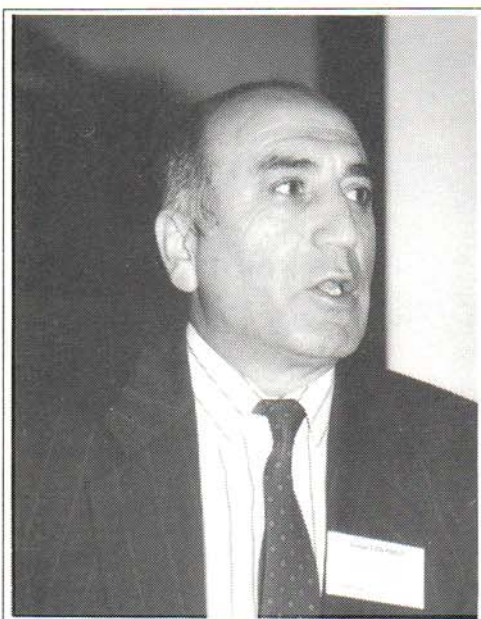


# CMS News

A Publication of The Clay Minerals Society

Winter 1995

## Clay meeting on the prairie



Ahmet Mermut, Chair of the Saskatoon Meeting.

*High Iron Photos*

### Grant application deadline May 1

The CMS Student Research Grant application deadline this year is May 1. Contact the Society Office for grant applications.

### CMS dues change

As a result of declining institutional subscriptions, the CMS Council has reluctantly found it necessary to raise membership dues to \$50 for subscribing members, \$20 for non-subscribing members, and \$15 (a decrease) for student subscribing members.

The 31st Annual CMS Annual Meeting was unusual in several respects, all pleasant. First, it was held August 13-18, a major departure from our long-standing fall schedule. Second, it was held in a foreign country—Saskatoon, Saskatchewan, Canada. One might argue that the first was necessitated by the second. This was our third Canadian meeting, and our fifth outside the USA. The tranquil campus of the University of Saskatchewan, with its flowers and classic limestone buildings, was a most agreeable site for our meeting, which was hosted by the Department of Soil Science and chaired by Ahmet Mermut. In spite of the new time and remote location, there were only slightly fewer attendees than at many recent meetings. There were several well-known clay types from overseas, including Victor Drits (Moscow), Alain Manceau (Grenoble), Neal Skipper (London), Gerhard Lagaly (Kiel), Amos Banin (Israel), Jacques Estoule (Rennes), and Theo Klopprogge (Netherlands).

The program included a pre-meeting Workshop on Scanning Probe Microscopy, chaired by Kathy Nagy and Alex Blum, and a post-meeting field trip. The workshop was well-attended (about 65), and included Volume 7 of our Work-

*continued on page 28*

## Baltimore meeting starts June 3

The 1995 Clay Minerals Society Annual Meeting will be held in early June this year. The earlier meeting time may catch some members off guard, so if you are planning to

*continued on page 19*

## New Treasurer



Courageous new CMS Treasurer Herman Roberson, Saskatoon 1994, took over the reins from Ken Towe at the end of the 1994 annual meeting.

*Jo Eberl*

## Directory changes needed

The CMS Directory is currently being prepared. Please let the CMS Office know your required changes as soon as possible. We would especially appreciate e-mail addresses, which can be sent to peberl@rmii.com

## Inside ...

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Memorial: S. W. Bailey  
Sustainer Profile: Alpha Earth  
President's Remarks: D. D. Eberl  
Educational Aids  
Council Business by Don Scafe  
Committee Personnel

### The Clay Minerals Society



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The Clay Minerals Society  
**The Clay Minerals Society**  
 P. O. Box 4416  
 Boulder, Colorado 80306 USA  
 (303) 444-6405  
 FAX (303) 444-2260

Many thanks to our advertisers this issue, **GAVA Scientific Instruments** and **Siemens Analytical X-ray Instruments**, for helping make this issue possible, and to the **Mineralogical Society** for reciprocal advertising.

*This newsletter printed on recycled paper.*

## Letters

### Linus Pauling closes the circle

Dear Patricia Jo:

Thank you so very much for the copies of your newsletter. I enjoyed reading the almost literal, if not completely literal, transcription of the interviews.

...As I have mentioned before, my father really enjoyed being with you (as did I). I believe that yours was the last formal lecture that he has given, the last of his life, the closing of the circle.

With best wishes, and again, thanks.

*Linus Pauling, Jr.*  
*Palo Alto, California*

### New order reflected in meeting participation

Dear Jo:

I just learned that no one from Chevron will be attending the CMS meeting in Saskatoon. As a sentimentalist, this saddens me because this will be the first meeting in the history of the Clay Minerals Society that Chevron will not be represented by at least one person. This reflects the new order in the petroleum industry (and some other industries); i.e., technology development no longer holds the priority that it has in the past. Chevron was a CMS charter member and has supported the Society consistently through its relatively generous Sustaining Membership and active participation in Society affairs by some of its staff. Hopefully, we will have some representation at the '95 meeting in Baltimore. I plan to be there.

This note is not to solicit a response. It is only a way of venting some frustrations and expressing sadness at existing circumstances.

*Marion G. Reed*  
*La Habra, California*

### Archives contributions

Many thanks for contributions to the Archives by J. Banfield, J. Burst, S. Guggenheim, G. Kacandes, W. Keller, F. Mumpton, D. Pevear, and C. Weaver. Some of these will be described in a later issue.

### X-ray look-alikes

Editor:

According to some, the ideas behind certain equipment are obvious: for example, the Debye-Scherrer powder X-ray camera and the pencil sharpener (or was it the other way around?). Do you have any new perspectives on the development of other X-ray equipment? Send photos to the Clay Doctor at the Society Office.

*Steve Guggenheim*  
*Chicago, Illinois*



*Photo taken by S.H. Hall, presented at the 1994 Jackson Award Lecture, Saskatoon, by S. Guggenheim*

## Thanks...

To the following people who contributed to this issue:

Jill Banfield  
 Adrian Bessara  
 Ginny Colten-Bradley  
 Joe Dixon  
 Dennis Eberl  
 Karuna Eberl  
 Eric Eslinger  
 Del Fanning  
 Steve Guggenheim  
 Bob Hall  
 Warren Huff  
 W. D. Keller  
 Howard May  
 Dewey Moore  
 Kevin Murphy  
 M. J. Nash  
 Dave Pevear  
 Don Scafe  
 Gray Thompson  
 Joe White

## Sturges W. Bailey 1919-1994

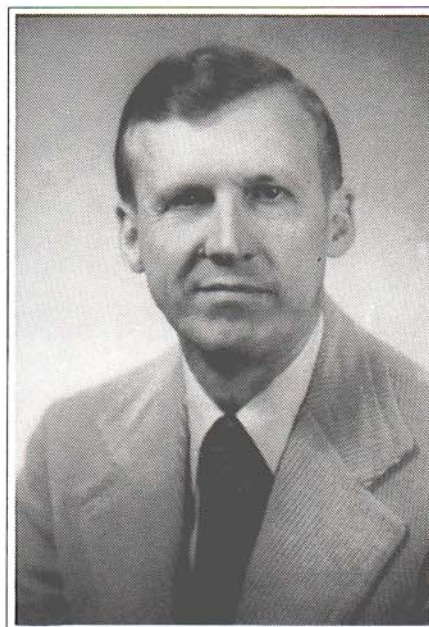
**S** W. ("Bull") Bailey died unexpectedly at his residence in Madison, Wisconsin, on the afternoon of November 30, 1994. Bailey was an outstanding scientist, teacher, and a wise counselor to many colleagues and students. His scientific interests primarily involved the structural characterization of the phyllosilicates, in which he essentially outlined the details of the entire group, including the micas, serpentines and chlorites.

S. W. Bailey was born on February 11, 1919, in Waupaca, Wisconsin. In his senior year at Waupaca High School in 1936, Bailey received his nickname "Bull" from a buddy intent on linking him dishonorably (and "unjustly") to two sisters named Weed via a variation of the lumber camp's "Bull of the Woods" (i.e., "tough doggedness"). Due to his own usage, the nickname followed him everywhere but Cambridge, where he was instead known by his middle name, "Bill." His nickname was delusory; Bull was a reserved, quiet person with a physical appearance quite opposite from expectations based on the nickname alone. However, in contrast to this outward, usually quiet manner, for those who knew him well and with whom he felt comfortable, he had an earthy sense of humor that seemed almost shocking.

Bailey obtained a B.A. degree in geology from the University of Wisconsin in 1941, where he concomitantly received Baccalaureate high honors and election to Phi Beta Kappa. His interest in mineralogy and geology developed in his sophomore year when he took a class in geology from W. H. Twenhofel. As a junior, his advisor, A. N. Winchell, "assigned" him to identify minerals by X-ray powder diffraction in his laboratory, and Bailey soon realized

that he wanted to become an X-ray crystallographer. Although he started his M.A. degree immediately upon graduating, World War II intervened, and he served in the U.S. Navy from 1942 to 1946 as an interpreter of aerial photographs. His formal education resumed upon his return home from service. Because A. N. Winchell retired during the war and the X-ray equipment had been discarded, Bailey worked on fluid inclusions in sphalerite and calcite from the southwest Wisconsin zinc deposits for his M.A. thesis under the direction of R. C. Emmons, and he graduated from the University of Wisconsin in 1948. For his Ph.D., he initially switched to economic geology, but asked his advisor, E. N. Cameron, if the Department was planning the purchase of an X-ray generator. Although Cameron was silent on the issue, shortly afterwards, R. C. Emmons, the department chairman, proposed that if Bailey would study under W. L. Bragg and W. H. Taylor to learn the field, he would guarantee a faculty position upon his return. Bailey recognized a good deal when he heard one, so he and his new wife, Marilyn, went to England. He studied at the Cavendish Laboratory at the University of Cambridge, England with a Fulbright Scholarship from 1949 to 1951. His official advisors were Sir Lawrence Bragg in his first year and W. H. Taylor subsequently, but he credited his officemate, J. V. Smith, with teaching him single crystal diffraction methods. In 1955, he received a Ph.D. degree in physics (X-ray crystallography), after completion of the refinement of the intermediate microcline structure.

Bailey returned from England in 1951 and started as an Instructor. He became an Assistant Professor in



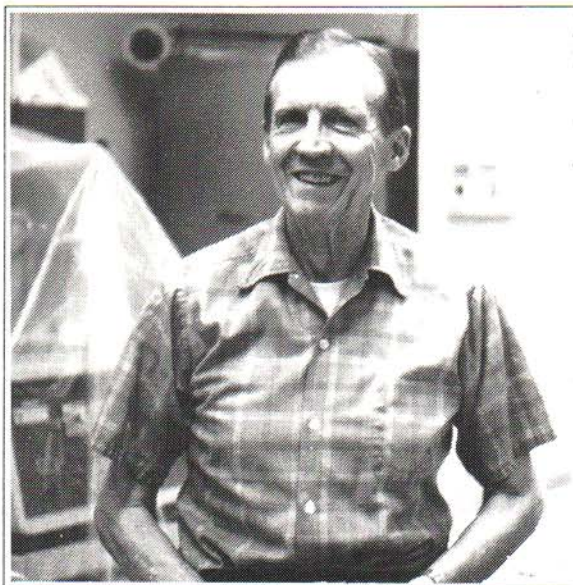
1952, an Associate Professor in 1956, and a full Professor in 1961. In 1976, he became the Roland D. Irving Distinguished Professor until his retirement in 1989, after which he became an Emeritus Professor. He served as the editor of *Clays and Clay Minerals* (1964 - 1970), and as President of the Clay Minerals Society (1971 - 1972), and he received that Society's highest research award, the Distinguished Member Award (1975). From 1973 to 1974, he was President of the Mineralogical Society of America, and he was a recipient of that Society's distinguished research award, the Washington A. Roebing Medal (1990). He was also the President of the Association Internationale pour L'Etude des Argiles from 1975 to 1978, and he was the first recipient of its distinguished research award, the AIPEA Gold Medal. In 1990, he received the Neil Miner Award of the National Association of Geology Teachers (NAGT) for exceptional accomplishments as a teacher. In addition,

*continued on next page*

Bailey was an Associate Editor of the *Journal of Sedimentary Petrology* (1960 - 1970), editor of the *Proceedings of the International Clay Conference* in 1972 and 1975, and the editor and organizer for the Mineralogical Society of America short course and proceedings volume on *Micas* in 1984 and then *Hydrous Phyllosilicates* in 1988. He was a Life-Fellow of the Mineralogical Society of America and an Honorary Member of the Mineralogical Society of Great Britain and Ireland.

