemistry in the sediments that the decay process didn't occur as quickly as the mineralization process," he said. "It was a perfect chemical soup."

After examining the dinosaur at a local lab, the scientists encased it and the remaining surrounding soil in plaster and hauled it by truck to a Boeing research center in Canoga Park, California, north of Los Angeles. There, Boeing volunteered the world's largest computerized tomography, or CT, scanner, originally built by NASA to scan space shuttle parts for flaws. At 8,000 pounds, the fossil became the largest object ever scanned at high resolution. The researchers are using the data to survey the body's interior before chipping away further on the fossil. "The CT scan is like a roadmap," said Manning. "It will help us recover the rest of the animal more easily and efficiently." The first significant findings from the dinosaur, currently under review at a major scientific journal, will describe the unique chemical balance that preserved the fossil. The body, meanwhile, remains on the Boeing scanner, as Manning and his colleagues sift through terabytes of data. So far, they have determined that the hadrosaur's hindquarters are 25 percent larger than previously thought for the species, meaning that it could run up to 28 mph -- faster than previously estimated. They have also discovered that the specimen's vertebrae, which museums commonly stack together, are actually spaced 10 millimeters apart. The result, Manning said, implies that scientists may have been underestimating the size of hadrosaurs and other dinosaurs. The National Geographic Channel, which helped fund the research, will recount the saga of Dakota's discovery in a documentary, Dino Autopsy, Sunday, Dec. 9, at 9 p.m. EST. Manning is also publishing a book, Grave Secrets of Dinosaurs, describing the fossil and its history. Although there are a lot of scientists involved in the project, Lyson and Manning have not yet allowed experts outside the project to assess the mummified dinosaur. But the scientific findings from the specimen may take decades to exhaust. "I'm 40 years old now," Manning said. "If I live till 80 I think I'll still be at the tip of the iceberg." *From* http://www.wired.com/science/discoveries/news/2007/12/dino_mummy

After excavating the dinosaur, scientists encased it and the surrounding soil in plaster. It was hauled to Boeing's giant CT scanner near Los Angeles. Photo: National Geographic Channel

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The Many Facets of Man-Made Diamonds

February 2, 2004

Synthetic diamond makers are targeting the gem market first, but their product could transform many other industries, too

By Amanda Yarnell

Before the 1930s, the gems of choice for engagement rings included opals, rubies, and sapphires. But in the 1940s, De Beers--the South African mining firm that controls the majority of the world's diamond supply--introduced "A Diamond Is Forever." The success of this campaign turned diamond into the symbol of eternal love and dramatically increased demand for the gems.

Today, two start-up companies are staking their futures on the lure of more affordable, laboratory-grown diamond gemstones. But because of diamond's remarkable optical, thermal, chemical, and electronic properties, synthetic diamond promises to offer a lot more than just beautiful jewelry. In a warehouse in Sarasota, Fla., a company called Gemesis is growing diamonds in two dozen or so high-pressure, high-temperature crystal growth chambers, each the size of a washing machine. Within each chamber, a tiny sliver of natural diamond is bathed in a molten solution of graphite and a proprietary metal-based catalyst at approximately 1,500 °C and 58,000 atm of pressure. Slowly, carbon precipitates onto the diamond seed crystal. A gem-quality, 2.8-carat rough yellow diamond grows in just under three-and-a-half days.

A rough diamond of this size can be cut and polished to give a diamond gem larger than 1.5 carats. (One-half carat is equal to 100 mg of diamond and is roughly the size of a kernel of corn.) Just like naturally occurring yellow diamonds, the yellow lab-grown stones get their color from trace amounts of nitrogen impurities: Replacing fewer than five out of each 100,000 carbon atoms in the diamond crystal lattice with nitrogen atoms gives a yellow diamond.

Naturally occurring fancy-colored diamonds--yellows, blues, pinks, and reds--are very rare and thus very valuable. A Gemesis-created yellow fancy-colored diamond--visibly indistinguishable from a natural one, even to a trained gemologist--can be purchased for about $4,000 per carat. That's about 30% less than the price of a natural diamond of similar color and quality, according to Robert Chodelka, Gemesis' vice president for technology.

