THE VORTEX

AMERICAN CHEMICAL SOCIETY **CALIFORNIA SECTION**
VOLUME LXXI NUMBER 1 **JANUARY 2010**

Best Wishes for the New Year

THE VORTEX

Published monthly except July & August by the California Section, American Chemical Society. Opinions expressed by the editors or contributors to THE VORTEX do not necessarily reflect the official position of the Section. The publisher reserves the right to reject copy submitted. Subscription included in $13 annual dues payment. Nonmember subscription $15.

MAGAZINE OF THE CALIFORNIA SECTION, AMERICAN CHEMICAL SOCIETY

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PRINTER:
Postscript Press
2861 Mandala Parkway Oakland CA 94608 510-444-3933
Printed in USA on recycled paper

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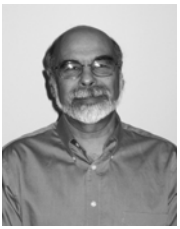
Volume LXXI January 2010 Number 1

Chair's Message

Paul Vartanian



First, I wish you all well in 2010. The economic signs seem to be showing some improvement and I hope your individual outlook for the time ahead is bright.

After my first term as Chair in 1987, I vowed that if I were to ever run again for Chair, it would be after I retired so that I could give the position the time it deserves. It is more difficult to arrange things when one works during the day and then have a face-to-face meeting for some Section activity when necessary.

I thank Dr. Eileen Nottoli for her leadership of our Section during 2009. She shepherded many initiatives for the Section during her term and our operations are better today than they have been in the past. I will build further on the foundation she has prepared.

The Section is fortunate to have many dedicated volunteers who serve as officers, councilors, committee chairs, or who take part in our activities to serve the membership. Activities like Project SEED, Family Science Night, Science Café, Women Chemists Committee meetings, or the Interview Workshops, to name a few, need committed volunteers who see the need and benefit of our activities for our members and community. More volunteer opportunities are available and if you have the inclination to expand your involvement in the ACS, please do so.

During the year you should see a new look to the Section's web site at www.calsec.org. The Section Bylaws have been revised and submitted to the ACS for review. If all goes well they will be presented to the membership for approval as part of the fall ballot. We are planning to phase in an electronic version of *The Vortex* to lower our costs and save a few trees. Our Section meetings will continue to be as diverse in topic and location as we can make them to serve all the different interests of our members.

We welcome feedback on what we do well; what we could do better; and what we either do not do and should or what we should eliminate. I am available at pfvartanian@gmail.com, and Julie Mason, who runs the day-to-day operation of the Section office, (office@calacs.org) is available as a resource for both the Section and the ACS.

Finally, enjoy the new year and make plans to participate in some Section or ACS activity that appeals to you.

California Section
American Chemical Society
January Meeting
"Chemists Without Borders:
The Power of Human Networks in the Information Age"
By
Bego Gerber, Ph.D.

Date: Thursday, January 28, 2010
Time: 6:00 pm Social Hour, 7:00 pm Dinner, 8:00 pm talk
Place: Mills College, 5000 MacArthur Blvd., Oakland, CA in the Gathering Room (Room 101) in the Graduate School of Business Building
Cost: $28 (Students $23, ACS members actively seeking employment, $14)
There is no cost to attend the social hour and/or talk only
Buffet Dinner: Oven Roasted Chicken Seasoned with Garlic, White Wine & Thyme Served with Farfalle Pasta Garnished with Fresh Basil, Cherry Tomatoes & Parmesan Cheese; salad; iced tea, or lemonade
Reservations: RSVP by Friday, January 22, to the Section office by e-mail at office@calacs.org or call (510) 351-9922

Abstract:

With over 160,000 members, the American Chemical Society is the largest scientific society in the world. The members also have a reach which is world wide. In the age of the Internet, any of us can reach just about anyone in our networks almost instantaneously (most of the time), no matter where they are on the planet. This also enables us to do humanitarian work which was heretofore less feasible. Dr. Gerber will discuss the portfolio of exciting opportunities that Chemists Without Borders are able to pursue as a result of the generous volunteerism of our members - chemists and non-chemists alike - and the benefits of the Information Age. Please bring your opinions and ideas to share. All are welcome.