Bailey was dedicated in his service to the Department of Geology and Geophysics at the University of Wisconsin. Besides being Chairman of the department from 1968 to 1971, he served as either a member or chair of nearly every committee. His devotion to the history of the department eventually developed into a book: *The History of Geology and Geophysics at the University of Wisconsin-Madison 1848 - 1980*. More importantly perhaps was the universal recognition by his colleagues that Bull was absolutely fair, generous, and above politics. This positioned Bull as wise counselor with high moral authority, which he used carefully and judiciously.

Bailey was involved with feldspar research early in his career, but he turned his attention to phyllosilicates, and this is the area for which he is known best. In 1951, S. A. Tyler encouraged him to study the clay minerals of the Lake Superior iron ores, in which he subsequently found polytypic variations among the chlorite and serpentine structures. In 1956, the seminal study of mica polytypes was published by Smith and Yoder and, in 1957, Bailey derived the 12 standard polytypes of the serpentines following similar procedures. Although the polytype work became part of his lectures and



Bull Bailey in his lab at Wisconsin, September 1994.

Courtesy Jill Banfield

courses, he waited twelve years to publish the results, when computers available to him became sufficiently powerful to enable calculation of the powder patterns. From 1960 to 1962, he derived the chlorite polytypes and followed this with structural refinements of chlorites and serpentines. This work clarified the nature of polytypism of these minerals and systematized the nomenclature, which was in complete disarray at the time with hundreds of ambiguous and useless names. By 1970, he redeveloped the description of mica polytypes to represent a more realistic atomistic view of crystal growth and, in so doing, he was able to unify the derivations of mica, serpentine, and chlorite polytypes. In the 1970's and 1980's, Bailey examined the concept that cation ordering may be a more common phenomenon in phyllosilicates than previously thought due to ordering in subgroup symmetries. This work resulted in the systematic refinements of many layer silicates. More recently, since his retirement, he had been developing the systematics of serpentine and chlorite periodic intergrowths. His contributions to phyllosilicate mineralogy, numbering over 100 published pa-

pers, extends far beyond descriptive aspects of individual structures. He popularized and extended the understanding of the nature and origins inherent in layer-type structures, and he helped establish the basis for structurally combining component units. This work had an important impact in recognizing and predicting limitations to phyllosilicate composition, crystal morphology, and stabilities. In addition, his work forms much of the basis of the field of clay mineralogy. His work has both stimulated and guided the development of both clay mineralogy and phyllosilicate mineralogy. It is fitting that the mineral baileychlorite, the Zn-rich chlorite end-member, was named in his honor.

Bailey was an extraordinary teacher, apparently comfortable in front of either small or large groups. Bailey's brilliant and successful career as a teacher developed from the qualities that make for an outstanding person. He responded to people with insight and respect, and both these traits were universally recognized by students and colleagues. With these traits, come patience and fairness, which are qualities that students generally remember most. He treated students as equals and, in this way, established friendship through respect.

Bailey was a very reserved and quiet person. Thus, he let the subject matter be the star of the lecture—no flashy presentations, jokes, or emotional interactions. Instead, his lectures were craftily constructed and absolutely clear and precise. Each lecture was delivered fluently and with care. Usually, early introductory material was presented using simplified examples from less complex systems so that the student was properly

*continued on next page*

"set-up" to appreciate and handle more complex versions later. For example, in his crystal chemistry course, he introduced the concept of superstructures early on with the Cu-Au alloys so that an analogy could be drawn for the complex feldspar superstructures near the end of the course. Clearly, the brilliance of his lectures was that he could systematically develop complex topics into a readily coherent and understandable course.

As organization and insight were the trademarks of Bailey's lectures, they were also key features of his writing. His sharp scientific insight was coupled to a clear and concise

style of writing. His articles not only presented the data and conclusions, but he offered the reader a tutelage. The NAGT presentation of the Neil Miner Teaching Award in 1990 was one of the most satisfying of the many awards that he received; he was particularly pleased when he was complimented on his teaching.

Bull was devoted to his wife, Marilyn, of nearly 45 years, and family. Before Marilyn's death and after the children had gotten older, he and Marilyn would travel the world together, in part during lecture trips to warmer climates. He is survived by a son, David S. Bailey, a grandson, Sean D. Bailey, a daughter, Linda M.

Bailey, and a brother, niece and two nephews.

Bull will be remembered by his many friends for his insightful scientific contributions and his genuine modesty. Along with a select group that includes George Brindley, Bill Bradley, M.L. Jackson, and John Hower, Bull Bailey was a pioneer in clay mineralogy.

*Stephen Guggenheim  
Chicago, Illinois*

#### Acknowledgments

I thank C.V. Guidotti and Linda M. Bailey for reviewing the manuscript.

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## Bull Remembered: A Compilation of Comments from Friends

Steve Guggenheim culled the following personal comments from the many sent to the Geology Department at the University of Wisconsin for Bailey's memorial service.

"...His friendly, unassuming manner endeared him to us and to all who had the good fortune of being a part of the "family" of clay mineralogist. We will miss his friendly smile and wise counsel."

*Joe L. White*

"...I first met Bull and Marilyn in 1949... Several students came from abroad, including Bull and Bob Furguson from Manitoba. There were two groups. About half the students had been in World War II, including Bull and Francis Crick... Bull came to Cambridge to learn the latest crystallographic techniques so that he could teach them at UW, and start a research program. I was a year ahead of Bull in knowledge of crystallography, and was assigned to help him learn the basic techniques. Helen Megaw asked Bull to solve the structure of K-feldspars. We now know that microcline has ordered aluminum and silicon atoms whose spatial arrangement controls the tartan pattern of twinning seen in thin sections of granites. Crystallographic techniques were very primitive by modern standards. Intensities on photographic films were estimated with spots on a standard film. Calculations were done by hand. Very important was preparation of a crystal nearly spherical in shape to equalize absorption of the X-rays. Bull became known as "The Razor King" for his skill in chopping a single crystal of microcline from a tartan twin. His data were truly excellent, and fully consistent with recent measurements..."

*J.V. Smith*

"...Bull's thesis was to determine the structure of that crystal of sanidine. It was a very tiny grain. One day Bull told me that once when he tried to mount his grain, it fell to the floor,

and he spent the whole afternoon on his knees searching for his thesis..."

*Zdenek V. Jizba*

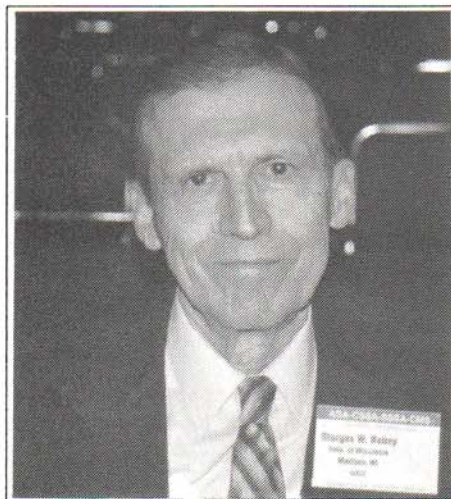
"...The death of Dr. S.W. Bailey marks the loss of a great scientist, a friend to many students such as I was many years ago, and to the clay science community... He was a key person in helping me launch a career on clays in soils and I will always treasure the instruction and guidance that he gave me in many ways. I once lost a crystal that he had carefully mounted for single crystal x-ray analysis. I have often thought what patience it must have taken for him to respond with composure to that event."

*J. B. Dixon*

"...When I first joined the Clay Minerals Society in the late 1960's, the Society's four "smartest" members were pointed out to me by my teacher, John Hower. They were W.F. Bradley, G.W. Brindley, Bull Bailey, and of course, Walter Keller. Bull almost never missed a meeting of the Society, for which he served as President, Distinguished Member and journal editor... As a great teacher, he also took individual interest in his "students," former students or otherwise. For example, I was surprised that once when I missed a meeting, he noticed, and the next year told me that he hoped it wouldn't happen again..."

*Dennis D. Eberl*

"Bull was the dominant influence in my career. From him I learnt not just about clays and X-rays, but the meaning of academic pursuit. I learned to question my own research first, the need for careful experimentation, and



*Bull Bailey in Minneapolis, 1992.*

*Jo Eberl*

that integrity is at the heart of scientific research. He and Marilyn gave essential support during my 6 years at Wisconsin, and Bull stood in as "father of the bride" when Glen and I were married in St. Francis chapel. His quiet humanity and care will be always with us."

*Tony and Glen Eggleton*

"...Bull was, in my opinion, the outstanding clay crystallographer in the world. He was able to present complex x-ray and mineral structure data in a clear, concise, and simple manner so that it could be easily understood. In addition to being an outstanding scientist, Bull was a genuine and fun-loving person. I remember at an international conference in Budapest, Hungary, the group visited a hall which was said to have the best acoustics in the world if you stood exactly in the center of the hall. As the group was leaving, I heard this loud clatter, looked around, and there was Bull doing a tap dance at the center spot..."

*Haydn H. Murray*

*continued on next page*

"...My first contact with Bull Bailey was on the 1956 summer field course, which he co-led with Lew Cline. At that time I had had only physical and historical geology. I recall Bull addressing the 60-some students on the topic of high-temperature and low-temperature feldspars as we were standing on Capulin Mountain in New Mexico. And, as you know, I understood a lot of what he said, because Bull had an uncanny ability to present complex topics in a straightforward, understandable way.

In those days, if there were female students, a chaperon was required. Bull was instrumental in choosing Sally Scholz to protect the women on the trip. She worked closely with Bull, and even ate his special dish of Spanish rice. When it was necessary to send one of the students home, she and Bailey made the tough decision. I can say that Bailey chose well, be-

cause Sally has been my wife for the past 32 years... Thanks, Bull, you have made a difference in the life of Gene LaBerge."

*Gene LaBerge*

"...Many times at meetings, I have asked students or foreign visitors if they have met Bailey yet, and they have shaken their heads in reluctant awe. When I would take them over to meet him, he would immediately ask questions, respond to them in a way that put them at ease, in some cases, I think, making the entire meeting worthwhile for the sake of this one encounter. He was always accessible; he treated others with respect... Always, he had a sense of fun and animation about him, a sparkle of mischief in his eyes, that made seeing him such a pleasure..."