IN THE ROUGH To grow its gem-quality yellow diamonds (a rough one is shown above), Gemesis uses washing-machine-sized crystal-growing chambers to reproduce the high pressures and high temperatures that nature relies on. GEMESIS PHOTOS

SYNTHETIC DIAMONDS are nothing new. Producing them has been a stable business for the past half century. Today, more than 100 tons of the stones is produced annually worldwide by firms like Diamond Innovations (previously part of General Electric), Sumitomo Electric, and De Beers. Tiny synthetic diamonds are used in saw blades for cutting asphalt and marble, in drill bits for oil and gas drilling, and even as an exfoliant in cosmetics.

The first synthetic diamonds (diamond grit) were produced in the early 1950s by researchers at the Allmanna Svenska Elektriska Aktiebolaget Laboratory in Stockholm, Sweden. They did not immediately publish their work. Soon thereafter, GE researchers reported their own successful diamond synthesis in Nature. Like Gemesis, both teams used conditions that mimic the pressures and temperatures under which diamonds are thought to form naturally. Prior to Gemesis, GE, Sumitomo Electric, and De Beers had reported the synthesis of large diamonds by similar processes. But these companies marketed their synthetic stones as heat sinks for electronics or used them solely for research purposes. Gemesis, on the other hand, is growing diamonds for jewelry. And because Gemesis' yellow lab-grown diamonds are visually indistinguishable from their mined counterparts, some in the gem industry have expressed concern that the lab-grown diamonds could be passed off as naturals.

Chodelka tells C&EN that Gemesis is "committed to disclosure," noting that all of the firm's diamonds are laser inscribed. In addition, he says trace amounts of nickel left in the diamond from the metal catalyst cause a short-lived phosphorescence after exposure to intense ultraviolet light--a characteristic not shared by most natural diamonds. He also points out that differences in the spatial distribution of nitrogen defects between natural and Gemesis-grown diamonds can be detected by Fourier transform infrared spectroscopy and X-ray absorption spectroscopy.

But Gemesis' business plan only begins with gems. Diamond has an extraordinary range of materials properties: It is the hardest and stiffest material known; is an excellent electrical insulator; has the highest thermal conductivity of any material yet barely expands when heated; is transparent to UV, visible, and infrared light; and is chemically inert to nearly all acids and bases.

Diamond's superlative properties are fine-tuned by impurities found in the carbon lattice--the same impurities that produce colors in naturally occurring diamond. Diamonds having a perfect carbon crystal lattice without defects or substitutions are colorless. Such diamond has a large band gap--meaning that the energy required to free an electron so it can move through the diamond lattice is high--and therefore is an excellent electrical insulator. But replacing some of the carbon atoms in the diamond lattice with boron--an impurity that produces the pretty blue color in some rare diamonds, including the famed Hope Diamond--transforms diamond into a p-type semiconductor. That's because boron has only three outer-shell electrons and can make only three of four bonds that carbon normally does in the diamond lattice. The result is a missing electron or "hole" that can move freely through the crystal, allowing the diamond to conduct positive charge.

For materials applications that take advantage of these remarkable properties, natural diamonds have obvious flaws: They are prohibitively expensive and limited in size. "Plus, with natural diamonds, you can't control the type or placement of dopants," notes James E. Butler, who is spearheading attempts to study, grow, and use diamond at the U.S. Naval Research Laboratory. As a consequence, Gemesis and many others are eager to create large synthetic diamonds with carefully selected impurities--for instance, boron-doped semiconducting diamonds that could be used to fabricate diamond-based electronic devices that could stand up to heat and chemical attack.

But high-pressure, high-temperature methods of synthesizing diamond like Gemesis' offer limited control of impurities and produce diamonds of limited size, Butler says. Apollo Diamond, a start-up company in Boston, thinks that a low-pressure technique called chemical vapor deposition (CVD) could be the answer. Butler agrees. "As interesting and as important as the high-pressure, high-temperature method is, it won't have the technological impact of diamond growth by chemical vapor deposition," he tells C&EN.

Apollo is using CVD to grow single-crystal diamond wafers big enough to be cut into diamond gemstones of a carat of more. Apollo's method can grow larger diamonds and is less expensive than high-pressure, high-temperature methods, notes Robert C. Linares, Apollo's founder and chairman.