Biography:

Dr. Bego Gerber's experience ranges from academic medical research to patented new product development in a no-walls start-up and in Fortune 100 R&D; from idea processing and information management to entrepreneurial lifestyle marketing and the development of B-quadrant businesses on the Internet. Bego was educated at Heriot-Watt University in Scotland, has Master's and Doctoral degrees from the University of California, and was a postdoctoral fellow at The Johns Hopkins University. He is Managing Director of Business Development International, a lifestyle marketing company, and is President and Co-Founder of Chemists Without Borders, an international humanitarian relief organization. Bego is an Executive Associate accredited by the Institute for Independent Business and a founding member of Advice That Works.

Science Cafe On "Searching For ET"

Dr. Marinda Wu

How do we search for ET? —and what would it mean if we find it? Dr. Margaret Race, a NASA researcher with the SETI Institute, fascinated an audience of almost 60 attendees with a talk on the science and policy of astrobiology at an ACS sponsored Science Café held at Pizzeria Amoroma in Orinda on Nov. 16. Dr. Race, who works with NASA's Office of Planetary Protection, discussed behind-the-scenes planning for solar system missions as well as the societal implications of space exploration. The audience asked many thought-provoking questions, including one about space exploration from a six-year old budding scientist who attended with her parents.

The Science Café was organized by Dr. Valerie Burke and Dr. Marinda Wu for the California Section and was the sixth since 2007 when ACS began encouraging local sections to promote Science Cafés as a way to connect local scientists with the general public through stimulating discussions in an informal setting. This most recent 2009 Science Café was one of our most successful in terms of audience participation. Suggestions for speakers or topics for future Science Cafés should be emailed to office@calacs.org

National Chemistry Week

Dr. Alex Madonik

The California Section returned to Hayward, CA to celebrate National Chemistry Week with another fabulous Family Science Night on Tuesday 20 October 2009 at Bret Harte Middle School. Principal Lisa Davies welcomed the ACS, and Dr. Alex Madonik, NCW Coordinator, thanked the crowd of over 400 for their enthusiasm.

The eager crowd then set out to explore a dozen hands-on activities, including several based on this year's NCW theme, "Chemistry, It's Elemental." Jeanne Pimentel donated her ACS commemorative Periodic Table beach blanket, which became the scene of the "Great Element Hunt" as kids of all ages tried to locate the elements matching symbols on their game cards. Visitors learned about elements in household products with the help of an XRF analyzer, assisted by Christina Medina of the Center for Environmental Health. .Slime, and the ever-popular Liquid Nitrogen Ice Cream rounded out the action.

Special thanks to Bret Harte Principal Lisa Davies and science teacher Adriana Gilmete, who took the lead to host Family Science Night, as well as the entire Bret Harte staff who turned out and opened their classrooms for this event. Thanks also to all of our volunteers. A complete report can be found on the Section website.www.calacs.org

San Franciscos State University Volunteers at Family Science Night

AGRICULTURE, PHOSPHATES AND ANTHROSOLS.

Evaldo Kothny

Phosphorus, 11th element in abundance, appears to have been discovered in 1669 by Henning Brand who wrote about it in a letter to the known philosopher Gottfried Wilhelm Leibnitz (1646-1716), although a more obscure discovery by Arabic alchemists was reported in the 12th. century A.D. All the correspondence of Leibnitz was saved and printed in many volumes which allowed to find the details of Brand's process. The experiment started with 50 buckets of fermented urine which was boilded down to a paste. This was mixed with sand and distilled. The elemental phosphorus and its characteristic of phosphorescence excited the public interest and remained a curiosity until it was found that its compounds are an essential part of bones, brain and nerves, besides it forms part of needed biological processes in vegetation.

Elaboration of phosphoric acid from bones allowed to make elemental phosphorus by distilling a mixture with charcoal as a reductant. Later, Friedrich Wohler (1800-1882) invented the production of phosphorus by calcining a mixture of tricalcium phosphate, sand and charcoal. In the late 1800s, James Burgess Readman applied the electric furnace to Wohler's method, which is still in use today.