*Patricia Jo Eberl*

### Bailey's Students

*(Listed in order of the awarding of either the M.S. or Ph.D. from 1953 to 1994)*

Robert Bell, Zdenek Jizba, Cecil Hewitt, Malcolm Mossman, Paul Ribbe, Bruce Brown, Robert Doman, Joseph Finney, Ian Threadgold, Charles Cinnamon, Richard Eggleton, Alice McDaniel Blount, Judith Lister, Charles Mansfield, Mary Lou Mooney, Patricia Moore, Diane Henry, Stephen Harvey Hall, Stephen Guggenheim, Janet Loveless, Thomas Phillips, Cynthia Anderson, Teresa Swanson, Charles Geiger, Rick Knurr, Marlene Filut, Audrey Rule, John McKinney, Hong Zheng

## M. L. Jackson's 80th birthday honored by SSSA symposium

A special symposium was convened November 14, 1994, during the 86th Annual Meeting of the Soil Science Society of America, in Seattle, to honor M. L. Jackson on the occasion of his 80th birthday. Emeritus Professor of Soil Science at the University of Wisconsin-Madison, and a world-renowned clay mineralogist, M. L. is also a Past President and Distinguished Member of The Clay Min-

erals Society. Chaired by Sridhar Komarneni (Penn State), the program featured presentations by Komarneni, D. C. Golden (NASA), Antonio Violante (U. of Naples, Italy), P. M. Huang (U. of Saskatchewan), H. M. May (U. S. Geological Survey), J. B. Dixon (Texas A & M), D. S. Fanning (U. of Maryland), and G. Borchardt (Soil Tectonics, Berkeley), all members of M. L.'s "academic family."

Speakers' contributions focused on research themes associated with Professor Jackson's career, or their own related interests that developed out of research experiences in Jackson's laboratories. A reception, with cake and refreshments, followed the formal presentations.

*Howard May  
Boulder, Colorado*

### Student Research Grant Awardees

CMS student research grants for 1994 were awarded as follows: **Thomas A. Toth**, student of **Darrell Schulze** and **Haydn Murray**, among others, Purdue University, for The stratigraphy and geochemistry of Minnesota's kaolin; **Enid J. Sullivan**, student of **Robert Bowman**, New Mexico Institute of Mining and Technology, for Determination of the topology and charge distribution of organo-zeolite surfaces utilizing atomic force microscopy and scanning-tunneling microscopy; **Susan E. Gill** student of **Keddy Yemane**, University of Pennsylvania, for Clay mineral occurrence and distribution as paleoenvironmental indicators in Pennsylvanian-age underclays; **Yan Xian**, student of **Gilles Villemure**, University of New Brunswick, for Electrochemistry of synthetic transition metal clays, **Heping Sun**, student of **Warren Huff**, University of Cincinnati, for HRTEM Study on kaolinization of biotite in the Osmundsberg K-bentonite [Lower Silurian] from central Sweden).

## Interviews with the clay scientists

### David R. Pevear

David R. Pevear is a Senior Research Associate at Exxon Production Research Company. He is a Past President of the CMS. The interview was conducted by Graham Thompson and Dennis Eberl in November, 1992, in Minneapolis, during the joint CMS/SSSA meeting.

**CMS:** Tell us something about your personal history. Where were you born? The question I want to lead into is what got you into science and what got you into clay science. Talk a little bit about John Hower, too.

**PEVEAR:** Sure, oh yeah. I was born on August 21, 1940, in Waltham, Massachusetts and from a family that had long lived in New England.

**CMS:** That explains it.

**PEVEAR:** I was always a very curious kid, and I liked to take things apart. When I was eight or nine, I liked to make things; I liked to investigate how things worked. I think there was an investigative or a mechanical aspect to me. My mother's father was a science teacher in a private high school in Newton. My mother's brother, John Ryther, was finishing up his graduate work at Harvard when I lived in Massachusetts, and I often went with him into his lab. So I think all of those things got me interested in science. When I was in high school, maybe even earlier, I used to make bombs and fireworks. I always liked fireworks, and I was very disappointed when we moved to New York and found that they were illegal. So I used to make them. I don't know how I got started in this, but even when we still lived in Massachusetts, I can remember my uncle bringing me back things like saltpeter and sulphur so I could mix them up and make gun powder.

We moved to New York, and I graduated from Hempstead High School in 1958, and then went on to Allegheny College, which is in western Pennsylvania. I was a chemistry major, and I did okay in chemistry, but there was a



Drawing by M. J. Nash

guy down the hall in the dorm who had taken a geology course, and he had a book on geology. I'd never thought about geology. I'd thought about chemistry because I had chemistry in high school, and I liked making bombs and fireworks and things like that, but I'd never really thought about rocks. I remember reading his book in the dorms and thinking, "Hey, this is neat stuff." I went for it at that time because it was one of the last sciences I became acquainted with. If I had

been given a lot of geology in high school and discovered chemistry in college, I might have ended up a chemist. Except chemists are boring. And they all look the same.

At Allegheny College, I was a beatnik. I had long hair and smelly arm pits. In fact, the other students used to call the group I hung around in The Goats. I wasn't always a good student. If I didn't like a course, I didn't go. I tried winging it on the exams to see if I could pass them all and just get by.

But I did get acquainted with clays there, because I needed to do a project, and I read in *Scientific American* about how to build your own DTA (differential thermal analysis), and I did that for a student project. It was typical of how I operated at that time. I was a student with absolutely no resources, I had no money. I was renting a little hole of a room someplace. The Geology Department didn't have any resources, like a shop or anything like that. They had just two geology professors.

I was walking down the street near the Geology Department and saw a vise on a guy's shop bench. I needed a big vise, so I said, "Oh, hey, can I use your vise?" I told him I was a student, and he said okay. I made the sample cups for the DTA machine out of spoons from the cafeteria, stainless steel spoons. I clamped a big nut in his vise and took a slightly smaller sized bolt and pounded it through the nut and made a little cup. And then I cut it off and drilled a little hole in the bottom. He had a drill that I was able to use. I actually had to buy a couple of things, and

**Pevear, continued**

one of them was an alumina tube for the furnace, and also chromel wire to wrap it with as a resistance element. I also bought chromel and alumel wires for the thermocouples. I welded the thermocouples with a mercury arc welder that I made by having the pool of mercury in the bottom of a flask. I hooked it up to house current, and then I lowered the twisted thermocouples down until they just touched the mercury, and when they did, it established an arc that fused the wires together. It never occurred to me that I might be breathing mercury vapor.

But it all worked. I got some clay minerals from our geology lab and actually ran DTA patterns on them. I didn't have a recorder, so I used a galvanometer. It had this little thing with a mirror on it twisting in a magnetic field. I had to record points as it heated up, both the furnace temperature and the differential temperature from the two thermocouples in their two cups, so I was madly writing numbers. When you hit that big exothermic reaction at the end, when it recrystallizes into beta-alumina or whatever it does, the galvanometer just went crazy. I had trouble catching the peak, because the peak would be gone before I could write down the numbers. So that's how I discovered clays.

**CMS:** What clays did you analyze?

**PEVEAR:** Oh, whatever I could find. Kaolinite, montmorillonite, illite, the standard ones. I did some carbonates and discovered that the breakdown temperatures for the carbonates were directly related to the position of the cations on the periodic table. Other people knew about this, but I discovered it again!

So when I was looking around for a place to go to graduate school—actually I didn't go out to the University of Montana because John Hower was there—I went out there because I wanted to get the hell out of Dodge. I had never lived in the West, and my parents were old fogeys and never went anywhere. I thought, "I want to go to someplace that has mountains." Since I always lived in the city, I wanted to go to someplace that was small town with mountains. I looked through a bunch of places, and that looked like a good place, so I applied. Although I had lots of A's on my resumé, I also had a few F's because, as I said, I sometimes just didn't go to class.

As I understand it, the letter of recommendation from my department chairman said I was a beatnik. I was told that John Hower held it up and said, "Hey, we gotta have a beatnik." Isn't it interesting that the word beatnik isn't used anymore?

**CMS:** Yeah.

**PEVEAR:** Hippie is still used a little bit, but not beatnik.

**CMS:** Oh, beatniks way preceded the hippies.

**PEVEAR:** Anyhow, I went there, and the first person I met was Tom Mowatt. Tom Mowatt says, "There's only one guy here that's any good, and that's John Hower, so I suggest you work with him." And he was right, sort of. I immediately became transfixed by Hower's teaching style, which was a cut way above what you normally got anywhere. A person who actually thought on his feet, solved problems and equations right there in the class, didn't always have prepared lectures, but always covered a very nice story, and I think that was it.

**CMS:** You didn't follow John to Cleveland though?

**PEVEAR:** Well, I had taken my pre-lims, and I had taken all my language exams. I was almost done, and it was a big decision. I could've gone, but I didn't, because there was an uncertainty about whether I would have to take those exams over again. Since I hated the whole idea of exams, and wanted to get on with it, and also would've rather lived in Missoula than in Cleveland, I just finished it with Arnie Silverman.

**CMS:** So you were living in a very nice place.

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*John Hower held up [my letter of recommendation] and said, "Hey, we gotta have a beatnik."*

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**PEVEAR:** Yeah, that house up on the hill.

**CMS:** The ranch.

**PEVEAR:** That's right. In 1964 in Missoula, I rented a little house high on the hill from a strange physics professor named Dick Hayden. I met Bruce Velde at that time. Bruce came back for his thesis defense.

**CMS:** What did you do your thesis on?

**PEVEAR:** My thesis was on the distribution of clay minerals in soil, river, nearshore marine, shelf and slope sediments on the southeastern United States between Cape Hatteras and Florida. That came about through a liaison with Orrin Pilkey, who got his MS. with Hower in Montana. Orrin Pilkey, who now is famous for his beach studies at Duke University, had just joined the staff at the University of Georgia Marine Institute. In 1964, I went there,

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**Pevear**, *continued*

stayed with Pilkey, and worked as his lab assistant for a while. I also collected samples for him. That was the year that you (Gray Thompson) and also Pete Hall and Ray Brenninger sublet that house on the hill from me.

**CMS:** Ray Brenninger lives in Helena now. His daughter is in my mineralogy class.

**PEVEAR:** But anyway, what I did my thesis on was basically the controls on sediment distribution using clay minerals as tracers to understand sediment dispersal mechanisms. There were some interesting results. For example, it turns out that the clay minerals on the continental shelf and slope have no relationship to the clay minerals in the adjacent soils and in rivers. The soils are full of kaolinite and some smectite, and the rivers are full of kaolinite and smectite (but mostly kaolinite), and then when you get out on the nearshore areas, you start picking up all kinds of smectite and illite. By the time you get to the continental slope, it's all illite and chlorite. There's hardly any kaolinite and smectite there at all.

**CMS:** Where's the kaolinite?

**PEVEAR:** At the present time the rivers are not feeding sediment out onto the continental slope.

**CMS:** Is the kaolinite getting dumped in the near shore environment?

**PEVEAR:** The kaolinite is being dumped in the estuaries. We showed that a main source of sediment in the estuaries is from the continental shelf. What's happening is that the continental shelf sediments are being winnowed. Every time the tide comes in, it brings sediments in, and then it flocculates in the estuary. So there's lots and lots of shelf sediment in the estuary, more than there is river sediment on the shelf. It's exactly the opposite of what we would have initially thought. The stuff out on the continental slope is from a completely different source. It comes from way up north. In fact, it's real interesting because if this was a big sediment system that later was preserved in the record, and you were looking at, say, the slope sediments and rise sediments, which might be the ones that would be preserved, then you would say, "Oh, look, chlorite and illite, it must have been a cold climate." Whereas actually the climate in the adjacent landmass is warm and humid, and making kaolinite.

**CMS:** Just to get off of science for a second, you were a grad student during the Vietnam War. How did that affect

studies at Missoula?

