The Opal Express

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President's Message

By Gene LeVan

Happy New Year to all the opal lovers!

Our Christmas dinner was very successful and enjoyed by all, Milt was the door prize winner of a very large boulder opal that he can cut on his 18" diamond saw.

For the 2008 New Year we are planning great meetings with good speakers be sure to come out and learn more about opals. I will have a small display of fine opal material for January meeting and rough black stones to sell.

See you at our general meeting on Thursday January 10th at 7:00 PM.

Gene LeVan presents Milt Roth with Large Boulder Opal Door Prize.

Newly Weds Russ & Vicki Madsen

Rollo Sternaman, Stan McCall, Gene and Loretta LeVan

Some of the AOS Members at our Christmas Party from left to right: Jim & Karen Lambert, Mike Kowalsky, Fran Todd, Lora Heidrich, Eva Coan, Evelyn Nissan, and Bob Dixon.

January Speaker – Jim Pisani on Virgin Valley

Jim Pisani will give a slide presentation on his recent trip to Virgin Valley to dig for opals. He will show how he digs for opal at the Royal Peacock Opal Mine and will have some black opal samples on display.

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Opal Society Workshop

The American Opal Society's workshop is open in January, 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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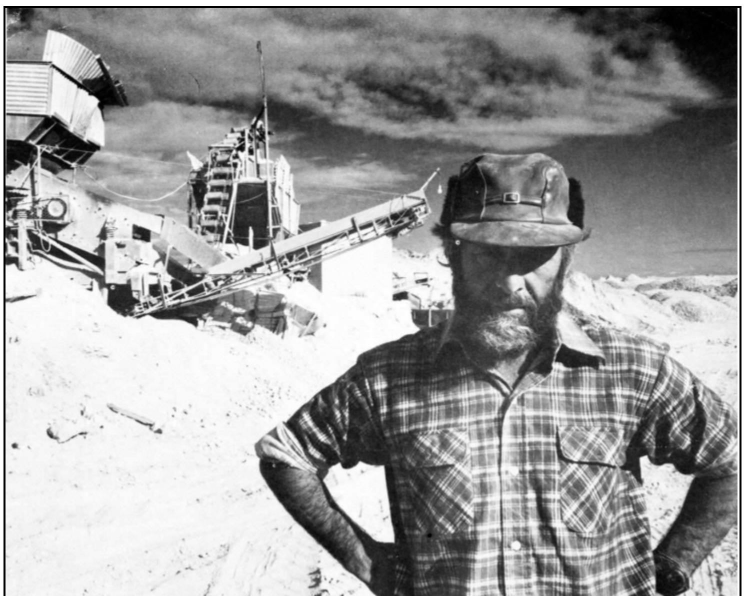

Kel Sheils at his Coober Pedy claim

Ultraviolet Recovery

Noodling plants at Coober Pedy switch on ultraviolet light to discover the glow of opal.

BY K. C. Sheils

Curious how seemingly insignificant scientific fact can be used to great advantage! About twenty years ago at the Coober Pedy fields here in Australia, there was talk about the possibility of using ultraviolet light to find opal. But nothing was done until one day a four-foot fluorescent "black light" tube was taken to the fields. The tube lay idle for some time until someone finally decided to give it a try: one night it was hitched up to a small petrol generator and used to illuminate a dump alongside a shaft where opal had been found. The dump was raked over roughly until opal began to shine like candles on a Christmas tree.

The time spent that night turned out to be something better than many Christmases put together. A few days after the lighted search, a passing opal buyer offered a good price for the stones that were found, thereby setting a large project in motion. A mobile darkroom complete with a conveyor running through it was built next and a front loader then added which could drop sandstone from a mullock dump onto the conveyor. As the conveyor was fed through the darkroom, "pickers" inside were kept busy taking opal from the belt. At Coober Pedy all opal fluoresces, some types better than others, with color or the markings of worthless potch; so everything has to be taken. The only way to tell really good opal under the black light is to observe a harlequin-like pattern of varying shades, but usually operators are just too busy to take time speculating about a stone.

Once a Coober Pedy opal is subjected to ultraviolet light on a wavelength of 3660 angstroms (366 nm), it immediately shines well. That is the principle of subjecting opals laid out on the four-foot wide belt in the darkroom to fluorescent light. Should the darkroom door open and daylight enter, it would become almost impossible to see opal, particularly if it is coated with sandstone and dust.

Opal from some areas fluoresces extremely well; some, on the other hand, glows little or not at all, depending on the impurities in the stone. Activators such as nickel, silver, or copper will cause fluorescence; in opals, uranium causes the glow.

The writer has found that when gypsum comes under UV and glows orange, the opal from the area is usually of gem quality. (In one area the writer found opal with traces of hydrocarbon, so possibly someone will drill there for oil someday.) The enormous mass of land which is capable of producing opal was at one time submerged beneath the sea. Geological maps, moreover, show that at different times some parts of Australia were pushed up and down; hence the existence of opalized shells. Opal is usually found in sandstone; at Coober Pedy the opal goes down to about 90 feet.

Wide Applications

The importance of this process emerges if one looks at the opal-extraction procedure in general. In mining, if a seam of opal is gouged out by hand and some material inevitably dropped in the sandstone on the floor of the drive the (lateral tunnel where digging occurs), trying to recover the gem is long and difficult. No matter how careful a miner is, some opal is always lost in the mullock.

