THE VORTEX

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THE VORTEX

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Volume LXXIII March 2012 Number 3

Chair's Message

Jim Postma

There were three visitors and newcomers at our last Executive Committee meeting. While that title sounds like an exclusive meeting, just the opposite is the case. That reminded me to extend an open invitation to all of our Members. Come and listen and/or particpate. In the case of the last meeting you would have heard about some intersesting discussion.

The first visitor gave a brief presentation on a program of the American Association of University Women. The TechTrek program (http://www.aauw-techtrek.org/) provides opportunities for young women entering the 8th grade to attend a summer camp at a university to encourage their interests in math and science, somewhat similar to the Society's SEED program.

The second visitor was interested in expanding his network of chemistry contacts in the area with a goal of understanding possible career objectives for someone in the field.

The executive committee consists of a broad range of chemists from universities and industry and covers a wide range of the scientific scene in the Bay Area, so I believe it was a worthwhile visit. And even without a particular goal in mind, I think you will find the members of the group full of fascinating stories of their careers, their travel, and their interesting lives and perspectives.

The third newcomer is becoming more interested in the activities of the Younger Chemists Committee and was present to coordinate the efforts of that group with the Section at large. Since the executive committee reviews all of the upcoming section events (and debriefing past ones) the setting helps to build a sense of the activities of the section: social, educational, and promotional.

That list gives you a few examples of why you might want to join us at one or more of our monthly meetings. Whether your interests are in sharing a program that the ACS might wish to collaborate, expanding your own circle of contacts in the field, or getting more involved in one of our many ongoing programs, (or proposing a new one); the invitation is open.

We meet on the first Tuesday evening of each month at the Mandarin Gardens Restaurant in Berkeley. Dinner is at 6: and the meeting begins at 7:00; we usually wrap things up soon after 8:00. You can find the details and the contacts for making reservations at www.acs.org; look under "About Us" and "ExComm." We will buy your dinner for the first time.

Celebrate-Earth Day
JOHN MUIR NATIONAL HISTORIC SITE
4202 Alhambra Ave.
Martinez, CA 94553

"Rethinking Recycling — It's Easy to Be Green!" April 21, 2012

The California ACS Section will again join with other community groups for a combined celebration of Earth Day and John Muir's Birthday on 21st April 2012 on the grounds of the John Muir National Historic Site in Martinez, CA. (10 AM- 4 PM). This celebration will allow interaction with hundreds of families, kids, and adults, at the Cal ACS canopy location. The hands-on demonstrations and activities will be consistent with the ACS Earth Day theme of "Rethinking Recycling — It's Easy to Be Green!" We will show you ways to be environmentally conscious by using renewable materials, and how this relates to chemistry and the roles chemists play.

Volunteers are needed to help with various demonstrations planned for both adults and children that visit. Please check with our Section office for information at office@calacs.org or with Sushila Kanodia (Earth Day Coordinator) at sushila.kanodia@gmail.com

YCC Valentine's Day Chemistry Photo Scavenger Hunt

squidbait

To Bond or Not To Bond brought together students from across the Bay for this YCC heart filled Valentine Chemistry Photo Scavenger event. Teams worked together to emphasize group learning and bonding.

Tales of frogs chemically reacting to create princes magically appeared along with images of carbon dioxide and water eloping and quests for an amine to be mine but what does this all have to do with our professional endeavors?

The event was created to celebrate the properties of the small tokens of affection that we exchange in our everyday lives and a lot of creative imagination about chemical properties. Scientists engaged in research often have to think outside the box, they ask questions that may not have answers. Many inventions in the past were discovered by accident (think Post-it Notes) and often by more than one person. I wanted to create an event that would make scientists think about the science around them, finding simple ways to communicate science that is interesting and social for our friends and families and non-scientists. Please join us for our next event which is a forensic science mystery that only science can solve "The case of the missing PEEPS" on March 25th. Contact and RSVP squidbait@ymail.com for more information.

Pictures and the list of clues from the Valentine event are posted at:
https://www.facebook.com/media/set/?set=a.365087836853350.101527.164045583624244&type=1&l=61a576ea9a

Save the Date
March 25 2012

The case of the missing PEEPS" on March 25th. Contact and RSVP squidbait@ymail.com for more information.

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ELK-N-ACS

Evaldo Kothny

Phosphorus and the Biosphere.