**PEVEAR:** It was a politically interesting time. Kennedy was shot shortly after I arrived in Missoula, and I remember being right there in the Lodge, eating lunch or drinking coffee or something, and then not too long after that, we began to have the Vietnam War problems. I was an active Vietnam War protester in Missoula. I got beat up once. I was on a march, and I carried an American flag that I had tacked onto a pole. Somebody took it away from me because they thought I was being insulting to the flag. It was a big pole that I had found in the wonderful attic of the old geology building. They hit me over the head with it, knocked me right down on the ground—knocked me out. And I know who did it, too.

**CMS:** Who?

**PEVEAR:** Well, later he came to a rally and argued with us. I recognized him. I don't know his name, but his father was a soldier. I can remember playing the exact same game, if you want to call it that, that President Clinton played. In fact, this discussion of Clinton's draft status is exactly similar to mine. First I almost got classified as 1-A, but then I got married in 1962. So then I had a marital status, and that got you reclassified. And then I got classified 1-A again, but then you could get off if you were a

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*They hit me over the head with it, knocked me right down on the ground—knocked me out.*

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student, so I went back to a student status. So I sort of lingered around almost being called. Then they had a lottery, and nobody knew whether they were going to go. What a great deal that was. I'm being sarcastic. Here are these students trying to study, and here was this lottery. You never knew. One day you'd have to be studying for your orals, and the next day you'd be drafted.

**CMS:** Do you think a lot of people just dropped out and worked against the war?

**PEVEAR:** Oh yeah, quite a number of people I knew went to Canada.

**CMS:** Were you ever tempted to do something like that?

**PEVEAR:** Oh yeah, in fact, I made several trips to Canada to scout out places to live, so it was a very real possibility. I think if I had gotten drafted, I would have left. I

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**Pevear, continued**

don't know if this is something you want to put on the tape, but I do find it interesting that Clinton was a Vietnam protester and that he's now our President. People were saying they wondered if his draft status would hurt him. As far as many of us are concerned, it helped him. He was very straightforward about it. He said, "All I want to say is I felt strongly against the war, and I didn't support the war, I don't support the war now, and I acted appropriately." But there's no doubt that students then were very, very different than students are now. I think we all realize that.

**CMS:** What do you mean different?

**PEVEAR:** Well, I think students back then were activist oriented. They were usually more radical than the faculty. Now it's the opposite. Students now tend to be very conservative. Well, I don't see that many students, so it's hard to know—what do you think?

**CMS:** They all have nose rings and nipple rings now.

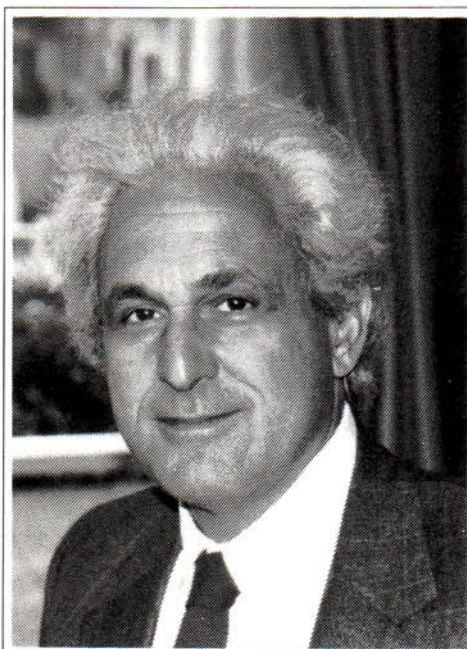
**PEVEAR:** Oh, yeah. Nose rings and nipple rings.

**CMS:** I don't know politically what that means.

**PEVEAR:** And you can't tell any more. For example, long hair—that was the sign of a hippie. If you had long hair, you were a war protester. But by the time the '80s came in, they had long hair in Houston in the '80s, and they're rednecks.

**CMS:** Let me steer us back onto the historical perspective of Pevear. After you finished your Ph.D., you went directly to Bellingham?

**PEVEAR:** Yes, I interviewed for several jobs in the late sixties—actually I hadn't quite defended my thesis—and I took a job at Western Washington University, but I interviewed for several jobs. In fact, Ray Brenninger and I even drove to GSA in his little Volkswagen Karmann Ghia that fall to look for jobs and interview. I did, as a matter of fact, interview for the job at Western Washington University at the time. I also interviewed at Marathon



*Dave Pevear in San Diego, 1993, during his tenure as CMS President.*  
Jo Ebert

Oil, and at the University of Florida at Tallahassee. I was offered all three jobs, which I thought was pretty amazing. The Florida job was nice in some ways. It was a research university with a lot more going on than a little school in Bellingham, Washington.

I was in my first clay minerals meeting, to wax back to what we're supposed to talk about, in 1969. I joined the society in 1964 because Hower really pushed it to all his students. He told us that if we joined in 1964, we'd be charter members, which might have been a lie, but anyway, a bunch of us joined up. The first meeting I went to was in 1969 in Dallas.

**CMS:** That was my first meeting, too.

**PEVEAR:** That's where I met Reynolds for the first time. And I remember he came up to me and stuck out his hand and said, "Hi, I'm Reynolds."

**CMS:** Amazing! So what about Western Washington? How did you like being there? Ada Swineford was there, right?

**PEVEAR:** Yes. There actually was a problem with Western Washington, though not a bad one. I loved it, but when I arrived, and I knew this, Ada Swineford was there, and she had just come from the Kansas Survey where she'd worked for a while. I think she had had some minor disagreement with the administration, so she quit and took a job out at Western Washington University. They had

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just acquired a new X-ray machine. But it turned out that Ada wasn't really suited for teaching anything but clay mineralogy. There were other courses they needed people to teach, like igneous and metamorphic petrology and things of that sort. Ada wasn't really up on those things, whereas I was, by comparison, and so I really didn't teach clay mineralogy. I got off of it for a while until she retired. That's why I say it was a problem. I think I

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**Pevear, continued**

would've been more active during that period. I didn't go to CMS meetings during that period.

**CMS:** You had some students, though, who went on in clays, like Duane Horton and Gene Whitney?

**PEVEAR:** Yes, Gene Whitney was Ada Swineford's student, but we worked together. I was on his committee, and Duane Horton was my student, and by that time Ada was just in the process of retiring. She took an early retirement. Ada and I were very good friends. I think a lot of people don't know what a wonderful person Ada Swineford was. For example, she was a strong supporter of human rights. She protested the Vietnam War, standing down in front of the federal building in Bellingham every single Tuesday. The war dragged on for years, and every Tuesday she went down there. If it was pouring rain, which it often was in Bellingham, she stood there with her umbrella with a small group of people, week after week after week.

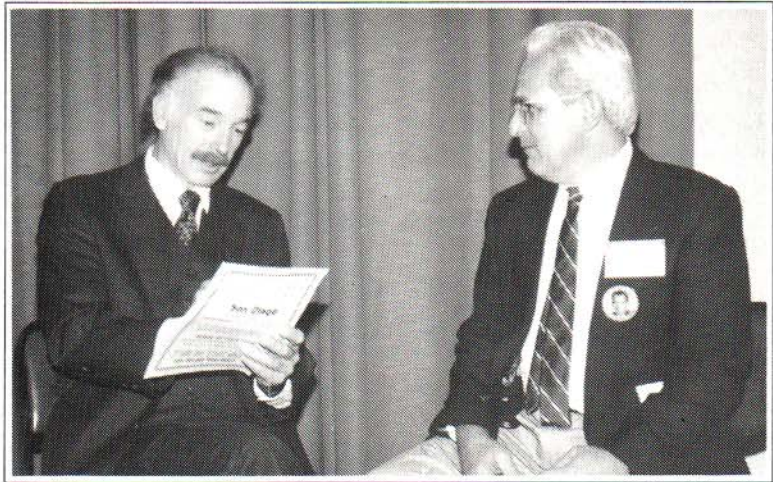
**CMS:** Ada was the editor of *Clays and Clay Minerals* for years. I think she was the first editor, wasn't she?

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*Ada Swineford was... a strong supporter of human rights. She protested the Viet Nam War, standing down in front of the federal building... every single Tuesday. If it was pouring rain... she stood there with her umbrella.*

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**PEVEAR:** That's right. Ada was from Penn State and was there at the same time that Weaver and a lot of other people were there. She also worked with Krynine and Bates, and that's where she got herself into clays. She was editor of several of the volumes, at least two that I know of, and that was back when *Clays and Clay Minerals* was a book that came out once a year rather than a journal. In fact, I remember helping her do the index on several occasions, where you had to leaf through papers and find key words to help you to index. Nobody else would do it, so she volunteered to do it. Also she was involved with a grand index of issues for ten years or so, which I think she worked on with Al Levinson—he's always been a kind of shadow member of our society; he seldom comes to meet-



*Gray Thompson interviewing Dave Pevear, Minneapolis, 1992.*

*High Iron Photos*

ings. Ada was a wonderful person, and she had a good friend, Dorothy Carroll, who was from Australia. She used to come and visit from time to time, and the three of us would sit around and discuss clays.

**CMS:** Did Dorothy Carroll live in Australia? Was she an Australian?

**PEVEAR:** Yeah. She may have come to the U.S. some, but I can't remember right now whether she had permanently relocated to the U.S. She had some connection with the Survey, so she might have been permanently located in the U.S. by the time that I had talked to her.

When Ada retired, I had been teaching the field course for Western Washington University. I used to teach it in the Drummond area west of Missoula because I knew something about the geology, and because there were a lot of good things around for teaching an undergraduate field course. You'd get rocks from Pre-cambrian to Recent, volcanics, metamorphics, thrust faults, folds, everything all in a square mile. And so right after Ada retired, I was taking over her duties in the clay courses that we had there. I remember visiting you while I was teaching that course, Gray, and saying, "Gosh, I'm going to be put back into the clay business because Ada's retiring. Can I see your syllabus that you give out to your classes?" because, of course, I hadn't been thinking about teaching clay mineralogy for a few years. I even remember you gave me a pre-print of a paper that you said was by this crazy guy named Jan Srodon. The paper was called something like, "The truth about glycol." Remember that paper?

**CMS:** Yeah.

**PEVEAR:** So that was my start of getting re-involved in the clay business. I might also add that in the period of time between when I started teaching at Western, which

**Pevear**, *continued*

was in the very late sixties when there was very high student activism on campus, take-overs, and all kinds of things like this—actually I was often involved in it—I also was in a rock and roll band.

**CMS:** Raise hell and feel moral about it.

**PEVEAR:** I played bass guitar and did some singing. Someone once said, "You guys are awful," but I think by today's standards we probably sounded pretty good.

**CMS:** Did the rock and roll band also live in your house?

**PEVEAR:** Several members of the rock and roll band did live at the house. After my wife Franny and I broke up, the band moved in, and that went on for a while. After I started teaching clays again, I started going to Clay Minerals Society meetings. That was in 1977 maybe. The next meeting I went to was in Bloomington, Indiana. I have gone to every one of them since. I can remember getting a copy of Reynolds' NEWMOD program (then called MOD 4) from you, Gray. It was a xerox of a xerox. It was the entire code, and it was all stuck together in one big long roll like a scroll. I still have it. Hower had annotated it to say what the different things meant, because back in those days, for that Dartmouth basic, variables couldn't have names such as pi or two-theta. Variables had to have names like B-1 and B-2 and B-3. I got a copy of it; I typed out all the cards by hand, and I tried to get it running on a little data general computer.