In normal mining at Coober Pedy, opal runs in a more or less horizontal seam. Occasionally, we get opalized seashells, belemnites and other fossils, most of which opalize very well indeed. In addition, we get "verticals," opal seams which appear unexpectedly that run up toward ground level; these are structured like a brick wall and usually can be taken out piece by piece without trouble. Such pieces usually yield very good opal which can be identified by the way the grain runs. Since the grain, or bars of color, in most opal runs horizontally, it is actually possible to tell by looking which way an opal has lain in the ground.

Although a miner has a good chance of gouging out most of the opal found in horizontal seams, he has few or no clues to the existence of fossils or verticals in sandstone. He therefore resorts to using explosives to move ground, blasting a few feet at a time; but when he does so any fossils or verticals usually get lost in the mullock. By using a "noodling plant" or one that makes use of the UV light technique to recover opal from a dump, one may recover almost an entire vertical opal seam. In fact, we have recovered as much as an entire seam minus one piece, a highly efficient operation by anyone's standard.

If one looks at what is recovered from this operation at the end of the day, however, one would think that with the exception of a few stones what was found was of little value. But when the material is tumbled in water for a half hour, then washed clean and inspected under light, the results can be very encouraging.

The trick is to find a dump which has produced good opal — but locating one of these among the thousands of abandoned claims at Coober Pedy can be a puzzle. Some holes have produced $20 million worth of opal, others a lot of opal without color and still others "potch and color" (opal with just a faint streak of fire) only. Local knowledge about sites is invaluable in determining where to begin but ultimately may, for a number of reasons, prove unreliable, so a person often may have to do a good deal of sorting through information from a number of storytellers before starting.

Finding a Worthwhile Dump

A good way to locate dumps of value is to look for one which has been scattered about. The local aboriginals generally have eyes like hawks, so it's often worthwhile to scour any mullock heaps where they find a speck of color. Another way is to look for dumps that are in a line, an indication that some serious work has been done to follow up a good seam.

But at times even this may be difficult. Usually miners try to hide any indications that they have found opal: they "backstow" or fill up old drives with the mullock so that no hint of an opal find remains on the surface. In addition, they may behave the same way that they did before making their find, pretending still to be glum, unsmiling, and too short of cash to spend money on luxuries at local stores. They do this because there are always people around looking for even slight indications of a new find in order to rob a mine at night.

For anyone determined to prospect for opal, a good method for locating a potentially worthwhile dump is to test a suspected area at night with a small hand-held UV lamp. Once a test proves positive, a machine may then be brought to work the entire area. A good part of the dump, however, should be worked to find real value since dirt with opal in it may have been tipped only in one area.

If secrecy is always advisable in mining for opal, it is equally important in the UV "noodling" plant. People involved in the process recognized that from the very beginning. Even when the first noodler was built, it was hard to find out what was going on since those involved with the procedure feared that any information about the technique would immediately reduce the number of profitable dumps available.

After the first primitive darkroom had been built, it was found desirable to separate both small and large pieces of sandstone into dust. Only material 1/4" to 2" was considered fit to look at, so a Link Belt vibrating screen was installed to separate the mullock efficiently by discarding dust and big pieces of sandstone. Since what remained was dust free, the search for opal became that much easier.

At present, there are a few noodling plants of varying design at Coober Pedy. Some can be operated by a single individual who alternates loading and darkroom chores: such plants generally contain a storage hopper. Others require that an additional person use a front-end loader all the time. One immediately gets some notion of how all such plants improved mining efficiency and, therefore, profits as well if one compares the output of a single individual earning a living by sieving dumps by hand with one man working ten hours a day in a noodling operation processing about 100 tons of mullock.

The Sheils's Operation

One of the best areas for opal at Coober Pedy is the two-mile long Olympic field which produced vivid fine quality opal that is mostly red and blue. We worked this field for about three years during which time we set up our plant alongside a bulldozer cut that was sixty feet deep. After we filled this in we trucked the waste sandstone out to vacant land several times a day. At the same time we were collecting a great heap of mullock which a contractor brought in from all the dumps around the Olympic. By the time the operation was finished, we decided to place all units of the plant on a forty-foot trailer so that we could move around to the dumps rather than bring the material to us.

Since then, the plant has been modified several times and now resides in a passenger bus which was too wide for road registration. It contains a vibrating sieve, conveyors to spread waste away from the plant, bucket elevators to store pay dirt in the hopper, a darkroom complete with conveyor belt and UV light, and a conveyor to distribute the pay dirt after opal has been removed. Thus, it becomes a fairly simple operation to drive up to a dump, try it, then stay to work it or move on.

In terms of specifics, we use a one-yard MF loader and run the plant with a 1 5-KVA diesel generator which incorporates a four-cylinder, 400-volt Perkins diesel engine. The three-phase electric motors give no trouble, whereas in the old days when we used 230-volt motors we had some difficulties. At present, all moving parts are controlled by a reduction gearbox, which gives us just the right speeds.

Actually, much research and a good many modifications have gone into fine tuning our plant's efficiency. Since 'the amount of opal in any dump varies, it is necessary to be able to slow down the flow of material through a darkroom or speed it up so pickers can work at a good pace.

Of course, the efficiency of an operation impacts on price of the gemstone. In the very early days of mining, the market demanded only the best opal: a top price then was roughly equivalent to $80 per ounce. Over $6,000 per ounce has now been received; even taking inflation into account, That is a considerable rise in price. Little wonder miners, in light of increased demand and ever rising prices, are loath to sell some of their best stones.