Unlike other biological nutrients, phosphorus compounds cycle differently from those elements which have a gaseous phase (C, S, N) thus are similar to those of Ca, Mg, K, Fe. These non-volatile elements move unidirectionally from bedrock through aquatic environments into runoff, plant communities or plankton and the food chain. Phosphorus compounds and Fe finally gets locked into oceanic sediments whereas the other elements remain in solution. On terrestrial environments, some elements move in a closed cycle. Phosphate is the only element which practically resides in living organisms and organic debris. Breakdown of debris releases phosphate which is again taken up by vegetation. Depending on the amount of phosphate in the soil, crops can or cannot be grown. Industrial formulations of phosphates in detergents, later discharged by sewage plants and agricultural runoff had changed the growth of some plant communities and had produced the euthropication of some lakes.

Rocks contain apatite, a hexagonal calcium phosphate-fluoride. The fluoride is partially replaced by chloride or hydroxide in a phosphorite. This compound is also abundant in phosphate rock, a conglomerate of mineralized marine shells. The substance is slightly fluorescent in ultraviolet light, as in teeth and bones, and is the basic substance in fluorescent lamps (invented in 1934).

Fertilizer management of N, P and K was promoted after 1840 by the chemist Justus von Liebig (1803-1873). One of the first fertilizers was wood ash which contains mostly non-volatile elements (Ca, K, P) thus lacks nitrogen. Early it was recognized that presence of organic matter was essential for good agricultural practice. This material is the reservoir for significant amounts of N, P, S. The supply of P to plants is dependent on the soil pH. Usually, acid soils, or those containing large concentrations of Fe and Al are detrimental to plants, whereas alkaline soils release P more readily. Biochemistry studies by Edwin Krebs and Edmond Fischer in the 1950s, indicated that one important pathway for energy in both animal or plant organisms involves an enzyme, phosphorylase, that becomes active in presence of phosphate. The phosphate is supplied by adenosine triphosphate, a kinase. Active phosphorylase breaks down glycogen and produces the energy active glucose. This mechanism is stopped by another enzyme, phosphatase. In muscle, energy is produced by oxidation of glucose which breaks down to lactic acid (this substance triggers the "sore muscle" feeling). Adenosine triphosphate seems also to have a role of controlling all basic cell activity, and phosphorylation has importance in neurological disorders. Rick-

ets, a disorder characterized by a lack of vitamin D (whose production on the skin is promoted by UV conversion of 7-dehydrocholesterol into vitamin D) which controls the absorption of Ca and P.

Anthrosol is one of the 30 soil groups in the clasification system of the FAO (Food and Agriculture Organization). According to the records, it comprises only 0.004 % of the earth's land surface. Compare this to the abundance of soils useful for agriculture (Cambisols = 12%, Acrisols = 8%, Phaseozems = 1.5%). Anthrosols are extremely useful for discovering human settlements, even if they existed in prehistoric times and have not left any visible artifacts. The key for establishing such settlements lies in the composition of the soil, especially as it refers to its phosphorus content.

The agronomist O. Arrhenius (not related to the chemist Svante Arrhenius) first suspected a correlation between native P alteration and human settlements. Detection of archeological settlements through phosphate analysis commenced in the 1930s, then spread through Europe and became important in the 1970s after development of a fast field test. Basically, the background P from an undisturbed site changes its content very slowly, whereas in a human settlement many manufactured products, discards, sewage, waste or fertilizer add P to the environment and also remove P by harvesting, livestock grazing and other alterations.

Interpretations are based on both P content of organic and inorganic soil components. Another complication is the original soil pH, the type of soil, whether it was waterlogged or dry, colloidal or grainy. This, however, does not answer the question of phosphorus availability around the root zone or transformations in availability related to the composition of the soil matrix and the chemical leachant. As example, field content of P in drainage waters may amount to less than 1 microgram per liter. It can be assumed, that all of the remaining P is strongly bound to Ca, Al and Fe. In the late 1970s a field test was developed for 50 mg soil placed on a piece of filter paper by

(Continued to page 10)

Moderation And Common Sense, XIX

A. Pavlath

Since 2008, I have addressed six alternate energy sources, which might help with the energy problem.