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*"Why, Dave," Reynolds says, "I can tell the difference between you and Gray Thompson in a nanosecond, but try to get a computer that can tell the difference."*

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**CMS:** That doesn't seem so long ago.

**PEVEAR:** No, but it was in the late seventies, and Hower's annotation was very helpful. There was one thing that said, "This is the statistical part, leave it alone," meaning that if we messed with the code, it wouldn't work any more after that. It would kill it. So it was very instructive, and I eventually rewrote it into Fortran.

**CMS:** An interesting thing now—Exxon is interested in it?



*Pevear discovers a fundamental particle.*

*High Iron Photos*

**PEVEAR:** Yeah, the latest thing I've been involved with in NEWMOD at Exxon where I work now, Exxon Production and Research Company, we have a smart, young computer scientist who came up to me one day, and said, "I kind of saw what you were doing at that talk you gave with these X-ray patterns that you calculated. You know, I think we could get that to work better using artificial intelligence." And I said, "Oh, no." And he said, "Yeah, you could solve the inverse problem. You could give it an X-ray pattern, and it would find a match. And I said, "No, you can't do that." You know what Reynolds says, computers aren't very good at pattern matching. "Why, Dave," Reynolds says, "I can tell the difference between you and Gray Thompson in a nanosecond, but try to get a computer that can tell the difference." So that's what I told this guy. He said, "Well, I'd like to try."

I gave him the code, and in two weeks using genetic algorithms, had a version that would actually solve the inverse problem. It doesn't do it elegantly, in terms of diffraction theory. It does it by a type of trial and error that is used to solve complex problems with many variables, and to get them to converge on a reasonable solution. The solution may not be a unique solution, it's not necessarily a determinant system, but you couldn't do any better yourself if you just tried to match them. It's been a very useful thing for us.

I stayed at Western Washington University until 1981, and I worked on several things while I was there, including Mount Saint Helens, which erupted in 1980.

**CMS:** You sent me a sample of ash.

**PEVEAR:** At that time, I had a summer position with the U.S. Geological Survey. In the late seventies, they had an environmental geology office in Seattle. They wanted to

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**Pevear, continued**

know the limit of the marine incursion during the last ice age. The Puget Sound area is all covered with glacial deposits. Besides till and outwash, there's something there that people call GMD. If you live there, you know about GMD. It's glacial marine drift stuff dropped into the marine environment from floating ice—and it has fossils in it from time to time, and they can still be in the marine growth position. What happened apparently in the Puget Sound area is when the ice got thin enough, the water came in and floated it. The problem they were interested in was earthquake prediction, and if they could find the glacial marine limit, and then see whether that had been uplifted in certain places as compared to other places. They couldn't be sure when they found till whether it was marine or not. I tried a bunch of things including exchangeable cations, which I determined for a vast number of samples since they were paying for it and I was hiring students. You know that game, and I also did boron. But as you might imagine, none of it worked, or at least none of it worked well. I could tell when I did known samples. When I did known glacial marine and non-marine drift, they fell into statistically separate groups, but there was a



Dave Pevear at NASA, 1991.

D. Pevear

shallower. Everybody was going around saying, "What can it mean? Could it be magma? No, it's probably not magma. Well, it might be magma," and then when you think of it in retrospect, in hindsight, I mean, it's a volcano, and there's earthquakes, and they're slowly coming towards the surface. And people say "Oh, could it be magma? Well, I don't know if it's magma." It's sort of like the recession, "Are we in a recession?" "Well, I don't know if we're in a recession." Remember that from a few years ago? But the USGS immediately, of course, became involved in it, and they involved me in it, in terms of sampling some of the deposits, even prior to the major eruption on

May 18, 1980. What they wondered was if there was any new material in the ash that was blowing out. They collected some of it, and, as you can imagine, the Survey people in Seattle didn't have any equipment. They didn't have a lab that they could use to do petrography and so on. Of course, there was a lab in Denver, and there was a lab in Menlo Park. But if they sent something to Denver or Menlo Park, it would take forever to get the results, whereas they could give it to Pevear, and he would do it immediately because he was enthusiastic about it. So we began looking at the tephra that was blowing out, and it was all old material that contained smectite.

**CMS:** What kind of smectite was in it?

**PEVEAR:** It was a trioctahedral smectite. A saponite. In fact, if you looked at pieces of it in the SEM, you could see it growing in vugs and fractures the way it is in deposits on the sea floor.

I had a couple of students who either had airplanes or had their pilot's licenses. I had money, so I would pay for gas, and we'd fly down to the volcano. The trip took a couple of hours, about 200 miles, so it would take us about four hours to fly down and back. We flew down there many times and flew around the volcano. The thing continued to bulge, and continued to have seismic activity getting further and further up toward surface.

Then on Sunday, May 18, it blew its top, as we all know, except I didn't really think of it right away. I was in bed, about 8:00 Sunday morning, and the first thing that I noticed was what sounded like an explosion. It was Swedish Independence Day, and there were a lot of Swedes in the area. They often set off cannons and things like that, so I thought, "Oh, those Swedes, they're up all night again." I heard two explosions, and that later be-

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*Prior to the eruption, Mount Saint Helens had unusual seismic activity... Everybody was going around saying, "What can it mean? Could it be magma? No, it's probably not magma. Well, it could be magma."*

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lot of overlap. So that meant in many instances you couldn't really discriminate.

**CMS:** You couldn't take single samples.

**PEVEAR:** A single sample would work if it was very high in sodium. It was the sodium that was important. If a sample had real high exchangeable sodium, then it was unquestionably marine.

The Mount Saint Helens ash was interesting, too. Prior to the eruption, Mount Saint Helens had unusual seismic activity. There were lots and lots of little earthquakes. They were down deep, and every day they got a little bit

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**Pevear, continued**

came a very interesting thing because nobody could account for why there were two explosions. Some people heard only one explosion. I remember that accompanying the explosion—my windows were open, it was May—and I had venetian blinds that were hanging down. The venetian blinds flew in like this. They moved as a result of the compressional wave. I noticed this, and then I went back to bed. A few minutes after that, I couldn't say how long it was, the ground shook. It was an earthquake. The small seismometer at the university made a great big peak.

Gene Witney used to change the chart paper sometimes. Then I immediately got out of bed and walked outside. Remember that Mercalli Scale, where at a certain level, everybody runs outdoors? Well, I did it. I had no control. I just went outdoors. I still didn't think it was St. Helens. It never occurred to me. I don't know if I was sleeping or what. Moments after that one of my students called up, and he said, "Dave, it's Scott. That was it." As soon as he said that, I knew. He said, "I got a plane. Let's go." So we flew right down there. Of course, it was pandemonium.

**CMS:** Oh, I'm sure.

**PEVEAR:** It was not only unbelievably spectacular to watch, but the emergency management people were just starting to get mobilized, and they didn't want any planes around there. There were lots and lots of little planes. I mean, people wanted to look. They were telling us to get out, and we were not getting out. We could hear on the radio all kinds of signals. I can remember hearing, "There goes some kids on a horse! Wait a minute, they're gone, they're gone!"

**CMS:** Oh, no kidding!

**PEVEAR:** You could see the mudflows coming down and taking the bridges out. It was real, real spectacular. And, of course, it was a small eruption.

**CMS:** By global standards, a very small eruption.

**PEVEAR:** After that, we sampled the ash, and made several trips by helicopter into the volcano within days after the major eruption. That was all really exciting. We went in with infrared sensors, looked for hot places, and sampled them. At one point we were told not to go more than 20 seconds, or something like that, away from the helicopter. We were just inside the cone, which was a breached crater by now, which had a dome. We were trying to sample some stuff from a glowing crack in the

dome, and the helicopter guy didn't really want to land us there. I was with Dave Dethier, who is from Dartmouth also. He's now, I think, at Williams or something like that, and David Frank, who is actually a member of our Society. I remember all of a sudden while we were sampling, of course we went more than 20 seconds away from the helicopter, there was a great roar. It erupted. It wasn't a great killing eruption, but just a big explosion with steam and ash. We rushed back to the helicopter, and as we rounded a little corner, there was the helicopter, disappearing. Well, he had good reason to. If they get a lot of that tephra into their air intakes, it wrecks the helicopter.

**CMS:** Did he come back?

**PEVEAR:** Oh, yeah. "Sorry boys," he said. It was strange sampling. We had special shoes and gloves because the ash flows and everything were real hot. They had crusts of all kinds of chemical precipitates and hydrothermal minerals all over them. You'd collect a piece of pumice, and pick it up with your gloves, and you'd drop it in the plastic bag, and it went right through. It was still so hot. The tephra from the May 18 eruption was full of fresh glass, which was, from our point of view, a proto-bentonite, and it had crystals, such as plagioclase. It had a few percent of clay minerals, in particular, smectite. That smectite, we concluded on the basis of study, was what we would call an accidental component; it was from the old cone. During the eruption, as the new magma was blast-

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*It wasn't a great killing eruption, but just a big explosion with steam and ash. We rushed back to the helicopter, and as we rounded a little corner, there was the helicopter, disappearing.*

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ing out, it was also picking up all this stuff. That was our best shot as to where that stuff came from, but it was present everywhere.

**CMS:** I remember you told me about this.

**PEVEAR:** Yeah, we published something in *Clays and Clay Minerals* in a paper that nobody knows about.

**CMS:** Saponite can form at really high temperatures, like 1000 degrees.

**PEVEAR:** We said that in the paper. We mentioned that it could have been of high temperature origin, but the old

*continued on next page*

**Pevear**, *continued*

deposits are full of it, and there's other things that were in the ash, too. There were little bits of chlorite, and there was a small amount of both tridymite and cristobalite, and that's what the vent rocks are full of. And, by the way, the cristobalite, or tridymite, is different than the stuff you see in bentonite. The stuff you see in bentonite is disordered, whereas the stuff you see in the volcano has much sharper peaks. It's formed by high temperature devitrification of glass. One of the things that that means is that the smectite that people find in volcanic ash soils, as was pointed out by Jeff Wilson at the meeting yesterday, is not necessarily formed there. And he credited Fio Ugolini, a guy who used to teach at the soils department at the University of Washington. I told Jeff that I was the one who pointed that out. He said he knew that. These soils people support each other. Jeff's a soil person, and Fio's a soils person. You wouldn't want to credit a geologist for this discovery.

**CMS:** What's Ugolini doing now?

**PEVEAR:** He went back to Florence, Italy, a number of years ago. Wonderful man.

**CMS:** Why did you leave Washington? Move from the back woods to Exxon?

**PEVEAR:** I left Western Washington University and went to Exxon because a couple of people at Exxon knew John Hower. He always became involved in these career manipulations. They asked, I was told by John, if he

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*There are probably a lot of different paths to take to get to mica, and they probably all go on at once, and sometimes one of them goes on more rapidly than other ones.*

---

knew a "world-class" clay mineralogist that they might be able to hire. So Hower called me up and asked me if I was interested. I said I was interested but that I didn't want to move to Houston. He said, "Well, you don't have to do it permanently; you can just take a leave of absence." So I said, "Maybe I'll do it," so I did it. I took a two-year leave of absence, and I did have an opportunity to go back, but I chose not to.

**CMS:** Was the research situation good in Houston?

**PEVEAR:** Yeah, I felt the job at Exxon was one that had

outstanding support for research. It's still real good there, and real good for me there. I'm also glad I stayed because I met Adrian in 1984, and we've been together ever since.

**CMS:** You've moved up, changed jobs, moved up through the Exxon research...

**PEVEAR:** I've had two promotions since I've been there. I have a fairly senior-type position, but it's not a management position. There was some attempt to move me into management, but I rejected it because I don't like that stuff.