Because of demand for superior stones in the early days a good deal of opal was simply discarded on the floor of drives in hope that the seam would improve in quality. A couple of enterprising young lads took advantage of this fact by first investing in a small 12-volt hand-held black light and then spending each day sieving the dirt in such drives. They produced many ounces of opal (which now sells for $30 an ounce) by this method with operating expenses restricted to occasional purchases of two 6-volt batteries. When they decided to cut down overhead, they bought a car battery — but after dropping this one day down a shaft, they went back to their original power supply.

There are really no rules about the quality of opal coming through a noodling plant. I have seen a black opalized shell which ended up in a fabulous 35 carat stone. It was found in a big lump of sandstone which had only a tiny speck of opal showing; that speck was picked up by UV light. When finished, the gem was worth $70,000.

Moreover, the returns for working this way are very good, with one advantage being that a person can choose to work fields producing the best opal and move quickly if nothing is found. How much better than mining by sinking a shaft and tunneling drives in hopes of finding something; that gets to be a very expensive business if one's luck happens to be out.

Occasionally we have worked an old claim in which a lot of pay dirt was left below, usually 60 feet down. To recover this, we bought a "blower," a variation of a vacuum cleaner that used a hefty 6-cylinder diesel to drive a cyclone fan. The blower was hooked to a series of 9" diameter tubes which were fed down into the old mine so that the pay dirt could be sucked up and sent to the plant. This is a more costly operation, but when someone is working a claim that has already produced something in the vicinity of a million dollars, it's very profitable to do so. A good deal of the opal found is sold overseas, with most being sent to our regular dealers and some to our mail-order clients.

From Outpost to Modern Town

Coober Pedy is a very relaxed town with a good many amenities — like a good food and water supply, a hospital, an air-conditioned and carpeted school — that make life far more comfortable now than it was in the past.

Thirty-three years ago when I first came, the road consisted of only two track wheels through the desert. If it rained, it was hard to get out of the bogs. Then too there was hardly anyone around: the few who had come to work the fields lived in small dugouts scattered about the area. More often than not, their families lived miles away.

Some of these miners were so poor that they were unable to buy food from the truck which arrived weekly to bring provisions; instead, they lived by trapping rabbits and carting water by hand from the nearest bore. Since all of the work was done by hand, even the arrival of so much as a small drill on the back of a truck caused a sensation. But even these drills did little good since most of the opal levels were beyond their reach.

Today life is totally different. Children no longer rely on correspondence courses transmitted over telephones having poor reception or an occasional illiterate operator as the source of schooling. Trees are beginning to grow again in town — a new sight for those old-timers who once depleted the settlement of trees to gain timber for mine shafts or firewood. And even many of the dugouts themselves in the fields are as comfortable as modern homes with all their conveniences. In fact, the rather stress-free life today seems to make for happiness.

If occasionally someone does suffer stress, the situation often ends happily. One group of miners operated a big drilling rig which put down a shaft in a mine in a few hours via a 3-foot-diameter bucket drill. About 50 feet down, the bucket broke on a rock which the workers thought was a costly obstruction. But this kind of stress lasted only till the bucket was recovered for the miners then went down to find the obstruction a 6-foot-thick opal.

From the Lapidary Journal, June 1986 .

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Here's a good thread I found on why opal fluoresces. The Editor

Is it Unusual for Opals to Fluoresce?

My mother recently gave me a lovely necklace that belonged to my grandmother. It has a row of 9 little pear-shaped rubies and a scattering of tiny full-cut diamonds (also 9 of them), but mostly it's an opal necklace. 43 small pear-shaped opals, very fiery, mostly blues and greens. The sort of opals you see in Edwardian jewelry. I'm guessing the necklace is from the 1950s.

I was checking it with my little fluorescent flashlight out of curiosity to see whether the diamonds had fluorescence. About half of them have medium or strong blue; the rest don't seem to have any. I was interested, but not surprised, to see that all the rubies lit up bright red under the blacklight. What surprised me was that the opals seemed to fluoresce blue-green, too.

At first I thought they were just reflecting the purplish blacklight of the flashlight. But when I turned it off in the dark after holding the blacklight close to it for a while, the fluorescent diamonds went on glowing for a few moments, as fluorescent diamonds do--and so did the opals. (The rubies, on the other hand, were completely dark as soon as the light went off.)

This specimen of opal is from Ogdensberg, New Jersey, and is shown fluorescing under short wave ultraviolet radiation. Common opal from Australia exhibits either no fluorescence or pale blue fluorescence. Males (1973) attributed the difference to wide spread contamination of American strata by uranium.
Webster (1983) and Arem (1987) attributed the green fluorescence of New Jersey opal to uranium minerals present in the opal as impurities or, to be more precise, to the uranyl group (UO_2).

Is this common behavior for opals? Are they often fluorescent, and do they often go on glowing after the blacklight's gone?

Fluorescence: The emission of radiation (usually visible light) when a substance is irradiated by higher-energy radiation such as ultra-violet light.

Phosphorescence: The continuation of fluorescence after the activating radiation is turned off.

Source: "Rocks and Minerals" by O'Donoghue

I have seen a lot of Fluorescent Opal from the Virgin Valley of Nevada area, but I have never checked to see if it is Phosphorescent.

Joker....

Apparently American opals commonly have yellow-green fluor, and Aus opal is either inert or shows blue-white fluor with green phosphorescence...green fluor is thought to be due to uranium minerals as inclusions ...

Got this info from "Fluorescence" by Robbins, p.171....learn something every day!