However there is one more problem: how do we use the obtained energy to replace fossil fuels, such as coal, gasoline and oil? The advantage of the fossil fuels is that they can easily be transported. In the case of the gasoline, cars and trucks can be easily refilled almost everywhere where we travel. Out of the six alternate energy resources five produce electricity. Only biomass utilization, which was addressed a few months ago, can provide other type of energy which I will further elaborate with new possibilities and problems next month. At this time I want to address on how to use additional amounts of electricity in our everyday life?

In the rural areas electricity from a windmill can be used to drive some stationary farm equipment. In the suburban areas electricity from solar cells on the roof can drive an air conditioning unit in the summer, and heat the house in the winter, but only daytime when the sun shines. Otherwise, one would need the cooperation of the electric company to exchange the electricity generated by the sun for the amount of energy needed during the night. In many states, legislation mandates this, though the excess electricity generated is not necessarily compensated.

In most areas, we cannot install our own windmill or put enough solar cells on the roof. We have to depend on receiving the electricity generated by all types of sources from coal to atomic energy. In the United States and some other countries 120V is common in households, while in Europe and mosts of Southe America it commonly is 220V, a fact you probably noticed during your travel in various parts of the world. Europeans, in spite of the higher safety problems associated with 220V, are more concerned with heat loss at high voltage during the transmission. Theoretically, increase in voltage quadratically decreases the heat formation. This is the reason why transmission at long distances is done at much higher voltage, anywhere between 200-800 KV. Even under these conditions the loss is estimated to be around 7%. Transmission is by overhead and underground systems; the latter is done in populated areas. The overhead transmission is cheaper to construct, but has some problems. Depending on how much current they carry, the wire can heat up and sag. High winds can cause further problems and power-outs. In addition, there is an uncertainty about possible health effect. There are unconfirmed reports about an increased cancer rate in the immediate vicinity of power lines and transmission stations. The jury is still out on that question, though this does not pacify those living nearby. If we increase the production of electricity from the various alternate energy resources to replace fossil fuel we would have to increase the voltage using existing lines, which would create limitations. The other solution would be to create considerably more high voltage power lines criss-crossing the country when the Not In My Back Yard (NIMBY) syndrome will again raise its head.

However, even if we overcome these difficulties we have to face another question: a large part of the energy provided by fossil fuel is used for transportation. The auto industry was frequently blamed for not developing cars which run on electric current. Recently hybrid cars were introduced, but they still need gasoline. The major problem of using only electricity for driving our car is the lack of light, inexpensive and long lasting batteries. Perhaps one day we will have only electric cars and then, what will happen when every evening 100-200 million cars are plugged in our garages to charge up the batteries?

Bottling Bubbles and Bucks: (Part 2)

Bill Motzer

In *The Vortex*, November 2008 I wrote about the chemical problems encountered with some imported bottled mineral water. In the U.S., bottled drinking water has become a major industry: in 2007, bottled water production was 33.4 billion liters with sales of $11.7 billion. According to Beverage Marketing, a research firm providing data to the beverage industry, in 2006 global production exceeded 178 billion liters. Public concern over bottled water has grown in the last few years. In 2006, the U.S. used more than 17 million barrels of oil to produce plastic water bottles with global usage exceeding 100 million barrels. Even more oil is required to produce the energy required to pump and purify water and for transportation of the filled bottles. In the U.S., less than 20% of plastic water bottles are recycled. Even so, the bottled water market was expected to grow significantly in 2008.

Why are consumers so enamored with bottled water, when a single 20 oz (591 mL) bottle typically sells for about $1.50? (A case with 24-20 oz bottles can be purchased on line for $17.99; this is about $4.80 per gallon.) But tap water cost in California, on the average, only about $0.001 per gallon. Some consumers say that it is the taste, some indicate that bottled water is more convenient, others that it is purer than tap water. Most consumers, however, do not know what is in the water they are consuming, assuming that if it comes from a "natural" source (e.g., spring or aquifer) it is better than tap water. In fact, bottled water produced by major suppliers such as PepsiCo (Aquafina(r)) and Coca Cola (Dasani(r)) take their water from municipal supplies, generally filtering the water before bottling or using reverse osmosis (RO).