**CMS:** Is Exxon sort of like the Bell Labs used to be, where you can just do interesting things?

**PEVEAR:** No. I've been for the past few years in a long-range research group where we do nearly 100% research. It was sort of that way throughout the lab when I first got there, which was during the boom of the early eighties, when all the labs were expanding and hiring people. But from '83 to maybe '87 or '88, I was mostly doing service work on reservoir quality and diagenesis-type stuff. At that time, I was responsible for maybe 15 other people in the group. That was fun, but when you're responsible for other people, you don't get your own work done. So we had a beautiful X-ray lab, and I oversaw everything that went on in it. But since about '88, I've pretty much been able to do research. Along with Craig Calvert and Bob Klimentidis, I'm sort of the clay person there. Craig actually has not been doing clay stuff lately and hasn't been so involved with the Society. He's been involved with some reservoir work up in Alaska. He's been doing real well.

**CMS:** Why are oil companies like Exxon interested in clay?

**PEVEAR:** Clay is mainly a bad actor for oil companies, although they use it for drilling mud. I'm not too much involved in that, but mostly clays plug up reservoirs. The work I've been doing there has nothing to do with that. What I've been working on is what I've always wanted to work on, and that's basically continuing John Hower's work, working with shale diagenesis. I think we've had some good results that have been very useful to Exxon. A group that I'm in is also a group that Wu-Liang Huang is in. Wu-Liang is an experimentalist, and he worked out a kinetic expression that is not dissimilar to the work that you did, Denny, some years ago, but it sort of extended it and enlarged on it. You know the paper because you reviewed it. It is in the Geothermometers issue of *Clays and Clay Minerals*. Lately I've been working on the K-Ar dating of illites and illite/smectites. Basically, oil companies are interested in the thermal history of basins. They want

**Pevear, continued**

to know how hot it was, and when. We've discovered that you can't just extrapolate present-day thermal gradients into the past. Sometimes you can, but many times you can't.

**CMS:** What about the Gulf Coast? The temperatures you measure now, are they similar to those in the past?

**PEVEAR:** Well, I think in the Gulf Coast, which is a continuously subsiding basin, the thermal anomaly that occurred in that basin was during rifting, and that was in Jurassic time. By the Eocene or Paleocene, when the Case Western Reserve University rocks were deposited, that anomaly had decayed away. You know, a rift basin opens up, gets real hot, the crust thins. The sediments deposited then are in a very different thermal regime, that is a very different thermal gradient, than rocks which are deposited much later, after the rift basin is starting to fill up. The anomaly that is created by, say, Jurassic rifting that opened up the Gulf of Mexico, is long since decayed away, and that means that the geothermal gradients today and the ones 15-20 million years ago are probably very similar.

**CMS:** Let me ask you a more general question. The Hower paradigm is one of continual reaction with continual transformation of smectite to illite. What's your overall feeling about the process?

**PEVEAR:** I think that smectite reacts all the way to 2M mica. As Fritz Lippmann pointed out long ago, muscovite is the most stable. There are probably a lot of different paths to take to get to mica, and they probably all go on at once, and sometimes one of them goes on more rapidly than other ones. By pathways I mean transformation or neoformation or recrystallization or Ostwald ripening. All these processes are building mica. They're building muscovite. I don't believe that the single kinetic expression that's in our paper is necessarily an expression of reality as far as a shale is concerned. It is an expression of experimental results. What we've seen so far in trying to calibrate it in places where we think we know the thermal histories, it appears to work reasonably well.



*Dave Pevear and John Hower, Hawaii 1981.*

*P. Hauff*

**CMS:** I wonder though, with so many variables in the equation, such as the potassium concentration and the thermal gradient, if you couldn't fit almost anything.

**PEVEAR:** You're right, Denny; we need to worry about uniqueness.

**CMS:** Also, there are episodic fluctuations. If you factor in Elliot and Aronson's paper on the Appalachian Orogeny, there are major changes through time.

**PEVEAR:** My own feeling is I think the jury's still out. For example, the so-called Allegheny Orogeny. It's also possible to transform bentonite

into illite using ordinary kinetics. How did all the illite form in the Illinois Basin? It doesn't take a lot of heat if you have warmish conditions and enough potassium. The reaction's very slow, but it does go.

**CMS:** But if it were kinetically controlled, why would Elliot and Aronson see the same radiometric ages through the entire Appalachian basin?

**PEVEAR:** They don't. They're not all the same.

**CMS:** There's almost no variation.

**PEVEAR:** Okay, but you've got a whole lot of rock that's never been heated much, and it's all about the same depositional age.

**CMS:** But just parts of the rock that have been heated a great deal. The deeper parts of the basin and the distal parts of the basin have been heated much less, and yet they show the same proportion of illite layers and the same radiometric ages. There's no systematic variation.

**PEVEAR:** Well, the ages are not the same, for one thing. I'm just trying to be a devil's advocate. I think that their explanation is perfectly reasonable, and if I were going to take their data and write a paper, that's probably what I'd say. All I'm saying is that I guess if you extract a potassium argon date from some kind of sedimentary rock, the

*continued on next page*

**Pevear, *continued***

date is always a singular number, but it may not be a singular event that gave rise to that. It may be an average, integrated age that represents slow additions of potassium to the system and to diagenesis, and then decay of potassium to argon over a longer period of time, or a shorter period of time, or an intermediate period of time. I think that you have to be careful about interpreting those ages as events. But that doesn't mean that they're not events; it's just that it's tempting to get an age and say it matches up with something. It's just like sequence stratigraphy. You can always find some sort of sea level change somewhere that seems to match up with some sort of bump on your log.

**CMS:** So what you're doing now is working up a thermal history of the basin using potassium argon dating?

**PEVEAR:** You can predict the potassium argon date that you should get from newly-formed illite on the basis of kinetics. The kinetics are embedded in the program that includes thermal history, changes in thermogradient and time, compaction, changes in conduction, thermal conductivity of the rocks with time as they compact, unconformities and uplifts, fission track kinetic expressions, vitrinite. You try to find a consistent thermal model that will fit all of those data. And they do a few things. For example, illite dates the burial phase; vitrinite gives the maximum temperature; and fission tracks date the uplift history of the basin. So together those techniques make a nice group for constraining the history of the basin. We're interested in it because that same thermal history that's recorded in these paleothermometers is also responsible for maturing the source rocks and making oil. Before we drill, we want to make sure our oil forms after the trap.

**CMS:** Do you want to throw in something else on the dating?

**PEVEAR:** One other thing we might throw in there about the dating is that I've also been dating fault gouge, something your friend Martin Kralik does, and I'm having very exciting results. These are from thrusts in the Canadian Rockies.

**CMS:** And they're giving the ages of the thrust faults?

**PEVEAR:** Yes.

**CMS:** That is exciting. Can you separate different faults?

**PEVEAR:** Yes.

**CMS:** You're dating illites in faults?

**PEVEAR:** Yes. Actually, the illite in the faults is amazing, very disordered, probably mostly from just being very fine grained size. The illites appear to have either grown in the fault gouge or to have been reset by the process. Maybe they're old illites, but in the process of being sheared, and all those maybe 001 planes bumping over each other and gliding around and everything, they are going to lose argon and get reset.

**CMS:** What is the texture? Does it look like it's been sheared?

**PEVEAR:** Yeah, basically.

**CMS:** Do you think there was hydrothermal alteration at the time of the thrusting?

**PEVEAR:** No, there's no evidence for high temperatures, although there's a little bit of conflicting information. And maybe as a closing thing, don't you wish that John Hower were alive today?

**CMS:** Oh, yeah.

**PEVEAR:** Sometimes I think, gee, I wonder what would John say about that? And then some other times I think, gee, he'd probably chew that to pieces.

**CMS:** Ed Perry, too.

**PEVEAR:** Ed Perry also. But we have to watch out. I'm waiting for all of us now to have our tragic ends. We all get to have a tragic end. Although I already figured out that I'm probably going to go like Mama Cass, choking on a ham sandwich.

**CMS:** You think these things go on forever, but when it's over you realize that it couldn't have gone on forever. Like coming to the meeting every year.

**PEVEAR:** You do get old, you get tired, you get feeble and your body falls apart. In fact, remember when you were a kid and nothing ever hurt you? Particularly, you never had what's known as aches and pains, but now I have things like joints that are stiff and my neck sort of hurts, and every now and then I'll be doing some trivial thing like taking out the garbage, and then my back hurts for a week. I guess our feet really are made of clay after all.

*President's Remarks***The Butterfly Effect**

*The following are the President's remarks given at the CMS Annual Meeting in Saskatoon.*

Now is the time in the program when those of us who are not President (most of us) can go out and have a cup of coffee, whereas those of us who are President need to say something presidential.

First of all, I should like to thank Ahmet Mermut and the organizing committee for inviting us to this wonderful city for what promises to be a fine meeting, and for the hard work they have put into this event. We thank the University of Saskatchewan, with its lovely campus and its deep, quiet atmosphere. There are many in the CMS to thank, and those who come to mind are Ray Ferrell, our journal editor, Jeff Walker, who edits our workshop volumes, Kathy Nagy and Alex Blum for organizing the workshop, our Sustaining Members, and, of course, Jo Eberl, the mother of the Society, who puts

it all together and makes the Society work.

With all this energy and devotion going into The Clay Minerals Society, an outsider might wonder why we should be doing this. Why study clays in the first place? And the president's answer to this question is, I don't know why we should study clays. Let's study clays to find out why we should be studying them. It is the only way to find out why. There are many beautiful, fundamental, and useful discoveries yet to be made.

The Society seems to be healthy and growing. Our membership has topped 1000, and our endowment, thanks to Ken Towe, is greater than one million dollars (US). It is no longer a U.S. society, but is international; a third of our members are non-U.S., as are a majority of our journal subscribers and journal article authors.

Yet our society is still a small society. Compared with other scientific societies that may have tens of thousands of members (ACS, GSA, SSSA), we are like a butterfly among eagles.

But even a butterfly can be influential. We know from chaos theory that some systems such as the weather are very sensitive to initial conditions, that a butterfly beating its wings in Brazil can affect a whirlwind over Saskatchewan. As an example of this, Bob Reynolds said that one of President Bush's scientific advisors, Chuck Drake, gave Bush a copy of our newsletter to read. It is said that Bush even used a Clay Doctor joke in one of speeches, and that is what cost him the election: the Butterfly Effect.

So if our Society continues to work in its modest way to promote clay research, to encourage and help students and disadvantaged scientists, to continue to publish a good journal and little gems such as workshop volumes, why, who knows what whirlwind might result from the flight of this butterfly?

*D. D. Eberl  
Boulder, Colorado*

**Baltimore**, *continued from page 1*

attend, please send in your forms as soon as possible. An extra information sheet is printed on page 20.

The meeting will be held from June 4-8, 1995, beginning with a pre-meeting workshop on June 3, *Reactions of Organic Pollutants with Clays*, convened by B. L. Sawhney. The technical program includes the following symposia: *Clays, Surfaces, and the Environment*, convened by Alan Stone; *One Hundred Years of X-rays*, convened by Dewey Moore; *The Source Clays Program: History and Future*, convened by Patricia

Costanzo and Jessica Elzea; and *Industrial Minerals*, convened by William Moll. The field trip, led by Martin Rabenhorst, is *Clay Minerals in Soil-Geologic Columns of the Piedmont and Inner Coastal Plain*. Besides the Ice-Breaker Reception, the Student Reception, and the Banquet, there will be an evening social event at the Baltimore Aquarium.