A CUT ABOVE Apollo uses chemical vapor deposition to grow plates of very pure diamond (left) that can be cut and polished into beautiful gems (right). APOLLO DIAMOND PHOTO

CVD allows finer control of impurities than do high-pressure, high-temperature methods, Linares says. This enables Apollo to produce a wider variety of colored diamonds--including colorless, pink, blue, honey brown, and even black. Like Gemesis, Apollo inscribes its larger lab-grown gems to aid detection. A combination of spectroscopic methods--including infrared spectroscopy and photoluminescence spectroscopy--can normally be used to distinguish Apollo gems from naturally occurring ones, according to Wuyi Wang, a research scientist at the Gemological Institute of America in New York City [Gems & Gemol., 39, 268 (2004)].

A slow, tedious version of the low-pressure CVD process was first documented in 1952 by William G. Eversole of Union Carbide. Back then, "there was a great deal of skepticism that one could grow

DIAMOND RING Because of its optical transparency, high thermal conductivity, and resistance to chemical attack, synthetic diamond is an attractive material for making optical windows for instruments used in extreme environments.

diamond at low pressures because diamond is thermodynamically unstable with respect to graphite," recalls John C. Angus, professor of chemical engineering at Case Western Reserve University, Cleveland. "Many people said that growth of diamond at low pressure violated the second law of thermodynamics. You were thought to be a fool or a fraud if you proposed this," he says.

Union Carbide subsequently abandoned the project. But a small band of Russian and American scientists, including Angus, pushed forward. By the late 1960s, Angus managed to prove that diamond growth by CVD was indeed feasible. The method was further refined into a viable commercial process in the 1980s by scientists at the National Institute for Research in Inorganic Materials in Tsukuba, Japan.

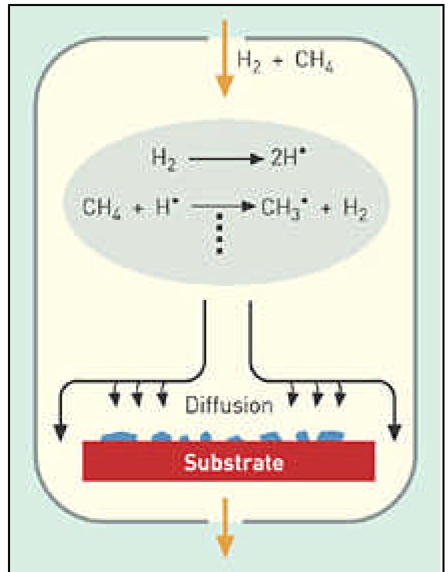
Hydrogen is the key to growing diamond and not graphite under these conditions, Angus' early work showed. At the surface, the carbon lattice of diamond is decorated with "dangling bonds" that can potentially cross-link to reorganize the surface into more stable graphite. Capping these bonds with hydrogen prevents graphite formation and generates reactive surface sites for attachment of carbon radicals.

In Apollo's CVD reactor, hydrogen gas and methane are flowed through a chamber containing a diamond seed crystal (often a highly polished synthetic one produced by high-pressure, high-temperature methods). The hydrogen gas is split into atomic hydrogen by the action of a hot filament or a microwave-generated plasma. The atomic hydrogen thus generated reacts with methane to give methyl radical and hydrogen gas. The carbon-containing radical species eventually deposit onto the diamond seed, forming new diamond carbon-carbon bonds. But the surface chemistry of how carbon atoms actually attach to the diamond lattice still remains murky, Linares notes.

Apollo's CVD method produces single-crystal diamond, just as nature does. But until relatively recently, most of the diamond grown by CVD methods was polycrystalline, not single-crystal. Polycrystalline diamond is a patchwork of minuscule diamond crystals (and sometimes tiny crystals of graphite). Because it retains many of naturally occurring single-crystal diamond's excellent properties, polycrystalline diamond has been targeted for a number of uses.

For instance, chemistry professor Robert J. Hamers of the University of Wisconsin, Madison, has developed a photochemical method for covalently linking DNA via an organic tether to the surface of polycrystalline boron-doped diamond films made by CVD. Recently, he and graduate student Wensha Yang found that the binding of complementary DNA strands to the DNA-labeled diamond surface can be detected directly by measuring the change in electrical properties of the diamond film. The direct electrical detection allowed by diamond eliminates the need for labor- and time-intensive labeling steps required by other biosensing methods.

And because semiconducting diamond can generate a wider range of potentials than other electrode materials, electrodes made of this material can be used to study redox reactions that can't be studied with conventional electrodes, notes assistant professor of chemical engineering Heidi B. Martin of Case Western. That and the many other excellent properties of diamond have led chemistry professor Greg M. Swain of Michigan State University and many other scientists to use CVD to grow polycrystalline boron-doped diamond electrodes that can detect--and in some cases degrade--redox-reactive organic contaminants in water supplies. In addition, Martin is using CVD to grow highly conductive boron-doped polycrystalline diamond microelectrodes that could directly sense a variety of redox-active neurotransmitters during neurotransmission. The diamond microelectrodes should be more sensitive, stable, and versatile than ones made of other materials, Martin says.