Physical and chemical transformations of P and its compounds are very variable and exciting. The various forms of phosphoric acid and its salts are easily affected by acidity changes (buffering effect). The element is vitally important for the normal biologic metabolism and for bioenergy production. It is also needed in the formation of the structure of the nucleus and the cytoplasm of the cells. It forms a component of nerve, bone and muscle tissue, and is a factor in osteoporosis.

The supply of P is tied up in rocks and sediments. Some rocks or primary phosphates are of volcanic origin, derived from the late stage of crystallization, such as from granitic pegmatites, ultramafic rocks, carbonatites and nepheline syenites. The main P mineral inside these substances is apatite. Phosphate bearing sediments (phosphorites) are originating from the collection of decayed shells and bones from marine invertebrates or guano from sea birds. Such marine deposits exist in Idaho, California, and Peru. The largest deposits of phosphorite are in North Africa and in Russia.

The elemental cellular composition comprise essentially carbon, oxygen, and nitrogen plus K, Ca, P, S, Mg and some other 8 elements. These elements have variable cycles, as example, the carbon (as its dioxide) cycles in about 5 to 10 years. Any cycle includes the atmosphere, the land, ocean and biosphere. As example, the level of carbon dioxide in the atmosphere (in equilibrium with the other components) remained stable for the past thousand years but ultimately increased 0.4% per year. This seems to be the result of a considerable cycle disruption, lately stemming from the energy production from fossil fuels and cutting of forests. Other biologic elements may have cycles affected by a variety of different factors.

Once the evolution of the biosphere was established, the function of P as a key factor for the primitive energy transfer is obvious for us at this time and understanding. All life depends on this phosphorus mediated energy transfer. During evolution, species were split off and grouped into communities. Natural selection by hereditary variants adapted to the environment creating new mutations with divergent characteristics (a good example are the separation of species such as the primitive 3 toed horses, modern horses, zebras and donkeys).

Phosphorus is contained in meat, fish, eggs and grains. It is involved in bone and teeth formation, kidney function, cell growth and muscle contraction. In the metabolic pathway, it converts food into tissues and energy, also helps in vitamin utilization particularly with the B-vitamins group.

Phosphorus cycling occurs almost unidirectionally by runoff from land into the ocean, as follows: the soluble P is taken up by some primitive biosphere (plankton and algae), then settles into the bottom of the ocean. A portion of this settled P becomes mineralized and is immobilized in sediments. The cycle may be disrupted by tectonic forces, thus P may be reincorporated into a new cycle.

A very small proportion of these pathways are comparted by arsenic and vanadium whose chemical and physiological characteristics have some similarity to phosphorus. Arsenic comprises about 1% of the phosphorus content in soil. The proportion may change with fertilization and with As containing pesticide sprays applied to crops now or in the past. Therefore, after mineralization, some of the phosphorus in those minerals may contain a trivial amount of As and V.

A key compound, Adenosine Triphosphate, intervenes in the energy production of glucose by oxidation. After photosynthesis, this triphosphate converts 1-2% of infalling energy into substances and supports respiration, the rest of the energy is transformed into heat. From the substances, 40-85% is stored. The stored product may be consumed by

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Mysteries of Chinese Purple (Part 1)

Bill Motzer

In the December 2010 through February 2011 issues of the Vortex, I described the unique invention and/or discovery of the pigment known as Egyptian Blue (EB) that the ancient Egyptians used to decorate limestone sculptures and statuettes, tombs, wall paintings, furnishings, cylinder seals, scarabs, inlays, pots, and beads. Archeologists now inform us that by examining pigments used by ancient civilizations, we can obtain an understanding of how a culture perceives and understands its world. EB was used from about 2600 – 2480 BCE through the fall of the Egyptian Empire in 332 BCE. However, it continued to be manufactured and used throughout the Greco-Roman period (332 BCE–395 CE). Its use died out in the fourth century CE, when the secret of its manufacture was lost, not to be rediscovered until modern times. By the extraordinary use of minerals and other substances in their world, the Ancient Egyptians may have been "The First Chemists."

In the Spring of 1974, in the Chinese province of Shaanxi, near Mount Li, farmers installing an irrigation well found pieces of ancient pottery that would ultimately lead to a remarkable discovery by the excavation of more than 8,000 buried life-sized terracotta warriors and their horses. Archeologists would later determine that these figures were more than 2,200 years old and that they represented an army accompanied by jade and bone objects, real weapons and chariots. It was built to protect the tomb of Shi Huang Di, the first emperor of the Qin dynasty. Many questions and mysteries surround these statues but one of the most intriguing is the origin of a synthetic purple pigment used to decorate the soldiers and their accessories. This pigment is commonly called "Chinese Purple" (CP) or "Han Purple." It is also accompanied by another blue pigment known as "Chinese Blue" (CB) or "Han Blue." Even more intriguing are the similarities in chemical composition between EB and CP/CB.

