The Apache Junction Rock & Gem Club, Inc.

SMOKE SIGNALS

Oct 2013

Officers of the Apache Junction Rock & Gem Club, Inc.		
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The Club meets on the second Thursday of every month October thru April at 7:00 pm at the Lapidary Shop, at the corner of Superstition & Ocotillo, Apache Junction, AZ

`Club Dues` - $24 a year per member prorated to first of month of joining. This may be paid at the general meeting or by mail to Ron Ginn, 691 N. Velero St., Chandler, AZ 85225.

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Next Meeting – Nov 14, 2013

Field Trips

None

Minutes of Oct. Mtg.

General Meeting of Apache Junction Rock & Gem Club
Minutes October 10, 2013

The Meeting was called to order by the President at 7:00 pm. She led the Pledge of Allegiance.

- President's Report: There will be a Coalition Field Trip in Payson. Meet at 9:30 am on Oct. 26th. near Taco Bell on Hwy 87 in the Basha parking lot. (corner of Hwy 87 and Hwy 260) Collecting will consist of fossils and geodes. Our club members went to Mr. Toner's home in Queen Creek on Oct. 9th for an estate sale of minerals-gems-rocks.
- The Secretary's report was accepted as circulated in the Newsletter for April 2013. Future Newsletters will be sent by email, posted in the shop, and have a supply of newsletters in the shop. She presented the club's field trip manual thanking all who contributed to the development of the manual. Disc formats of the manual will be available at the November meeting for $10.00.

- Trustee's report: Mr. Perkins suggested we have a pot luck BBQ dinner at the Lapidary shop. He also suggested that the club participate in parades.
- Membership: We currently have 220 members of the club.
- Lapidary: Mr. Koontz announced there would a project to repair the front fence on Friday, Oct. 11, 2013 starting at 7:00 am. Other wind damage consisted of the small building being blown away, flag destroyed, and flag pole bent.
- Lapidary: Mr. Jonas called for volunteers to be shop monitors as ideally we need two monitors each day. If we had more monitors, we could have afternoon and weekend shop hours. He will be holding training courses focusing on the use of the lapidary equipment. There will be orientation sessions for the lapidary shop. We need the orientation film disc for the sessions. The 24" saw and 10" saw have been repaired. The two 18" saw and the second 10" saw are in the process of repair. New keys have been cut for the shop. Also security cameras have been place in the interior and exterior of the shop. He suggested that the display cabinets be placed in the shop to show the lapidary projects of club members. Tours of the shop can occur after club meetings and during shop hours.
- The nominating committee for the 2014 club officers and one trustee will consist of Lois Perkins, Laura Jonas, and DeWitt Wright. Nominees will be presented at the Nov. meeting. Elections will be held in December 2013.
- Katy Tunnicliff will be the 2014 Rock Show Chairperson.
- A committee will be formed to plan future field trips.
- Cindy Koontz and Lois Perkins are seeking local shows for club participation. They have four organized: (1) Mesa Market Place Swap Meet Oct. 12th 8 am to 1 pm, (2) Black Canyon City Nov. 1, 2, 3, (3) Caliente Mobile Home Park in Florence, AZ Nov. 6th, and (4) Mesa Market Place Swap Meet in January and March of 2014. If we open the Lapidary Shop for sales, the members will need an AZ license and tax deferred number to sell items. We are seeking additional parking at nearby businesses and will get written permission to use their areas.
- The Jewelry Box Gathering for members, both men and women, to share their skills were most successful last season. This activity will be again planned for one day per week plus some evening and weekend sessions.
- The Earth Science teacher from Apache Junction High School would like speakers for her class.
- Doc won the 50:50 draw for $26.00.
- The meeting adjourned at 8:15 pm. Mr. Toner had an exhibit of the estate rocks-gems-minerals for the members to view and purchase.

Article of the Month

Diamond vs. Graphite

by Andrew A. Sicree

Hard vs. soft

Most mineral collectors know that diamond and graphite are chemically the same, differing only in their crystal systems and their cost. Diamond is a cubic mineral while the mineral graphite possesses hexagonal symmetry.