LET IT RAIN To make diamond by chemical vapor deposition, hydrogen gas and methane are flowed through a chamber containing a substrate. Heat or a microwave-generated plasma is used to split hydrogen gas into atomic hydrogen, which then reacts with methane to give methyl radical and hydrogen gas. The carbon-containing radical species eventually deposit as diamond onto the substrate.

U.K.-based Element Six, formerly known as De Beers Industrial Diamonds, is already selling CVD-grown polycrystalline diamond films for various applications, notes Steven E. Coe, the firm's R&D manager. The company markets its polycrystalline diamond for use as heat spreaders in high-power electronic devices. It also uses the material to fashion surgical blades that are resistant to dulling and optical windows for high-powered CO2 lasers.

NEVERTHELESS, using single-crystal diamond instead of polycrystalline diamond in such applications has advantages. Because the C—C bonds that hold its patchwork of tiny crystals together are weaker than C—C bonds in single-crystal diamond, polycrystalline diamond isn't quite as thermally conductive, as optically transparent, or as strong as single-crystal diamond. In fact, for some applications--particularly those such as electronics that require the highest carrier mobility--only single-crystal diamond will do, Linares tells C&EN. For diamond to live up to its promise as an alternative to silicon for fabricating electronic devices, "what's required is high-quality, single-crystal CVD diamond in usable sizes," Coe adds. Coe and his colleagues at Element Six proved this was possible just over a year ago [Science, 297, 1670 (2002)] and now can grow high-quality, single-crystal diamond wafers that are 5 mm square. Linares tells C&EN that Apollo currently can grow high-quality, single-crystal diamond wafers that are about double that size. He predicts that within the next four years the company will be cranking out 4-inch square wafers.

Both Coe and Linares suggest that, thanks to its high thermal conductivity and electrical carrier mobility, single-crystal semiconducting diamond will be the ultimate material for fashioning high-powered electronic devices. Element Six is already making some simple prototype devices, such as switches, from p-type semiconducting diamonds, Coe says. But most devices will require both hole-conducting (p-type) and electron-conducting (n-type) diamond semiconductors. The former is easy: Both Element Six and Apollo report that they can use their CVD methods to make boron-doped single-crystal diamond wafers that are excellent p-type semiconductors. Producing n-type semiconducting diamond has proven more challenging, however.

A number of potential n-type dopants have been investigated, most notably phosphorus. A group led by Hisao Kanda of Japan's National Institute for Materials Science has shown that doping diamond with phosphorus gives n-type semiconducting diamond. The team has gone on to show that phosphorus-doped and boron-doped diamond can be combined to make a simple electrical device called a p-n junction.

But so far neither phosphorus nor any other n-type dopant has demonstrated exactly the right electrical properties, according to Butler. Butler, Jacques Chevallier of the Laboratoire de Physique des Solides et de Cristallogénèse, in Meudon, France, and their colleagues recently reported that impregnating boron-doped CVD diamond with deuterium yields n-type semiconducting diamond [Nat. Mater., 2, 482 (2003)]. Despite this promising development, Angus--whose own lab is doping CVD diamond with a combination of boron and sulfur to get n-type semiconductivity--comments that "all of the n-type work, including ours, is interesting in a scientific sense but not yet practical for devices."

The payoff for such work is potentially huge: Today's microchips are running hotter and hotter because more and more transistors are being crammed onto them. If the trend continues, silicon may not be able to take the heat. Diamond could be the perfect solution.

Despite its superior combination of electrical, optical, thermal, and chemical properties, though, diamond may never totally replace silicon for two reasons: Silicon is both cheap and firmly entrenched in the computer industry. Still, Reza Abbaschian, a professor of materials science and engineering at the University of Florida, Gainesville, whose lab helped to perfect Gemesis' diamond-growing method, believes that "for certain specialized applications, such as devices that run at high power or high temperature, diamond may be just the ticket."

http://pubs.acs.org/isubscribe/journals/cen/82/i05/html/8205diamonds.html

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Thomsonite

By Lorraine Weaver, Rockhound News

Thomsonite, a zeolite mineral found in volcanic rocks as seam or gas cavity fillings, is named after a Scotch chemist, Dr. I. Thomson, who analyzed it.