Modern forensic analytical techniques have determined that EB is an alkaline earth calcium silicate with the general formula $CaCuSi_2O_{10}$. However CB and CP both substitute barium for calcium having the respective formulas $BaCuSi_2O_{10}$ and $BaCuSi_2O_6$. Because of this similarity, it has been hypothesized that CP and CB were originally derived from EB and that the ancient Chinese may have conducted "reverse engineering" techniques to EB to ultimately formulate CB/CP. If this is true, then CP/CB may represent one of the earliest known cases of cross-cultural technology transfer that may predate the Silk Road (~125 BCE), which opened China to the west, and perhaps even predate the invention of paper or the compass.

However, there are problems associated with the reverse engineering hypothesis including the following.

(1) By the first millennium BCE, EB had spread throughout the Mediterranean region becoming readily available and employed by several civilizations. Its synthesis was well known and raw materials such as quartz sand (SiO_2), copper minerals such as malachite or $Cu_2CO_3(OH)_2$, calcium carbonate ($CaCO_3$), and an alkali such as natron (a sodium bicarbonate mixture) were relatively easy to mine or obtain. The same is not true for CP: most copper ores including blue azurite $[Ca_3(CO_3)_2(OH)_2]$, although relatively abundant in China, were mined mainly to produce copper and copper alloys. And, azurite does not produce a stable blue or purple pigment. Additionally, heating of the EB mixture only requires temperatures ranging between 800 and perhaps 900 °C for several hours (depending on the amount of alkali used). Heating a comparable mixture of CP's components requires sustained temperatures above 1,000 °C.

(2) To date, no calcium-bearing EB has been found in China and even if a connection between China and Egypt had existed, it does not explain why the Chinese somehow knew and then decided to substitute barium for calcium. If they had the recipe for EB, they could just as easily have reproduced it as a pigment.

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March Historical Events In Chemistry

Leopold May

March 1, 1862 One hundred and fifty years ago, Edward Franklin was born. He was a researcher in chemistry of nitrogen compounds.

March 2, 1848 Phippe A. Barbier, who synthesized the first organomagnesium compound, was born on this date.

March 5, 1637 Three hundred and seventy-five years ago, John van derHeyden, who invented the fire extinguisher, was born. He and his brother, Nicolaas, patented it on September 21, 1677.

March 6, 1787 One hundred and twenty-five years ago, Joseph von Fraunhofer, who discovered the dark lines in the solar spectrum (Fraunhofer lines), was born.

March 7, 1827 John H. Gladstone, who was born on this date, was a researcher on refractive index of and its relationship with density.

March 9, 1912 One hundred years ago, Stanley G. Thompson was born. In 1950 he codiscovered berkelium (Bk, 97) and californium (Cf, 98), in 1952, einsteinium (Es, 99), and both fermium (Fm, 100), & mendelevium (Md, 101) in 1955.

March 10, 1762 Two hundred and fifty years ago, Jeremias B. Richter, who discovered the law of equivalent proportions, was born. He was the first to establish stoichiometry, the basis of quantitative chemical analysis.

March 11, 1864 Cato M. Guldberg & Peter Waage presented their paper "Studienuber Affiniteten" describing the Law of Mass Action to the Norwegian Academy of Sciences and Letters, on this date.

March 12, 1790 John F. Daniell, who invented the Daniell electrochemical cell, was born on this date.

March 14, 1931 Ronald C. D. Breslow, who was born on this date, demonstrated antiaromaticity; invented artificial enzymes, and used electrochemical methods to study carbon cation. He also served as President of the ACS.

March 19, 1883 Seventy five years ago in 1937, Walter N. Haworth shared the Nobel Prize in Chemistry for his investigations on carbohydrates and vitamin C with Paul Karrer for his investigations on carotenoids, flavins and vitamins A and B_2. He synthesized ascorbic acid (Vitamin C) in 1933, did research on sugars and dextran as blood plasma substitute, and was born on this date.