Gary - www.diamondexpert.com

From http://www.pricescope.com/idealbb/view.asp?topicID=59842

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Opal Chips: Photonic Jewels

January 22, 2001

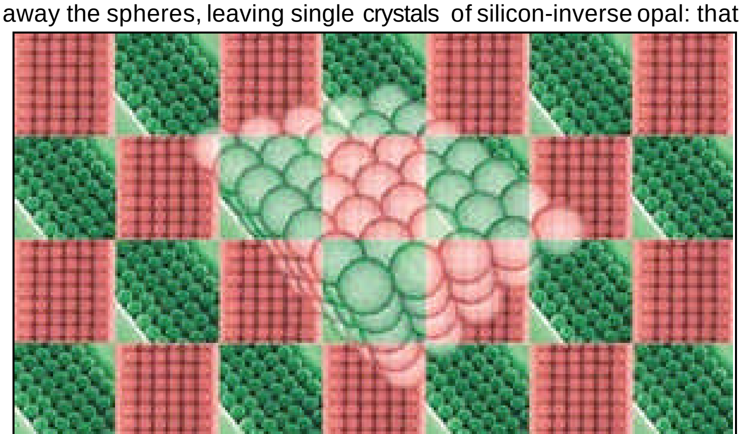
Colloidal crystals in silicon wafers may lead to first practical photonic chip

By Michael Freemantle

Integrated microphotonic systems that rely on light rather than on electrons to carry information are expected to have a revolutionary impact on communication and information management systems. Light not only travels much faster than electrons, but it also carries larger amounts of information per second.

The development of microphotonic systems, however, will require the efficient synthesis of high-quality crystals of silicon with particular properties that influence the propagation of light. These crystals must have a three-dimensional photonic band gap that blocks photon transmission at the near-infrared wavelength of about 1.5 μm—the wavelength of choice for fiber-optic telecommunications. Such photonic band-gap crystals confine light in all three spatial dimensions and therefore could be used to manipulate signals in the light circuits of all-optical microchips. And because they are made of semiconducting silicon, they would be fully tunable by an externally applied voltage and could be integrated with conventional silicon-based microelectronics.

Last year, chemistry professor Geoffrey A. Ozin and physics professor Sajeev John at the University of Toronto and coworkers described a simple and inexpensive method for the large-scale preparation of 3-D silicon photonic crystals [Nature, 405, 437, (2000)]. The method relies on the use of a template of close-packed microspheres of opal—an amorphous form of hydrated silica—connected by small "necks" formed during sintering. After filling the voids between the silica spheres with silicon, the team dissolves away the spheres, leaving single crystals of silicon-inverse opal: that



CONFINING LIGHT Silica colloidal crystal is superimposed on scanning electron microscopy images of opal chip.

is, interconnected networks of silicon shells enclosing spherical air-containing voids.

"When the refractive index contrast between the voids and the silicon lattice is sufficiently large, the photonic crystal diffracts light according to Bragg's law," Ozin explains. "An omnidirectional photonic band gap develops when the refractive index contrast is above a threshold value of 2.85. Light with wavelengths corresponding to this band gap cannot propagate through the crystal."

LIGHT CANNOT PROPAGATE, that is, unless there are intentionally placed defects in the crystal. And it is these so-called extrinsic defects—designed imperfections in the periodicity of the crystal—that researchers are seeking to exploit for the development of photonic information technology. A point defect, or vacancy, in the crystal could act as a microcavity to trap light, for example. Line defects could operate as waveguides that connect photonic devices in all-optical microchips. And planar defects could be used as mirrors in microphotonic systems.

"Following our synthesis of a 3-D silicon photonic crystal, we realized that it was paramount to gain control over intrinsic defects," Ozin explains. "These defects are random collections of imperfections such as missing spheres, dislocations (that is, crystal planes that do not line up with one another), and polycrystals that are arranged haphazardly."

Our method is a straightforward, fast, reproducible, and cost-effective way of fabricating micrometer-scale patterned single-crystal colloidal crystals in silicon wafers."

The key aim of photonic crystal research, he points out, is to prepare crystals that exclude intrinsic defects but incorporate extrinsic defects that can be built into the crystal in a controlled manner during crystal manufacture.

"Extrinsic defects enable the crystal to function in a controlled way," Ozin says. "With polycrystals and crystals with intrinsic defects, one can only observe average photonic crystal properties. Moreover, the defects can destroy the photonic band-gaps that one is trying to exploit for photonic device applications."

Last month, Ozin and University of Toronto postdoctoral chemist San Ming Yang reported what they consider to be a breakthrough in photonic chip development. The two chemists described a method for preparing single crystals of silica microspheres in the grooves of a silicon wafer [Chem. Commun., 2000, 2507]. They dub these opal crystal-containing wafers "opal chips."

THE SINGLE CRYSTALS—opals—are close-packed arrays of silica microspheres. The spheres have colloidal dimensions and, because they all have approximately the same diameters, are monodisperse.

The crystals can be made essentially free of defects. "When vacancy defects are present in the silica colloidal crystals, they can easily be identified and their effect on optical properties evaluated," the authors note.

The microspheres have diameters of around 840 nm. "Microspheres this size are needed to push the operating wavelength of the photonic crystals to 1.5 µm," Ozin says.

Previous methods of organizing monodisperse microspheres into single-crystal colloidal crystals have suffered from a number of problems, Ozin and Yang point out. For example, they cannot be used to simultaneously control order, structure, defects, thickness, area, orientation, and registry of the crystals.

"Our method is a straightforward, fast, reproducible, and cost-effective way of fabricating micrometer-scale patterned single-crystal colloidal crystals in silicon wafers," Ozin says. "The method has the capability of controlling defects in colloidal crystals as well as the number, area, orientation, and registry of close-packed layer planes of both large- and small-diameter microspheres in the colloidal crystals embedded within a single-crystal silicon wafer."