Pure Thomsonite is dead white in color. The colorful banding in most Thomsonites is caused by infiltrations of foreign minerals during growth. Iron, copper, and other elements are responsible for the pink, red, green, black, purple, brown, and yellow colors.

Thomsonites have been found in Nova Scotia, Colorado, Oregon, Michigan, New Jersey, Minnesota, Czechoslovakia, and Germany. Ontario Thomsonites are reddish and brownish tints, and are found on the beaches of Michipicotin Island in northeastern Lake Superior. Michigan Thomsonites are found on the beaches of Isle Royale and in areas of the Upper Peninsula.

The Minnesota Thomsonites are found along Thomsonite Beach in Cook County, about *5.5* miles along the shoreline of Lake Superior between Grand Marais and Lutsen. An authority estimates the locality to be only *65* feet across the outcrop.

The basaltic rocks containing the Thomsonites in the Grand Marais area are among the oldest on this continent, ranging from 1.1 to 1.4 billion years in age.

In Thomsonite formation, the liquid magma within the earth rose to the surface. As this occurred, the surrounding pressure decreased. As a result, any gases in the magma expanded. Voids were formed by these gases as the rock solidified. Later, water containing dissolved minerals percolated through the rocks, depositing minerals in the voids.

The most color is found just below the opaque dark green skin. Dark green and black colors are next to the skin, while the pinks, yellows, and other colors are more into the interior of the spheres. Many eyes appear in the radiated masses.

The Thomsonites of Grand Marais are distinctive. No others like them are found anywhere in the world. The best specimens are found in the gravels of Lake Superior, where the constant wave action has weathered them out of the basalt. The Thomsonites are free of the green skin or basalt matrix, as they are partially polished because of the constant tumbling by the waves. Most nodules measure one-eighth to five-eighths inches. Specimens over an inch

are highly prized. They have many eyes and are highly chatoyant. Those imbedded in the basalt are hard to remove without fracturing. There is a way to do it, but much care and practice is needed. These Thomsonites are covered with an opaque green skin.

November seems to be the best time to collect from the lake because the gravels are close to shore and Lake Superior is calmer. The best specimens are found by scuba divers.

Thomsonite has a hardness of about *5.* The minerals are very brittle and most have fracture lines. However, they make beautiful and valuable jewelry. The fractures enhance the beauty of the pieces.

Thomsonite was mined during the Middle Ages in Scotland, and was used as a good luck stone. Queen Victoria commissioned the Chippewa Indians to mine Grand Marais Thomsonites because the nodules were becoming scarce in Scotland.

Thomsonites have been found in Alaskan Eskimo burial sites over 2,000 years old. The Russians made jewelry using Thomsonites in the 8th century.

Thomsonites are found along the beaches of the Keweenaw Peninsula and on Thomsonite Hill not far from Eagle Harbor.

From The Pegmatite, 9-2002, via the Conglomerate 2/98

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Opal Cultural Beliefs and Historic Timeline

- 4000 B.C. Ethiopians: Symbol of wealth, magical qualities and limitless possibilities to its owner. Hypothetical origin of opal gems
- 2000 B.C. Greeks: “Opallios”- to change color; Symbol of hope, and prophecy
- Romans (First to sell opals, creating image of a rare and exquisite gem): Hope and purity
- 476 Some thought of opal as the “eye Stone,” stating it helped with good eyesight. Also, it was thought to protect hair color on blonde women. It was heard to give possible invisibility to its owner.
- 1700-1800 Europe: Some claimed opal to be bad luck-associated with pestilence, famine, fall of monarchs. Queen Victoria, though, was a lover of opals and made opals highly fashionable. The highest quality opals were found in Australia, where mines began popping up all over continent.
- 1849 Discovery of Opals in Australia – Johannes Menge
- 1890s Queensland opens major fields: Koroit, Yowah and Opalton. Another mine opens up called White Cliffs; Opal now being sold on World Market.
- 1895 Lightening Ridge originally known as Wallangulla
- 1907 First cutter, Charles Deane Old Town on Lightning ridge
- 1915 Coober Pedy Founded
- 1930s Although mining had slowed, more men were willing to get into the occupation in hopes of earning money during the Depression.
- 1932 Eastern European mines unable to compete with Australia and mining slows for Europe.
- 1946 New Findings bring opal mining back up to speed
- 1956 Opaline Australia founded by George & Zoe Christianos- Eight Mile Field, mining spread throughout Australia and was carried on by son, Peter Christianos

- 1985 Seminal work by the Geological Survey of New South Wales leads to better, more scientifically controlled exploration for opals
- 1998-1999 Estimated value of opal production in the States is about $44 million. New South Wales (and Australia) is a leading world producer of opals.
- 1999-Present Australia mines more than 50% of the world's opal.