Diamond, of course, is the hardest substance known. One characteristic of a good gemstone is that it has to be hard enough to stand up to the wear-and-tear of being worn on a ring, but even among gemstones, diamond's hardness stands out. On the Moh's Scale of Hardness, talc (H=1) is on one end while ruby/corundum (H=9) and diamond (H=10) are on the other. This scale gives the impression that diamond is only a step harder than corundum. But if we measure "absolute hardness" with a sclerometer – an instrument that gives a much more precise and meaningful measure of harness – we find that, if talc has an absolute hardness of one, then corundum has an absolute hardness of 400. Diamond then has an absolute hardness of 1600, four times the hardness of corundum and 1600 times the hardness of talc.

On the other hand, graphite is stuck way down at the bottom of the Moh's Scale of Hardness. At H = 1½, it is among the softest minerals, almost as soft as talc. Graphite is so soft we can use it to make pencils – it is actually softer than the paper we write upon.

But the two differ in much more than hardness. Graphite is always a black, opaque mineral, while diamonds occur in every possible color and they can be clear or white or black and opaque. Although some diamonds may be semi-conductors, most diamonds are electrical insulators. Graphite, on the other hand, is a good conductor of electricity. These two species have other dramatically different properties. But if both graphite and diamond are composed solely of carbon, why are their properties so drastically different? Can crystal structure be so much more important than chemical composition?

Allotropy in carbon

Diamond and graphite are *allotropes* of carbon – pure chemical elements that share the same bulk chemical composition, but with the atoms bonded together in different arrangements. Two or more allotropes can exist for an element and each will have a different arrangement of atoms. Allotropes are analogous to *isomers*, which are chemical compounds with identical molecular formulae but different structural arrangements. Other allotropes of carbon exist, but only graphite and diamond are found in nature as minerals. In addition to diamond and graphite, the list of pure solid elemental carbon allotropes includes amorphous carbon, *fullerenes*, and other more exotic structures. Fullerenes (a.k.a. *buckminsterfullerenes*) are structures in which the carbon atoms form sheet-like structures, balls, or tubes. One fullerene, C-60, is composed of 60 carbon atoms and looks like a microscopic soccer ball.

Toner used in photocopiers and laser printers is simply a mixture of carbon powder (usually a mixture of fine particles of amorphous carbon and graphite) with a fusible (i.e., "meltable") polymer.

Bonding in diamond

In any crystalline solid, atoms are arranged in a three-dimensional lattice. Each atom in a crystal lattice is bonded to its nearest neighbors in a precise, repeating pattern. The strengths of the inter-atomic bonds and the geometry of the lattice control the properties of the solid. Differences in the atomic structural arrangements of diamond and graphite are the source of their radically disparate properties.

A glance at the periodic table tells us that carbon has four valence electrons. Thus each carbon atom usually forms four chemical bonds. Unlike elements such as sodium and chlorine, which react to form ionic bonds, carbon tends to form covalent bonds.

In te diamond structure, carbon's four valence electrons, one in an s-orbital and three in p-orbitals, undergo sp^3 hybridization. This means that electrons in the s- and p-orbitals combine to produce a tetrahedral hybrid orbital. This hybrid orbital enables carbon to form four bonds, each bond having the same strength, and each bond forming at the corner of a tetrahedron with the carbon atom in the center. When multiple carbon atoms bond together with overlapping sp^3 hybrid orbitals, each carbon atom connects to four other carbon atoms and the resulting structure is a three-dimensional tetrahedral lattice, much like an atomic jungle gym.

The three-dimensional lattice of diamond is extremely strong and it renders diamond impervious to dissolution, even in most strong acids. The structure also makes diamond the hardest substance known. And because the overlapping sp^3 hybrid orbitals hold their bonding electrons quite tightly, diamond is a good electrical insulator. However, impure diamonds with small amounts of boron (substituting for some carbon atoms) are semi-conductors. These diamonds tend to be blue in color. The deep blue color of the famous Hope Diamond in the Smithsonian is thought to be the result of boron impurities.