Although the official deadline for abstracts was February 1, abstracts can be submitted later than that date and will be considered, if space allows.

For more information, contact D. S. Fanning (General Chair), Dept. of Agronomy, Room 1112, H.J. Patterson Hall, University of Maryland, College Park, MD 20742, USA. tel: 301-405-1344, fax: 301-314-9041, e-mail: df3@umail.umd.edu; or V. Colten-Bradley (Technical Chair), U.S. Nuclear Regulatory Commission, MS T7D13, 11545 Rockville Pike, Rockville, MD 20852, USA. tel: 301-415-6616, fax: 301-415-5399, e-mail: vcb@nrc.gov.

## CMS ANNUAL MEETING, BALTIMORE, JUNE 1995 INFORMATION AND RESPONSE FORM

***PLEASE RETURN AS SOON AS POSSIBLE  
IF YOU HAVE NOT ALREADY DONE SO***

Registration and hotel information will be sent only to those who have expressed an interest in attending. If you are interested in receiving further information about the meeting, please express your interest in attending the meeting by filling out the following and returning it as soon as possible to:

Clay Minerals '95  
c/o Dr. D. S. Fanning  
Department of Agronomy  
Room 1112, H. J. Patterson Hall  
University of Maryland  
College Park, MD 20742 USA

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Organization \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_ E-mail \_\_\_\_\_

\_\_\_\_\_ I am interested in giving a paper in the following session: \_\_\_\_\_

\_\_\_\_\_ I am interested in giving a poster presentation.

\_\_\_\_\_ I am interested in attending the workshop.

\_\_\_\_\_ I am interested in attending the field trip.

\_\_\_\_\_ I will bring an accompanying person(s).

\_\_\_\_\_ I am interested in attending the Evening at the Aquarium.

\_\_\_\_\_ I am willing to help judge student papers.

# Diagenesis, overpressure and reservoir quality

## A special issue of *Clay Minerals* available in late 1994

The interplay of overpressure and diagenesis is an important factor in developing reservoir quality and controlling the movement of pore fluids and hydrocarbons within sedimentary basins. A special issue of *Clay Minerals* has been devoted entirely to 20 papers presented at a conference on 'diagenesis, overpressure and reservoir quality' held at the University of Cambridge in March 1993. This conference was the fifth in a series of meetings at the University of Cambridge on the general theme of clay minerals and petroleum exploration, and was organised by the Clay Minerals Group under the auspices of the Mineralogical Society of Great Britain, the London Petrophysical Society and the Geological Society of London.

The issue is available at a cost of US \$40 per copy from the Mineralogical Society office, 41 Queen's Gate, London SW7 5HR, UK.

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#### EDITORIAL

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- P. L. HALL. Physical and chemical aspects of the development of overpressuring in sedimentary environments
- L. WENSAAS, H. F. SHAW, K. GIBBONS, P. AAGAARD, and H. DYPVIC. Nature and causes of overpressuring in mudrocks of the Gullfaks Area, North Sea
- T. J. KATSUBE and M. A. WILLIAMSON. Effects of diagenesis on shale nano-pore structure and implications for sealing capacity
- R. E. SWARBRICK. Reservoir diagenesis and hydrocarbon migration under hydrostatic palaeopressure conditions
- M. RAMM and K. BJØRLYKKE. Porosity/depth trends in reservoir sandstones; assessing the quantitative effects of varying pore-pressure, temperature history and mineralogy, Norwegian Shelf data
- C. A. CADE, I. J. EVANS and S. L. BRYANT. Analysis of permeability controls: a new approach
- P. DE CARITAT, J. D. BLOCH, I. E. HUTCHEON, and F. J. LONGSTAFFE. Compositional trends of a Cretaceous foreland basin shale (Belle Fourche Formation, Western Canada Sedimentary Basin): diagenetic and depositional controls
- H. LINDGREEN. Ammonium fixation during illite-smectite diagenesis in Upper Jurassic shale, North Sea
- J. S. SMALL. Fluid composition, mineralogy and morphological changes associated with the smectite-to-illite reaction: an experimental investigation of the effect of organic acid anions
- K. ZIEGLER, B. W. SELLWOOD, and A. E. FALLICK. Radiogenic and stable isotope evidence for age and origin of authigenic illites in the Rotliegend, southern North Sea
- M. WILKINSON, A. E. FALLICK, G. M. J. KEANEY, R. S. HASZELDINE and W. J. MCHARDY. Stable isotopes in illite: the case for meteoric water flushing within the Upper Jurassic Fulmar Formation sandstones, UK North Sea
- C. V. JEANS, J. G. MITCHELL, M. SCHERER and M. J. FISHER. Origin of the Permo-Triassic clay mica assemblage
- M. OSBORNE, R. S. HASZELDINE and A. E. FALLICK. Variation in kaolinite morphology with growth temperature in isotopically mixed pore-fluids, Brent Group, UK North Sea
- G. E. MCAULAY, S. D. BURLEY, A. E. FALLICK and N. J. KUSZNIR. Palaeohydrodynamic fluid flow regimes during diagenesis of the Brent Group in the Hutton-NW Hutton reservoirs: constraints from oxygen isotope studies of authigenic kaolin and flexural modelling
- R. N. T. STEWART, A. E. FALLICK, and R. S. HASZELDINE. Kaolinite growth during pore-water mixing: isotopic data from Palaeocene sands, North Sea, UK
- P. J. GREENWOOD, H. F. SHAW, and A. E. FALLICK. Petrographic and isotopic evidence for diagenetic processes in Middle Jurassic sandstones and mudrocks from the Brae Area, North Sea
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- S. HILLIER. Pore-lining chlorites in siliciclastic reservoir sandstones: electron microprobe, SEM and XRD data, and implications for their origin
- B. HUMPHREYS, S. J. KEMP, G. K. LOTT, BERMANTO, D. A. DHARMAYANTI and I. SAMSORI. Origin of grain coating chlorite by smectite transformation: an example from Miocene sandstones, North Sumatra back-arc basin, Indonesia
- J. M. HUGGETT. Diagenesis of mudrocks and concretions from the London Clay Formation in the London Basin

## Education

The Society Office often receives requests for teaching materials, such as syllabi, lab exercises, course contents, textbooks, bibliographies, and so on. Those who use such materials are encouraged to let the Office know, so your suggestions can be passed on to others. Below are two examples, a lab manual from Joe Dixon and Norm White, and a bibliography from Joe White.

### ***Mineralogy Laboratory Manual by J. B. Dixon and G. N. White now available***

We have revised the manual and produced the 1995 version that we plan to use next Fall term. We are making it available on a cost of duplicating basis for those of you who may want to use it in the Spring term or later. This manual is the one that many of you examined at the Agromomy meetings in Seattle in 1994. It is more than 139 pages, spiral bound so that you can add or delete pages to meet your own class schedule. Dr. White and I have developed this manual over the years of teaching soil mineralogy to a variety of students (engineers, geologists, soil scientists), employing many types of samples.

To obtain a copy, call Copy Corner, (409-693-0640) or fax (409-693-1367). Michael Kubelka, Manager, advised that he would ship copies on receiving payment of about \$8.00 plus shipping and handling. The total cost would be about \$12.00 when only one copy is ordered. A credit card purchase may be the simplest way. Copy Corner is a local firm, and it is the only duplicating firm we found that would ship copies that normally sell over the counter.

I will be pleased to learn of your experience with the manual and how we may improve it in future years. I believe that you will find that combining your ideas with those in this manual will result in a strong course in soil mineralogy. Perhaps just as important to you will be the time you will save by having a lab book for the whole term where every student can have a copy at a reasonable cost.

*Joe Dixon*

*College Station, Texas*

### ***Joe White's List of Books on Historical and Philosophical Developments***

*Following is a list of publications dealing with historical aspects of chemistry, X-ray diffraction analysis, and clay research in Great Britain, which Joe White mentioned while presenting the 1994 Pioneer in Clay Sciences Lecture.*

#### **Historical and Philosophical Developments in Physical Chemistry, X-ray Diffraction, and Geochemistry**

- "Physical Chemistry from Ostwald to Pauling: The Making of a Science in America," John W. Servos, 1990, Princeton University Press, 41 William Street, Princeton, NJ 08540, USA. ISBN 0-691-08566-8.
- "The Development of X-ray Analysis, Sir Lawrence Bragg," Edited by D. C. Phillips, and H. Lipson, 1992 (an unabridged and corrected republication of the edition first published by G. Bell and Sons, Ltd., London, in 1975), Dover Publications, Inc., 31 East 2nd Street, Mineola, NY 11501, USA. ISBN 0-486-67316-2.
- "Selections and Reflections: The Legacy of Sir William Bragg," Edited by J. M. Thomas and D. C. Phillips, 1990, Royal Institution of Great Britain, Published by Science Reviews Ltd., 40 The Fairway, Northwood, Middlesex HA6 3DY, UK. ISBN 0-905927-43-5.
- "Victor Moritz Goldschmidt: Father of Modern Geochemistry," Brian Mason, 1992, The Geochemical Society, Division of Sciences, Mathematics and Engineering, Trinity University, 715 Stadium Drive, San Antonio, TX 78212, USA. ISBN 0-941809-03-X.

#### **Historical and Philosophical Developments in Clay Research and Technology in Great Britain**

- "Fuller's Earth: A History of Calcium Montmorillonite," Robert H. S. Robertson, 1986, Mineralogical Society Occasional Publication, Volturna Press, Hythe, Kent, UK. ISBN 0-85606-070-4. (Order from Robert H. S. Robertson, The Resource Use Institute, Ltd. Dunmore, Pitlochry, PH16 5ED, Scotland).
- "History of Clay Research in Great Britain," Robert H. S. Robertson, Clay Minerals Group Occasional Paper, 1989, The Mineralogical Society, 41 Queen's Gate, London SW7 5HR, UK.

## Ask the Clay Doctor

(Not a real doctor)

**Dear Clay Doctor:** The poet William Blake wrote that one can see the world in a grain of sand. What can one see in a fundamental particle of clay?

A Material Girl, Aberdeen

**Dear Material Girl:** A particle of clay is much smaller than is a grain of sand, and therefore one can see in it only about as far as Cleveland.

**Dear Clay Doctor:** What kind of clay is found on the Lunar surface?

Spaced in Strasbourg

**Dear Spaced:** Moonmorillonite.

**Dear Clay Doctor:** Is clay mineralogy a Newtonian science?

Rush, Fat City

**Dear Rush:** The Newtonians believe that for every action there is a reaction, and therefore are known to be reactionaries. Newtonians already are investigating the phyllosilicate clintonite. They study how it reacts to grinding and pulverization, and are extremely interested in learning about activity between its sheets. Therefore, the Newtonians may also be interested in supporting clay science. In basic research, for example, scientists could search for clays deposited by the Flood, or discover the type of clay from which Adam was fashioned. In applied research, many high-quality clay deposits will have to be found to make the bricks required to build strong prison walls and orphanages. In short, I look forward to a bright and prosperous future for clay science under the Newtonians.

**Dear Clay Doctor:** Among the many changes taking place around us is the increasing use of acronyms in ordinary communication. Has this trend affected clay science?