The method employs a standard soft, or chemical, lithography process to prepare etched silicon wafers. First, a polydimethylsiloxane (PDMS) master that defines the groove patterns on the wafer is inked with hexadecanethiol in ethanol and printed onto a gold-coated silicon wafer. A nanometer-thick layer of titanium is used as an adhesion layer between the gold and silicon.

The bare gold surface is then removed with cyanide etching solution, and the underlying silicon substrate is anisotropically etched with potassium hydroxide solution to give V-shaped grooves with 70.6° apex angles beneath the surface of the wafer.

"This angle is the exact angle needed for the microspheres to grow in a vectorial fashion within the grooves to form the desired pattern of face-centered, cubic colloidal crystal parallel lines," Ozin explains. "By controlling the dimensions of the etch pits in the silicon wafer, we can control the dimensions and shapes of the silica colloidal crystals."

The next step in opal chip preparation is to place a PDMS block flat and tight on the patterned silicon wafer. A drop of an aqueous dispersion of monodisperse silica microspheres is added at the interface between the wafer and block. The microspheres are driven into the V-shaped grooves by capillary forces. They then self-assemble into single-crystal colloidal crystals exclusively inside the grooves.

"The microspheres are prepared by a standard method known as the Stöber synthesis," Ozin says. "However, the maximum microsphere diameter you can obtain with this method is about 500 nm. We therefore use the 500-nm spheres as seeds to grow the larger spheres required for silicon photonic crystals operating in the near-IR."

Finally, the PDMS block is removed to leave the opal patterned chip. The sphere diameters in the crystals vary by between 2 and 5%. "We are now trying to get the polydispersity down to 0.1%," Ozin says.

By preparing single-crystal silica colloidal crystal templates with well-defined extrinsic defects, it should be possible, in principle, to fabricate silicon-inverse colloidal crystals, that is, 3-D silicon photonic crystals, with extrinsic defects that replicate the extrinsic defects in the template.

"This process for growing single-crystal colloidal crystal patterns could easily be integrated into chip fabrication facilities and is amenable to mass production," Ozin and Yang note.

Lorenzo Pavesi, physics professor at the University of Trento, Italy, and an expert on silicon-based optoelectronics, comments that the work is an interesting development in the field of photonic crystals.

"Opals are a way of realizing 3-D photonic band-gap crystals where the light propagation properties are drastically modified with respect to normal light," he remarks. "Until now, 3-D lattices of opals have been produced with little control of their structures. Ozin and Yang demonstrate an inexpensive and feasible way not only to produce opal 3-D lattices but also to structure them in such a way that they can be used in practical photonic circuits. In addition, they demonstrate a way to engineer opal-based photonic crystals within a silicon chip."

Pavesi adds a few caveats about the research, however.

"Before one can be confident of this technique, some aspects need to be clarified, such as the compatibility of the opal crystals with the usual microelectronic processing methods," he says. "The thermal characteristics, damage threshold, aging of the structures, and properties of light in the structures need to be determined. In addition, the compatibility of the deposition process, which is a wet one, with other silicon processing, and the ease and feasibility of introducing active materials into the opal to realize active devices will also have to be determined.

"Once all of these aspects have been clarified, one can imagine that the technique could provide a new impulse in the field of silicon-based photonics," he concludes.

The potential of the technique is not just confined to photonics, however. Ozin and Yang point out that the method combines soft lithography, self-assembly, and microfluidics, and future applications could therefore be found in lab-on-a-chip technologies.

OPAL CHIPS may find utility for positioning and connecting lab-on-a-chip arrays of microfluidic and microreactor devices that perform chemical and catalytic transformations, as well as ion, molecule, and macromolecule separations with simultaneous optical detection, the Toronto chemists suggest.

Chemistry professor and lab-on-a-chip expert Jed Harrison at the University of Alberta, Edmonton, comments that the use of microstructures such as the opal chip to pattern and assemble microparticles in a uniform and controlled pattern is an exciting step toward converging nanotechnology and micromachining.

"Ozin and Yang's results suggest the ability of microfluidic devices to contribute to nanofabrication and to nanomaterials synthesis," he says. "In this sense, microsystems can become the tools to access and control nanosystems."

From the American Chemical Society Journal, http://pubs.acs.org/isubscribe/journals/cen/79/i04/html/7904sci1.html.

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*"Are the Great Pyramids made out of **OPAL**? (i.e. diatomaceous earth) - The Editor*

The Surprising Truth Behind The Construction of the Great Pyramids

This behind the scenes article was provided to LiveScience in partnership with the National Science Foundation.

By Sheila Berninger, and Dorilona Rose, 18 May 2007

"This is not my day job." So begins Michel Barsoum as he recounts his foray into the mysteries of the Great Pyramids of Egypt. As a well respected researcher in the field of ceramics, Barsoum never expected his career to take him down a path of history, archaeology, and "political" science, with materials research mixed in.

As a distinguished professor in the Department of Materials Science and Engineering at Drexel University, his daily routine consists mainly of teaching students about ceramics, or performing research on a new class of materials, the so-called MAX Phases, that he and his colleagues discovered in the 1990s. These modern ceramics are machinable, thermal-shock resistant, and are better conductors of heat and electricity than many metals—making them potential candidates for use in nuclear power plants, the automotive industry, jet engines, and a range of other high-demand sys tems.