March 23, 1962 Fifty years ago, Neil Bartlett made the first noble gas compound, $XePtF_6$, on this date.

March 26, 1753 Count Rumford (Benjamin Thompson), who invented a simple photometer, was botn on this date. He was a researcher in heat and demonstrated first law of thermodynamics. Also, he improved cooking and heating systems in addition to animal breeding. He married Antoine Lavoisier's widow to improve his position in science.

March 29, 1855 Konrad J. Bredt, who described the first correct structure of camphor, "Bredt's Rule for bicyclics", was born on this date.

March 31, 1831 Archibald Scott Couper, who was born on this date, developed the organic structural theory at the same time as August Kekule and was first to use bond lines for organic structures

Progress Report on California Section Store

The software that will allow visitors to purchase products from the Calacs website is almost complete. The Section will be able to offer personalized and decorated tshirts, mugs, labcoats and many other products for sale. A portion of all sales will be used to fund various Section programs. The system should be operational by the end of March.

Ideas are needed; sayings and artwork. Royalties will be paid on selected ideas and artwork. Send your work to Lou Rigali at qpfans@qpfans.com

2011 Annual Report Chair's Comments

The California Section had an outstanding year in 2011, the International Year of Chemistry, (IYC) increasing the scope and breadth of our offerings to members, the public, education, and the profession. It is estimated that we reached about 20,000 people with our events and activities. Details of our achievements are provided below.

Celebrating the International Year of Chemistry

We created an IYC committee with a grant to support our IYC activities, aligned our monthly programs and events with the quarterly themes of Environment, Energy, Materials and Health, and added dedicated IYC section events for section members and the general public. We held an IYC reception where all section members were invited and encouraged to bring international guests. A section member participated in the IYC opening ceremony in Paris and the North American celebration in Puerto Rico. At these events and at many others, the section's Technology Milestones in Chemistry posters were displayed in multiple languages. Our IYC Chair distributed information on IYC to over 70 members of the local public media and even wrote to each winner of the Bay Area Science Fair, thanking them for their interest in science and encouraging them to talk to their science teachers about IYC 2011.

Expanded Service to our Members

The section had a phenomenal year in terms of seminars, science outreach, and joint sponsorship of chemistry activities. We participated in about 50 events, with about 40 of these organized by us and the remainder being joint activities with other chemistry-related organizations. Note that this total represents an average of about 5 events per month, given the typical slowdown in July and August. We explored ways of increasing our event attendance and new cost models, and we continued to support the Northern California subsection which held its own series of events throughout the year.

Outreach to Underrepresented Minorities, **Underserved Communities, and the General Public**

The section initiated a collaboration with the Lafayette Library and Learning Center to co-host a monthly Science Café, featuring diverse speakers on many aspects of Science (chemistry in the Civil War, the conservation of Bhutan art, and nuclear energy in a post-tsunami Japan. The section's Project SEED program was very successful, with 40 students (one more than in 2010) who reached academic, industry. and government institutions. Our CMA and Womens Chemists Committee (WCC) were active at Earth Day events (thousands of participants, with alternative energy theme), the Saturday Science Academy (collaboration with National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) which brings science to undeserved schools, and Bay Area science events, including a science festival with over 22,000 attendees. We held two very successful science nights at middle schools (one during National Chemistry Week (NCW) serving minority or non-English speaking communities, with dozens of hands-on demonstrations, and involving hundreds of students, parents, and teachers. Our reinvigorated Younger Chemist Committee (YCC) organized or participated in about a half-dozen events throughout the year, including unique events such as "Energy" Egg hunts at Easter, chemistry "Whodunits", and Christmas caroling with chemistry jingles. These events were featured in local media write-ups and publications such as Chemical Industry Digest.

Career Services and Continuing Education for our Members

The section continued its program for student interview workshops with a program held in conjunction with the Santa Clara Valley Section and Association of Industrial Chemical Engieers (AIChE), and preparations were made for the next workshop to be held in mid January 2012. In partnership with the San Francisco chapter of the Electrochemical Society, the section sponsored two Short Courses for our members.

Partnerships in Support of Chemistry

Many new partnerships were formed through

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events either sponsored by us or in which we participated, including national laboratories, the USDA, several universities, the Berkeley Center for Green Chemistry, the Bay Area Science Festival, the Golden Gate Polymer Forum, the San Francisco chapter of the Electrochemical Society, Iota Sigma Pi and Alpha Chi Sigma, and organizations sponsoring Bay Area Earth Day events. All of these efforts to broaden our base resulted in new attendees, new contacts and liaisons, and in some cases new volunteers. We also continued our support for Shasta Meadows Elementary School for a unique program using elementary school students to perform chemistry and physics shows at high schools (over 1000 participants total).