How can you be certain if water is safe for consumption? For tap water, large water purveyors such as municipalities and water districts are required to adhere to both state and federal water quality regulations. All regulated maximum containment levels (MCL) have been compiled in a publication of the Central Valley Regional Water Quality Control Board titled A Compilation of Water Quality Goals; it can be downloaded free at www.waterboards.ca.gov/centralvalley/. Another method is to read the annual report mailed with your water bill; many of these can also be obtained on line. For example, in Contra Costa County, the water supplier is the East Bay Municipal Water District (EBMUD). The annual water quality report for 2007 can be obtained at www.ebmud.com. It lists important constituents such a microbiological, radioactive, inorganics (including lead and copper), organics, and unregulated substances such as n-nitrosodimethylamine NDMA that may be produced from chloramines used to treat raw water.

The water quality chemistry for the products of some water bottlers are also listed online. In West Virginia all bottled water bottlers and distributors are required to obtain a permit from the West Virginia Department of Health and Human Resources to verify that the water is from an approved source, has been tested for potential contaminants and is inspected to verify that it is bottled in a sanitary manner. West Virginia has listed (at www.wvdhhr.org/phs/bottled water/index.asp) bottled water from over 160 plants under 790 labels from plants in 31 states and 9 different countries.

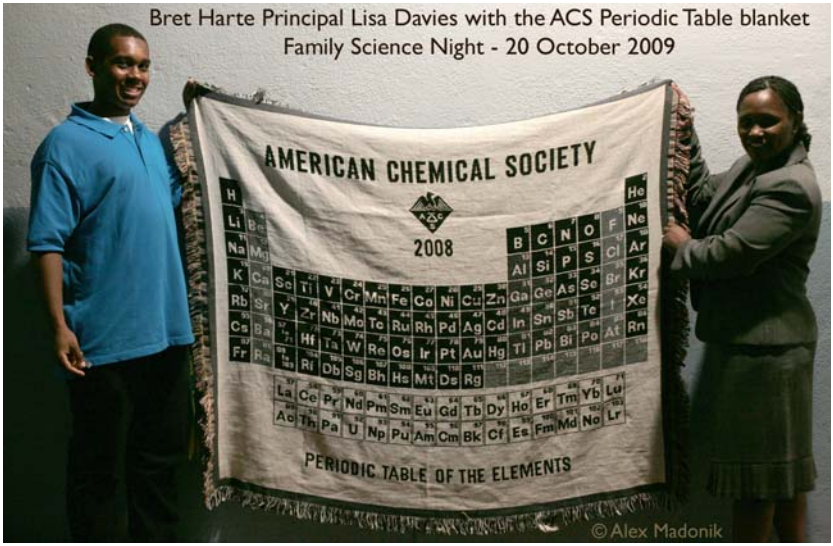
Finally, one should remember that MCLs rely on health-based risk assessments, which in part take into account economic factors. Substances that recently have been reported in the press impacting municipal and bottled water supplies such as a pharmaceutical and personal care products (PPCPs), NDMA, and perchlorate are now routinely analyzed down to µg/L (part per billion) concentrations and may also be detectable in ng/L (part per trillion) concentrations. Whether such concentrations can cause harm to humans remains debatable. However, as a water quality geochemist, I'll continue to consume and enjoy my tap water. (Note: This paper was written in December 2008).

(continued from page 7)

putting two drops of a 5% solution of ammonium molybdate in 1.75N HCl as extractant for 30 seconds. Immediately after, two drops of a 0.5% solution of ascorbic acid are added and the development of a blue ring is recorded after 2 minutes.

With this simple tool, are you prepared to test phosphate in your backy

Family Science Night "Great Element hunt" with volunteer Blanca Domingo and kids



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