Then Barsoum received an unexpected phone call from Michael Carrell, a friend of a retired colleague of Barsoum, who called to chat with the Egyptian-born Barsoum about how much he knew of the mysteries surrounding the building of the Great Pyramids of Giza, the only remaining of the seven wonders of the ancient world.

The widely accepted theory—that the pyramids were crafted of carved-out giant limestone blocks that workers carried up ramps—had not only not been embraced by everyone, but as important had quite a number of holes.

Burst Out Laughing

According to the caller, the mysteries had actually been solved by Joseph Davidovits, Director of the Geopolymer Institute in St. Quentin, France, more than two decades ago. Davidovits claimed that the stones of the pyramids were actually made of a very early form of concrete created using a mixture of limestone, clay, lime, and water.

"It was at this point in the conversation that I burst out laughing," says Barsoum. If the pyramids were indeed cast, he says, someone should have proven it beyond a doubt by now, in this day and age, with just a few hours of electron microscopy.

It turned out that nobody had completely proven the theory...yet.

Professor Michel Barsoum stands before one of the Egyptian pyramids for which he has found evidence suggesting some of the stone blocks were cast, not quarried. Credit: Michel Barsoum, Drexel University

"What started as a two-hour project turned into a five-year odyssey that I undertook with one of my graduate students, Adrish Ganguly, and a colleague in France, Gilles Hug," Barsoum says.

A year and a half later, after extensive scanning electron microscope (SEM) observations and other testing, Barsoum and his research group finally began to draw some conclusions about the pyramids. They found that the tiniest structures within the inner and outer casing stones were indeed consistent with a reconstituted limestone. The cement binding the limestone aggregate was either silicon dioxide (the building block of quartz) or a calcium and magnesium-rich silicate mineral.

The stones also had a high water content—unusual for the normally dry, natural limestone found on the Giza plateau—and the cementing phases, in both the inner and outer casing stones, were amorphous, in other words, their atoms were not arranged in a regular and periodic array. Sedimentary rocks such as limestone are seldom, if ever, amorphous.

The sample chemistries the researchers found do not exist anywhere in nature. "Therefore," says Barsoum, "it's very improbable that the outer and inner casing stones that we examined were chiseled from a natural limestone block."

More startlingly, Barsoum and another of his graduate students, Aaron Sakulich, recently discovered the presence of silicon dioxide nanoscale spheres (with diameters only billionths of a meter across) in one of the samples. This discovery further confirms that these blocks are not natural limestone.

Generations Misled

At the end of their most recent paper reporting these findings, the researchers reflect that it is "ironic, sublime and truly humbling" that this 4,500-year-old limestone is so true to the original that it has misled generations of Egyptologists and geologists and, "because the ancient Egyptians were the original—albeit unknowing—nanotechnologists."

As if the scientific evidence isn't enough, Barsoum has pointed out a number of common sense reasons why the pyramids were not likely constructed entirely of chiseled limestone blocks.

Egyptologists are consistently confronted by unanswered questions: How is it possible that some of the blocks are so perfectly matched that not even a human hair can be inserted between them? Why, despite the existence of millions of tons of stone, carved presumably with copper chisels, has not one copper chisel ever been found on the Giza Plateau?

Although Barsoum's research has not answered all of these questions, his work provides insight into some of the key questions. For example, it is now more likely than not that the tops of the pyramids are cast, as it would have been increasingly difficult to drag the stones to the summit.

Also, casting would explain why some of the stones fit so closely together. Still, as with all great mysteries, not every aspect of the pyramids can be explained. How the Egyptians hoisted 70-ton granite slabs halfway up the great pyramid remains as mysterious as ever.

Why do the results of Barsoum's research matter most today? Two words: earth cements.

"How energy intensive and/or complicated can a 4,500 year old technology really be? The answer to both questions is not very," Barsoum explains. "The basic raw materials used for this early form of concrete—limestone, lime, and diatomaceous earth—can be found virtually anywhere in the world," he adds. "Replicating this method of construction would be cost effective, long lasting, and much more environmentally friendly than the current building material of choice: Portland cement that alone pumps roughly 6 billion tons of CO_2 annually into the atmosphere when it's manufactured."

"Ironically," says Barsoum, "this study of 4,500 year old rocks is not about the past, but about the future."

From http://www.livescience.coml via The Nugget, 10/07.

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Asteroid On Track For Possible Mars Hit

Researchers say the object, about 160 feet across, has a high chance of plowing into the planet Jan. 20.

By John Johnson Jr., LA Times Staff Writer
December 20, 2007

Talk about your cosmic pileups.

An asteroid similar to the one that flattened forests in Siberia in 1908 could plow into Mars next month, scientists said today.

Researchers attached to NASA's Near-Earth Objects Program, who sometimes jokingly call themselves the Solar System Defense Team, have been tracking the asteroid since its discovery in late November.

The scientists, based at the Jet Propulsion Laboratory in La Cañada Flintridge, put the chances that it will hit the Red Planet on Jan. 20 at about 1 in 75.

A 1-in-75 shot is "wildly unusual," said Steve Chesley, an astronomer with the Near-Earth Objects office, which routinely tracks about 5,000 objects in Earth's neighborhood in space.

"We're used to dealing with odds like one-in-a-million," Chesley said. "Something with a one-in-a-hundred chance makes us sit up straight in our chairs."

The asteroid, designated 2007 WD5, is about 160 feet across, which puts it in the range of the space rock that exploded over Siberia. That explosion, the largest impact event in recent history, felled 80 million trees over an area of 830 square miles.