The structure of graphite

Alternatively, graphite's structure is based on sp^2 hybridization. This means that one carbon s-orbital from hybridizes with two p-orbitals to yield a trigonal planar hybrid orbital which is triangular rather than tetrahedral in shape. Each carbon atom with an sp^2 hybrid orbital will then bond to three other carbon atoms in the same plane. The result is a sheet of carbon atoms arranged in a hexagonal pattern, like a sheet of chicken wire. The remaining unhybridized p-orbitals stick out above and below the sheet of carbon atoms. These p-orbitals provide the electrons that allow the carbon sheets to stick together. The sheet structures are stacked one on top of the other and are bonded together by the overlapping unhybridized p-orbitals, producing pi bonds.

Graphite's inter-sheet pi bonds are weak in comparison to the bonds formed between carbon atoms within a sheet. The slippery feel of graphite arises from these weak pi bonds because it takes only a small amount of pressure to break the pi bonds holding sheets together. Sheets of graphite begin to slide, one over the other. Graphite is thus quite soft and has a slippery feel. Also, because the non-hybridized p-orbitals overlap, the electrons in graphite's pi bonds are delocalized, meaning that they are free to move about within the space between the graphite sheet structures. In metals, such as copper, delocalized electrons are the cause of electrical conductivity. Graphite is a semi-metal. Graphite crystals have the highly unusual characteristic of being a poor conductor of electricity in directions perpendicular to its sheet structures but a good conductor in directions parallel to the sheets. This is because the conductive delocalized pi bond electrons can migrate in between the sheets but cannot easily cut across from one sheet to the next.

Graphite and Lead in Pencils

Every schoolchild knows that pencil lead isn't really "lead" but rather it is graphite. Before graphite came to be used in pencils, charcoal or lead metal sticks were used for making marks. Metallic lead is quite soft and will leave a gray streak on paper. Although graphite has replaced lead for writing purposes, we have retained the use of the word "lead" – much to everyone's confusion.

In the 1500s, a huge deposit of bulk graphite was discovered near Borrowdale, in Cumbria, England. This material could be sawn into sticks, and because it was thought to be a form of lead, it was called *plumbago* (Latin for "lead ore"). Apparently, it was first used for marking sheep, but its value for writing on paper soon became apparent. And because it could withstand the heat of molten iron, it was also valuable for lining molds used for the manufacture of cannon balls. Graphite acted as a mold release agent, making it easier to remove a freshly-cast iron cannonball from the mold.

Although the Borrowdale material could be sawn into usable pencil-like sticks of pure graphite, most of the world's graphite wasn't so pure. It had to be separated from other minerals. In the 1600s, powdered graphite was mixed with other materials (including sulfur and antimony) and molded into pencil-like sticks, but these every graphite composites were inferior to the sawn sticks of graphite. In the late 1700s, French and German inventors discovered that graphite could be mixed with clay, molded into rods, and then fired in an oven to produce composite that was ideal for writing. Moreover, by varying the clay content, hardness of the rods could be changed, and different darknesses of marks achieved. And thus the modern pencil lead was born.

A harder pencil makes a lighter mark and a softer pencil makes a darker mark. Modern pencils usually bear markings indicating the hardness and tone of the pencil. One system for indicating pencil hardness uses "H" (for hardness) to "B" (for blackness), and "F" (for fine point). Commonly used pencils progress from "B" to "F" to "HB" to "H". Some manufacturers use numbers (1 = "B", 2 = "F" to 2½ = "HB", 3 = "H"). Specialty pencils can be harder than "H" (labelled "2H," "3H," "4H," etc.) or softer than "B" (labelled "2B," "3B," "4B," etc.). Marking schemes vary from manufacturer to manfacturer.

Weird Geology: Diamonds in Space

Not all diamonds on the Earth are native to our planet. Some meteorites are known to contain diamonds. Some of these extra-terrestrial diamonds formed when asteroids collided with each other. Because of their great speeds, the shock wave of the collision is so intense (high pressure) that graphite in the asteroid is changed into diamond. "Shock diamonds" are at most only one- to two millimeters in size and are typically highly fractured. Fragments of asteroids that land on the Earth are called meteorites.