Expanded Public Relations and Communication

The Section has increased its use of online communication, moving the section newsletter to downloadable format, use of the ACS Network, and a presence on Facebook and Twitter. A two page "Executive Summary" of the section was written and distributed to members who inquired about the section, a section manual update was initiated, and a short "business card-like" handout with a mission statement was created to pass out to members of the general public.

Recognition of Excellence in Chemistry, Teaching, and ACS Service

The section recognized outstanding service to the section through the Petersen Award, five Salutes to Excellence awards, a free luncheon for 50 and 60 year ACS members, and an "Unsung Heroes of the Section" award. For demonstrated strength in high school teaching, monetary awards were given to both the teacher and the high school, and the section also presented an award for community college teaching excellence. In addition, educational grants for chemistry education were awarded, bringing the total section disbursements for this 17 year program to almost $150,000.

Active Participation in ACS Governance

The California Section continued its longstanding tradition of very active participation in ACS National governance activities, with participation on the ACS Board of Directors, Committee Chair (LSAC), membership on national committees (SOCED, ConC, MAC, LSAC, CEI, SEED, CPRC, CCA for example), Chair of the 2012 International Chemistry Olympiad committee, and by sending a full complement of section representatives/ Councilors to the Leadership Institute and both national meetings. Our section is also active in the steering committee for the Western Regional Meeting and is actively planning for a 2013 WRM in the Bay Area. We are especially proud of the fact that the 2012 ACS President-Elect will be the 8th person from the California Section to serve in this highly visible and important role.

Bryan Balazs,
2011 Chair, California Section

(Phosphorus continued from page 6)

herbivores which assimilate 15-80% of the plant material eaten. Only 5-25% of the consumed product remains stored in tissues of living organisms. Carnivores feeding on herbivores assimilate 60 to 90% of the material they ingest and store approximately 15% of this food. A third category is the detritus pathway. Only a small amount of detritus (decaying tissue) is consumed, the rest falls into the repository of oil and coal, a process that endured for about 200 million years.

Excess phosphate in water effluents causes eutrophication in lakes and rivers, a negative effect of algae blooms and depletion of oxygen.

Could anyone think about life without phosphorus? How about life with an excessive amounts of phosphorus? Would not these experiments be very exciting?

(Mysteries continued from page 5)

(3) It is known that by 2,200 years ago Chinese glassmakers were most interested in synthesizing jade, a mineral regarded as sacred in Taoist culture. Although jadeite [a pyroxene mineral with a composition varying from $NaAlSi_2O_6$ to $Na(Al,Fe^{3+})Si_2O_6$] generally is green, many ancient pigments that form blue and purple ultimately degrade to green and even black, particularly if there is erratic thermal control.

Archeologists therefore suspect that these glass makers, who began experimenting with different pigments, may have either stumbled onto stable blue and purple pigments or in fact may have conducted experiments until they found stable pigments. If the ancient Egyptians were "The First Chemists" were the ancient Chinese the "First Experimental Chemists?" I'll explain more about this in Part 2.

2013 Western Regional Meeting Organizing Committee Report

Co-General Chairs Lee Latimer and Natalie McClure

A contract has been signed to hold the meeting at the Hyatt Regency Santa Clara on Great America Parkway for October 3-6, 2013 in Santa Clara. The location is easily accessible from Hgwy. 880 or 101, it is on the light rail in San Jose and adjacent to the Santa Clara Convention Center. Parking is free. We anticipate a large meeting which should be able to accommodate and expand into the convention center. The education program may be centered at a local community college.

Focus is now on developing the program with the available space. The approach is a committee with members responsible for groups of disciplines or symposia. Currently, Janet Gunzer-Toste (Genentech, CalACS) is organizing Organic, MedChem and possibly Biotechnology in combination with Dr. Clare Komives of San Jose St. U. Neal Byington is organizing Analytical, Fuel and Petroleum division related programs.

Other positions on the organizing committee are being considered for volunteers.

Meetings are scheduled for the second Tuesday of the month. Check with the Chairs for details.

Interest in volunteering is encouraged. Please contact Lee or Natalie (currently chair of Santa Clara Valley Section.)

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