From http://users.wpi.edu/~tlufkin/Geology%20Website/history.htm

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February 2008 Gem & Mineral Shows

2-16–TUCSON, AZ: Annual show, "AZ Mineral & Fossil Show"; Martin Zinn Expositions; The InnSuites Hotel, 475 N. Granada; 10-6 daily, 10-5 last day; free admission; more than 400 dealers from all over the world, artists' gallery; free shuttle to other Zinn shows; contact Regina Aumente, P.O. Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mz0955@aol.com; Web site: www.mzexpos.com

2-16–TUCSON, AZ: Annual show, "AZ Mineral & Fossil Show"; Martin Zinn Expositions; The Mineral & Fossil Marketplace, 1333 N. Oracle Rd.; 10-6 daily, 10-5 last day; free admission; more than 400 dealers from all over the world; free shuttle to other Zinn shows; contact Regina Aumente, P.O. Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mz0955@aol.com; Web site: www.mzexpos.com

2-16–TUCSON, AZ: Annual show, "AZ Mineral & Fossil Show"; Martin Zinn Expositions; Quality Inn, 1025 E. Benson Hwy.; 10-6 daily, 10-5 last day; free admission; more than 400 dealers from all over the world; free shuttle to other Zinn shows; contact Regina Aumente, P.O. Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mz0955@aol.com; Web site: www.mzexpos.com

2-16–TUCSON, AZ: Annual show, "AZ Mineral & Fossil Show"; Martin Zinn Expositions; Ramada Ltd, 665 N. Freeway; 10-6 daily, 10-5 last day; free admission; more than 400 dealers from all over the world; free shuttle to other Zinn shows; contact Regina Aumente, P.O. Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mz0955@aol.com; Web site: www.mzexpos.com

8-10–SANTA MONICA, CA: Show; Gem Faire; Santa Monica Civic Auditorium, 1855 Main St.; Fri. 12-7, Sat. 10-7, Sun. 10-5; $5 weekend pass; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: www.gemfaire.com

15-17–MONTEREY, CA: Show; Gem Faire; Monterey County Fairgrounds, 2004 Fairground Rd.; Fri. 12-7, Sat. 10-7, Sun. 10-5; $5 weekend pass; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: www.gemfaire.com

15-24–INDIO, CA: Show; San Gorgonio Mineral & Gem Society; Riverside County Fairgrounds, Gem & Mineral Bldg. #1, 46-350 Arabia St.; all days 10-10; Riverside County Fair and Date Festival; contact Bert Grisham, (951) 849-1674

22-23–NORTHRIDGE, CA: Show, "San Fernando Valley Gemboree"; Del Air Rockhounds; United Methodist Church, 9650 Reseda Blvd.; Fri. 3-9:30, Sat. 10-5; free admission, children under 16 must be accompanied by adult; dealers, demonstrations, exhibits, silent auction, plant sale/boutique, games, geode cutting, stone sculpture, youth/Scout activities; contact Julia Marin, 18220 Marilla St., Northridge, CA 91325, (818) 886-7190; e-mail: ohmarin@earthlink.net

23-24–ANTIOCH, CA: Annual show, "Treasures of the Earth 2008"; Antioch Lapidary Club; Contra Costa County Fairgrounds; Sat. 10-5, Sun. 10-5; adults $3, Scouts in uniform and kids 12 and under free; lapidary demonstrations, dealers, faceted stones, hand-made jewelry, rocks, beads, supplies, opals, fossils, minerals; contact Ellen Bauer, (925) 458-2539; e-mail: ebauer_lapidary@yahoo.com

23-24–SAN FRANCISCO, CA: Show, "San Francisco Crystal Fair"; Pacific Crystal Guild; Laguna Ave. and Marina Blvd.; Sat. 10-6, Sun. 10-4; admission $6; contact Jerry Tomlinson, (415) 383-7837; e-mail: sfxtl@earthlink.net; Web site: www.crystalfair.com