Some meteoritic diamonds, however, are older than the asteroids. Indeed, they may be older than our solar system! They formed when the star that was the precursor to our Sun went supernova and spewed out the elements that subsequently built up our sun, the planets, and the asteroids. These "presolar" diamonds – even smaller than shock diamonds – got caught up in the formation of the asteroids, and were later carried to the Earth in meteorites. These diamonds are studied for clues to the origins of our solar system.

If you desire a truly humongous diamond, you must venture beyond our solar system. White dwarf stars are the remnants of burned out suns and they're composed of carbon and oxygen. Recently, while studying a white dwarf star (technically named BPM 37093) located 50 light-years from the Earth in the constellation *Centaurus*, astronomers from the Harvard-Smithsonian Center for Astrophysics determined that the core of the Earth-sized little star had solidified into diamond. "The interior of this white dwarf has solidified to form the galaxy's largest diamond," reported astronomer Travis Metcalfe. This diamond is 2,500 miles (4,000 km) across and weighs 3 million trillion trillion times more than the 3106-carat (five carats equal one gram, so the stone was approximately 1.3 pounds) Cullinan, the largest diamond ever found on Earth!

Rock Shows

Oct 12-13—SIERRA VISTA, ARIZONA: 39th Annual Show; Huachuca Mineral & Gem Club; Cochise College; 901 N. Colombo Ave.; Sat. 9-5, Sun. 10-4; free admission; raffle, silent auction, gems, jewelry, lapidary supplies, fluorescent display, geode cutting; contact Maudie Bailey, 5036 S. San Carlos Ave., Sierra Vista, AZ 85650, (520) 249-1541; e-mail: gmbailey@msn.com; Web site: huachucamineralandgemclub.info

Oct 19-20—SEDONA, ARIZONA: Annual show; Sedona Gem & Mineral Club; Sedona Red Rock High School; 995 Upper Red Rock Loop Rd.; Sat. 10-5, Sun. 10-4; adults $3, children (under 12) free; more than 40 dealers, rocks, gems, minerals, fossils, beads, jewelry, Kids' Corner, displays, demonstrations, hourly raffle, grand prizes; contact Gayle Macklin, PO Box 21222, Sedona, AZ 86341, (520) 921-0100; e-mail: gayleis@gmail.com; Web site: www.sedonagemandmineral.org

Nov **1-3—BLACK CANYON CITY, ARIZONA:** 37th Annual Rock-a-Rama; High Desert Helpers; High Desert Park; 19001 E. Jacie Ln.; Fri. 9-4, Sat. 9-4, Sun. 9-2; free admission; outdoor show, door prizes, dealers, demonstrators, minerals, gemstones, jewelry, fossils, crystals, tools, equipment, books, lapidary supplies, gold panning, beading, wire-wrapping, faceting, stone carving, gem setting, raffle, rock I.D.; contact Sue Coordinator, PO Box 212, Black Canyon City, AZ 85324-0212, (602) 471-0173; e-mail: riverdiva@gmail.com; Web site: www.highdeserthelpers.org

Nov 16-17—PAYSON, ARIZONA: Annual show; Payson Rimstones Rock Club; Mazatzal Hotel & Casino Event Center; Hwy. 87 Mile Marker 251; Sat. 9-5, Sun. 10-4; adults $2, children (under 12) free; gems, minerals, fossils, lapidary equipment, jewelry and findings, slabs, rough material, gold prospecting equipment, displays, education center, Spinning Wheel, fluorescent display, beading, sandstone painting, silent auction; contact Margaret Jones, PO Box 884, Pine, AZ 85544, (928) 970-0857; e-mail: margieaberry@gmail.com

Nov 30-1—WICKENBURG, ARIZONA: Show and sale; Wickenburg Gem & Mineral Show; Hassayampa Elementary School; 251 S. Tegner St.; Sat. 9-5, Sun. 10-4; free admission; rocks, gems, minerals, beads, jewelry, fossils, kids' room, door prizes, raffle; contact Beth Myerson, 21825 W. Date Creek Rd., Wickenburg, AZ 85390, (480) 540-2318; e-mail: myerbd@gmail.com