The Tunguska object broke up before hitting the ground, but the Martian atmosphere is so thin that an asteroid would likely plummet all the way to the surface, digging a half-mile-wide crater in the surface, Chesley said.

Once it hit, it would probably send plumes of dust high into the atmosphere, scientists said. Depending on where it hit, the plume could be visible through telescopes on Earth, he said.

The Mars Reconnaissance Orbiter, which is currently mapping the planet, would have a front-row seat. NASA's two JPL-built rovers, Opportunity and Spirit, might also be able to take pictures from the ground of the impact's effects.

Because scientists have never observed an asteroid impact -- the closest thing being the 1994 collision of comet Shoemaker-Levy with Jupiter -- such a collision on Mars would produce a "scientific bonanza," Chesley said.

The asteroid's course has now taken it behind Earth's moon, he said, so it will be almost two weeks before observers get another chance to plot its course more accurately.

The possibility of an impact has the Solar System Defense Team excited.

"Normally, we're rooting against the asteroid" when it has Earth in its cross hairs, Chesley said. "This time we're rooting for the asteroid to hit."

From http://www.latimes.com. Reprinted for educational purposes under the "fair use" provision of the U.S. Copyright Act.

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Displaying Your Treasures

By Clay Williams, El Dorado County Mineral & Gem Society

Whether a case contains mineral specimen(s) or the product of any other related activity, the challenge is to display them to best effect. The author, who is struggling with the mastery of this art and has been for a number of years through successes and occasional failures, was asked by several club VIP's to share some of his insights.

A good place to start is the color scheme. The colors of all supporting elements of the exhibit should be relatively muted and, for the best effect, should both match each other and what is being displayed. The author took labels in colors that were appealing and also blended with his specimens, along with a junk piece of mineral that matched those specimens, to a fabric store where he placed each next to liner fabric candidates. The store clerk must have wondered what was going on. When the winning fabric was finally determined, the only other limitation was, could enough be purchased to cover all liner foam board and any possible fabric covered risers?

The word, muted, cannot be emphasized enough when talking about the case, the liners, the mounts and/or risers and the labels! All should be less eye catching than the object or objects of display. Various earth tone colors are an excellent way to execute this difference. Avoid bright colors, especially red, at all cost! That the last, when on cars, draws inordinate scrutiny from police should be a hint why. The bright purple liner that I saw at a recent show should probably go in favor of something much less attention getting -- after all, the intent is to get people to focus on what is being displayed, not on the background.

Labeling is important and indicates the exhibitor has taken the trouble to correctly identify your treasure. In most cases, such as with minerals and fossils, it should definitely include locality and name information. This should be more specific than, say, "Emerald, South America." A better effort would state that emerald is a variety of beryl and, at the very least, give the country and province, region or district of origin. It also might be nice to know where a lapped piece of tiger's eye, topaz in a jewelry setting or turquoise in a belt buckle came from. Competitive entries have certain requirements, which vary for different types of displays. Check the AFMS rules and CFMS Supplementary Rules Information. It would also be a good idea to ask for someone's advice if you are contemplating such a move.

Even though not really muted, black, depending on the shade of your liner, usually is fairly readable. Readability is an important issue and is one reason why the author tested a sample label at the fabric store. Readability also limits your choice of fonts. Making that font bold and of a reasonable size helps, as it must be assumed that not everyone can see or read well.

The author's labels are composed on a PC and then printed onto transparencies using an ink-jet. Each transparency page is then cut into individual labels, which may be further trimmed to fit in the spaces between specimens. Gloves are used whenever handling the finished product, as it fingerprints easily. This not-often-seen procedure gets lots of attention from those more interested in the process than the item or items being displayed.

Layout within the case is, of course, a personal thing. However, too much clutter looks very unprofessional and should be avoided; it diminishes the overall impression. Also to be avoided is the placement of lower quality material among stars; the former detracts from the latter. This is easier said than done, especially if one is new to collecting and, therefore, has a limited choice of what to include.

Labels should be of consistent type and not look like they were just thrown in. The liner or liners should cover the entire area visible through the glass, and not be stained or dirty. Avoid giving the appearance that your effort was lacking.

It is a good idea to try putting your case together pre-show. Such a dry run will get the kinks out, if any. It is the time to make final changes and is great practice, especially if the exhibit is at all complex. Also this can uncover any omissions while something can still be done.

Good luck! Ed. Note: Clay Williams has credentials behind his advice. He has entered his displays and won in competition at California Federation of Mineralogical Societies shows. He won the 1st Place Advanced Minerals Trophy for his copper minerals case and was also awarded the coveted Hamel Minerals Trophy at the 2005 CFMS Show in Roseville, CA. In June, he received the 1st Place Masters Minerals Trophy for his copper mineral case at the 2007 CFMS Show in Lancaster, CA.

From CFMS Newsletter, 2007-11

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January 2008 Gem & Mineral Shows

1-27--LAUGHLIN, NV: Annual show; Cloud's Jamboree; Avi Resort & Casino, 10,000 Aja Macav Pkwy.; 7-6 each day; free admission; indoor and outdoor vendors; contact Dick Cloud, P.O. Box 1917, Quartzsite, AZ 85346, (866) 558-7719; e-mail: Cloudsjamboree@tds.net; Web site: www.cloudsjamboree.com

4-6--MESA, AZ: 36th annual show, "Flagg Gem & Mineral Show"; AZ Mineral and Mining Museum Foundation; Mesa Community College, Dobson Rd. and U.S. Hwy. 60; Fri. 9-5, Sat. 9-5, Sun. 9-5; free admission; kids' activities, free samples for children and teachers, more than 80 vendors, minerals, fossils, gem and lapidary materials, special exhibits, Peralta Stones; contact AMMMF, P.O. Box 41834, Mesa, AZ 85274, (480) 987-8958; e-mail: dminerals@yahoo.com