29-2–COSTA MESA, CA: Show; Gem Faire; Orange County Fairgrounds/Bldg. 10, 88 Fair Dr.; Fri. 12-7, Sat. 10-7, Sun. 10-5; $5 weekend pass; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: www.gemfaire.com

29-2–HAYWARD, CA: 60th anniversary show and sale; Mineral & Gem Society of Castro Valley; Centennial Hall, 22292 Foothill Blvd.; Fri. 10-6, Sat. 10-6, Sun. 10-5; 3-day; contact Larry Ham, (510) 887-9007; Web site: www.mgscv.org

29-9–IMPERIAL, CA: Show; Imperial Valley Gem & Mineral Club; Imperial Valley Fairgrounds, IV Gem and Mineral Bldg., 200 E. 2nd St., at Hwy. 86; exhibits, dealers, demonstrations, gold panning, kids' games; contact Pat King, (760) 791-9192

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The Opal Express is published monthly by
The American Opal Society.

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Please address all inquiries and exchange newsletters to:
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Are Your Dues Due Now?

PLEASE CHECK YOUR ADDRESS LABEL. If your label shows **the** current month/year your dues are DUE NOW. If the date is older, your dues are overdue.

A Renewal Grace Period of two months will be provided. If your dues are due now you will receive two additional issues of the newsletter. Please note, however, that as the system is now set up, if your renewal is not received you will be AUTOMATICALLY dropped from membership thereafter. It is your responsibility to assure your dues are current.

Thank you,
The Editor

The Opal Express
American Opal Society
P.O. Box 4875
Garden Grove, CA 92842-4875

Volume #41 Issue #2
February 2008

TO:

Some Topics In This Issue:

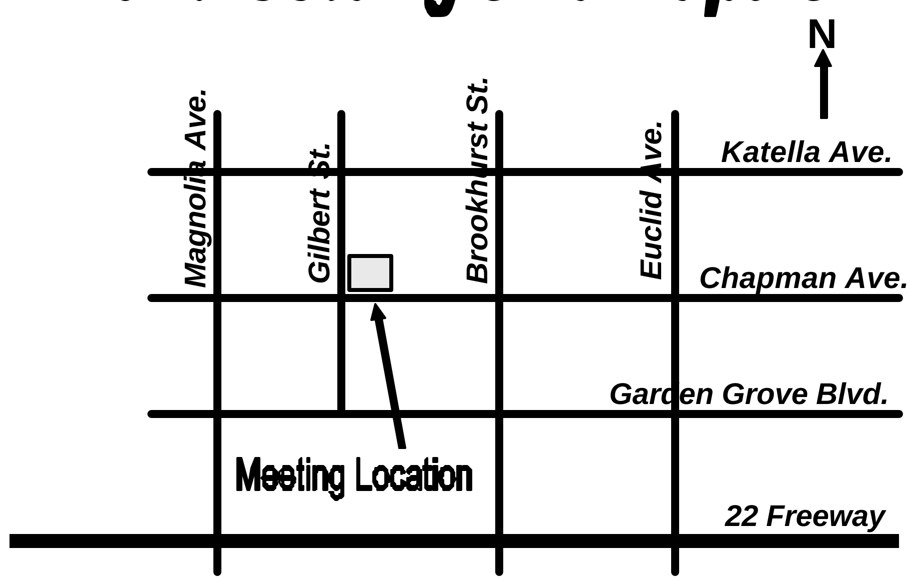
- **AOS Election**
- **Buying Opal**
- **Rare Mummified Dinosaur Unearthed**
- **Man-Made Diamonds**
- **Thomsonite**
- **Opal Beliefs and Historic Timeline**

Important Info:
Board Meeting – January 22th

General Meeting - February 14th
David Kramer, one of our area's foremost jewelry designers, will demonstrate his technique on how to cut small but beautiful opals. In addition, he will show how to set these opals.

February 14th

David Kramer on Cutting and Setting small Opals



— ***GENERAL MEETINGS*** —

2nd Thursday of the Month
7:00 pm - 9:00 PM

Garden Grove Civic Women's Club
9501 Chapman Ave.
Garden Grove, CA 92841

(NE corner of Gilbert & Chapman)

MEETING ACTIVITIES
Opal Cutting, Advice, Guest Speakers, Slide Shows, Videos, Other Activities

The American Opal Society

http://OpalSociety.org

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