4-6--SANTA ROSA, CA: Show; Gem Faire; Sonoma County Fairgrounds/Grace Pavilion, 1350 Bennett Valley 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

11-13--DEL MAR, CA: Show; Gem Faire; Del Mar Fairgrounds/Exhibit Hall, 2260 Jimmy Durante Blvd.; 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

18-20--GLOBE, AZ: 51st annual show; Gila County Gem & Mineral Society; Gila County Fairgrounds, U.S. Hwy. 60; Fri. 9-5, Sat. 9-5, Sun. 9-4; adults $2, high school students with ID and children with parents free; dealers, demonstrators, lapidary equipment, jewelry, books, tools, minerals, slabs, fossils, glass blowing, wirecraft, jewelry making, bead making, door prizes; contact Bill Morrow, (928) 812-0561, or Andy Clark, (928) 473-3042

18-20--HILLSBORO, OR: Show; Gem Faire; WA County Fairgrounds, 873 NE 34th Ave.; 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

19-20--FREDERICKSBURG, TX: 39th annual show; The Fredericksburg Rockhounds; Pioneer Pavilion, Lady Bird Johnson Park; Sat. 10-6, Sun. 10-5; free admission; hourly door prizes, raffle prizes, gold panning, fossils, gems, jewelry, exhibits, lapidary demonstrations, tame geologists, Rolling Rockhounds meeting; contact Jeff Smith, 208 Castle Pines Dr., Kerrville, TX 78028, (830) 895-9630; e-mail: jeffbrenda@ktc.com; Web site: www.fredericksburgrockhounds.org

23-27--QUARTZSITE, AZ: 42nd annual show, "QIA Pow Wow"; Quartzsite Improvement Association; 235 E. Ironwood Dr.; Wed. 9-5, Thu. 9-5, Fri. 9-5, Sat. 9-5, Sun. 9-5; free admission; more than 400 vendors, rocks, gems, minerals, beads, wire wrap supplies, jewelry, fossils, lapidary, field trips, displays, demonstrations; contact Diane Abbott, P.O. Box 881, Quartzsite, AZ 85346-0881, (928) 927-6325; e-mail: powwow@qiaaz.org; Web site: www.qiaaz.org

25-27--ROSEVILLE, CA: Show; Gem Faire; Placer County Fairgrounds, 800 All America City Blvd.; 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

Thank you for continuing to support your American Opal Society!

American Opal Society Membership Renewal

TYPES OF MEMBERSHIP		DUES / FEES)	AMOUNT PAID
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ONE TIME INITIATION FEE All New members		**$10**	
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Please make check or money order payable to "***American Opal Society***". Mail payment and application to:

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An optional, quicker method of payment is via the **Internet**. To pay, just visit the membership page on our website at http://opalsociety.org/aos_application_by_web.htm and complete the form. You may pay with a **Credit Card** or via **PayPal** account. The transaction is completely secure and the AOS never sees your credit card number. The AOS PayPal account is **membership@opalsociety.org**.

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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
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Volume #41 Issue #1
January 2008

TO:

Some Topics In This Issue:

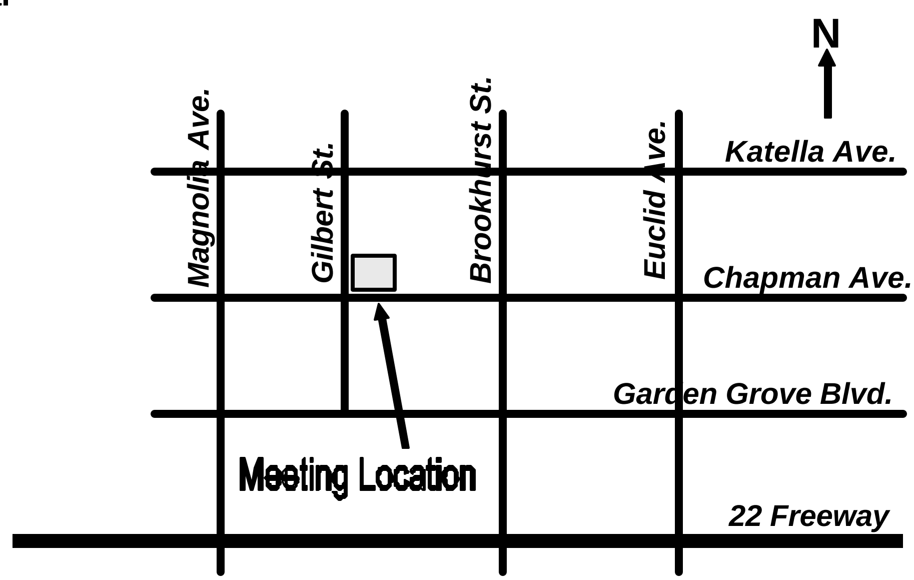
- **Ultraviolet Recovery**
- **Is it Unusual for Opals to Fluoresce**
- **Opal Chips: Photonic Jewels**
- **Truth Behind the Great Pyramids**
- **Asteroid May Hit Mars**
- **Displaying Your Treasures**

Important Info:
Board Meeting - January 7th

General Meeting - January 10th
Jim Pisani will give a slide presentation on his recent trip to Virgin Valley to dig for opals. Opal specimens will be displayed.

January 10th

Jim Pisani on Virgin Valley 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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