Verbose, Vincennes

**Dear Verbose:** Oh, indeed it has. In fact, clay science was one of the earliest disciplines to routinely employ acronyms. We are accustomed, for example, to the use of TOT for 2:1 layer structures, and NEWMOD for some sort of computer program. But it might interest you to know that 8th century Ethiopic agrarians used BURP

(bentonitic underclay with random polytypes), BELCH (bilayer equilibrium in chloro-hydroxides), and BLOB (back-loaded oriented ballclay) on a daily basis. Persian contemporaries frequently referred to PHISH (phlogopite in situ hybridization) and CHIPS (chlorite interlayer proton stabilization). Early Bavarian scientists anticipated the discovery of radiation when they observed SCREECH (strip-chart recorded electron emission by cathode heating) and GASP (Geiger activated sensory photoelectrons). Simultaneously, Sicilian geophysicists proclaimed to the world the discovery of PIZZA (pressure-induced zero zeta authigenesis). Later, Sumerian scientists scribbled SCUD (smectite collapse under diagenesis), KLUTZ (K-line undulation in tritiated zeolite); and DOODAD (direct octahedral occupancy during allophane dilatancy) in their lab notebooks. A brilliant but obscure Ukrainian was the first to record THUD (trioctahedral homogeneity in untreated dickite) in the 1870's. And most recently, Russian, Polish, and American scientists have collaborated to coin the use of MOM in the clay vocabulary. It, of course, represents one of the most vocal groups to make headlines during the great smectite embargo of the late 80's, Mothers Out of Montmorillonite. For more information, circle 232 on reader service card.

**Dear Clay Doctor:** Does any of our clay-mineralogy wisdom-jargon classify as an "intellectual construct?" Gabor B. Levy, *American Laboratory*, May 1994, Editors Page, gave an example of "Intellectual construct" in his article "Fuzzy is logical." "Even if all the solutes were removed (from pure water) you will still have 1/10 ppm hydrogen ions and the same amount of hydroxyl ions at room temperature. H<sub>2</sub>O is a fiction—an intellectual construct." Is "kaolinite, H<sub>4</sub>Al<sub>2</sub>Si<sub>2</sub>O<sub>9</sub>" a construct for the intellectuals, thus leaving "kaolin" for the mud daubers?

Fuzzy Thinker, Columbia

**Dear Fuzzy:** You are correct in writing that "kaolinite" is an intellectual construct. Kaolinite is found in "kaolin" (another intellectual construct). Kaolin is a "rock," and this rock is a "clay." However this term ends, the intellectual constructs. Thereafter it is "clay" all the way to the bottom.

**Dear Clay Doctor:** What does a clay mineralogist eat for lunch?

Hungry Man in Houston

**Dear Hungry:** Lattice and tomato.

*The Clay Doctor is available for consultation. Please send contributions to the Society Office.*

## Feats of Clay

**Victor A. Drits** has recently been named an Honorary Member of the Mineralogical Society, an honor reserved for only 20 living mineralogists. Other notable people who have been elected to this honor include **S. W. Bailey**, **Linus Pauling**, **Ralph Grim**, **George Brindley**, and **Paul Kerr**.

New babies have arrived in the homes of **Jessica Elzea**, **Jill Banfield**, **Jay Matthews**, **Pete Ryan**, **Alex Blum**, and **Paul Nadeau**.

**Joe Stucki** and **Sridhar Komarneni** have been named Fellows of the SSSA, an honor which is extended to up to only 0.3 percent of its active members.

**Fred Longstaffe** is currently President of the Geological Association of Canada, Canadian Member and Earth Sciences Representative

for the NATO Advisory Panel on Advanced Study Institutes, Member (Group Chair for Earth Sciences) of the Natural Sciences and Engineering Research Council of Canada Committee on Research Grants, and Chair of the Department of Earth Sciences at the University of Western Ontario. In his words, "Sounds like I'm looking for a job as chief bureaucrat of the Universe."

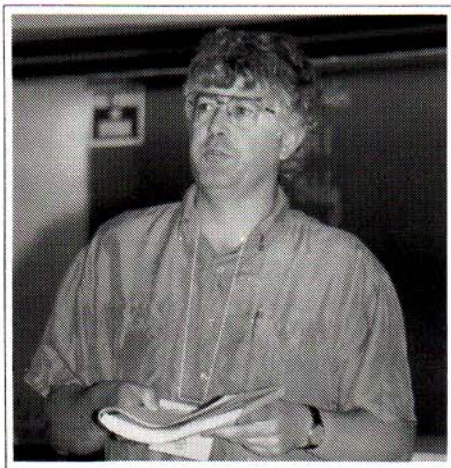
**Sridhar Komarneni** recently gave invited talks in Irsee Germany, Lausanne, Switzerland, Madras and Bombay, India, Sapporo, Japan, and Tokyo, Japan, and **Colin Harvey** has just returned from a fascinating trip to Thailand, and North and South Viet Nam.

The results of the 1994 elections are as follows: Vice-President Elect: **Stephen Guggenheim**; Treasurer: **Herman E. Roberson**; Councilors: **Eric V. Eslinger**, **Murray B. McBride**, **David R. Veblen**, **Lucian W. Zelazny**.



*Victor Drits and Bull Bailey, two Honorary Members of the Mineralogical Society, San Diego 1993.*

*Jo Eberl*



*Fred Longstaffe in Saskatoon, 1994. High Iron Photos*

Plenary speakers at the Baltimore meeting will be **W. D. Johns**—Distinguished Member, **Gerhard Lagaly**—Brindley Lecturer, **David L. Bish**—Jackson Lecturer, and **Rustum Roy**—Pioneer Lecturer.

Student awards at the meeting were as follows: Best Paper: **W. Dubbin**, student of **Tee Bon Goh**, University of Manitoba; Best Paper Runner-up: **B. T. Sheldon**, University of Tennessee-Knoxville; Best Poster: **E. Padmanabhan**, student of **Ahmet Mermut**, University of Saskatoon, and **Fredieric Vitali**, Centre de Geochemie de la Surface at Strasbourg; Best Poster Runner-up: **C. N. Rhodes**, Leeds Metropolitan University.



*Student Award Winners at Saskatoon: Bill Dubbin, Eswaran Padmanabhan, Chris Rhodes, Frederic Vitali. Absent: Brian Sheldon.*

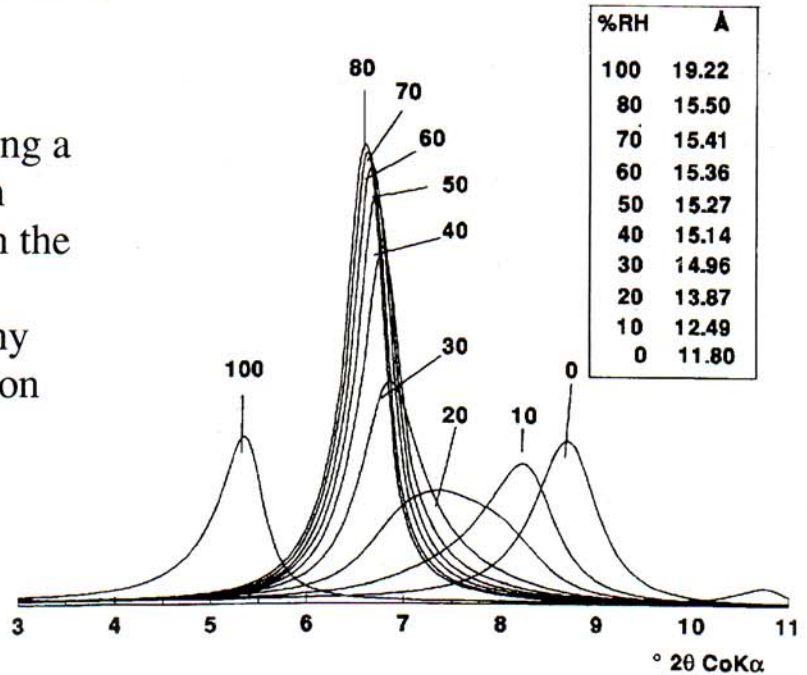
*High Iron Photos*

**The Clay Minerals Society notes with sadness the deaths of Chris Fanning, Max Lipsicas, and Linus Pauling. A memorial to Dr. Pauling will be included in a later issue of the newsletter.**



At what relative humidity did you measure your samples yesterday? XRD systems improve drastically these days; they control all parameters except the conditions in the specimen chamber. This is especially a problem for humidity sensitive materials such as clay minerals, zeolites, hygroscopic salts, etc.

This problem can be solved by using a Relative Humidity Generator from GAVA. With this system the RH in the specimen chamber can be kept constant during measurement at any RH - value, best for your application



Specifications:

- \* - applied gas: air, N<sub>2</sub>, O<sub>2</sub>, He
- \* - RH-range : 0-90% (lowest obtainable value depends on the dryness of the applied gas)
- \* - accuracy: ± 1.5%

Systems:

- A 0 - 10 l/min., specimen chambers
- B 10- 100l/min, combinations of specimen chamber and specimen changer
- C special applications, e.g. any chamber in which samples are measured, weighed and stored

For additional information, contact:

GAVA Scientific Instruments  
 Wagenmakerstraat 11  
 1791 EJ Den Burg - Texel - The Netherlands  
 31(0)2220 69398 fax: 31(0)2220 10244

## Meeting Calendar

**April 23-26, 1995, El Paso, Texas: 31st Forum on the Geology of Industrial Minerals.** Technical sessions with both pre- and post-meeting field trips on both sides of the border. Contact: Gretchen Hoffman, Registration Chair, New Mexico Bureau of Mines and Mineral Resources, Campus Station, Socorro, NM 87801. Tel: 505-835-5640; fax: 505-835-6333; E-mail: gretchen@gis.nmt.edu.

**May 24-26, 1995, University Park, Pennsylvania: Fifth Annual Goldschmidt Conference.** Contact: Michael McKibben, Technical Program Chair, Department of Earth Sciences, 1456 Geology Bldg., University of California/Riverside, Riverside, CA 92521. Tel: 909-787-3444; fax: 909-787-4324; E-mail: MCKIBBEN@UCRAC1.UCR.EDU

**May 29-June 2, Baltimore, Maryland: AGU Meeting.** Contact: AGU, 2000 Florida Ave. N.W., Washington, D.C. 20009. Tel: 202-462-6900; fax: 202-328-0566.

**June 3-8, 1995, Baltimore, MD: The Clay Minerals Society Annual Meeting.** Symposia: Clays, Surfaces, and the Environment; One Hundred Years of X-rays; The Source Clays Project, History and Future; Industrial Applications of Clay Minerals. Contact: Del Fanning, Dept. of Agronomy, U. of Maryland, College Park, MD 20742. Tel: 301-405-1344.

**June, 1995, Newtown Square, PA: The ICDD X-ray Clinics.** The ICDD Clinic on X-ray Powder Diffraction will be held in two week-long sessions as follows: Fundamentals of X-ray Powder Diffraction - June 5-9, and Advanced Methods in X-ray Powder Diffraction - June 12-16. The ICDD Clinic on X-ray Fluorescence Spectrometry will also be held in two week-long sessions as follows: Fundamentals of X-ray Fluorescence - June 19-23, Advanced Methods in X-ray Fluorescence - June 26-30. Contact: Theresa Maguire, International Centre for Diffraction Data, 12 Campus Blvd., Newtown Square, PA 19073-3273. Phone: 610-325-9814; fax: 610-325-9823; e-mail: Maguire@ICDD.COM

**June 28-29, 1995, Newcastle-on-Tyne, UK: Organic-Minerals Interactions in Soils and Sediments.** Contact: Andrew Aplin, Fossil Fuels and Environmental Geochemistry Post-graduate Institute: NRG, Drummond Bldg, Univ. of Newcastle, Newcastle upon Tyne, NE1 7RU, United Kingdom. Tel: 091-272-6426; fax: 091-216-1182; E-mail: A.C.Aplin@ncl.ac.uk

**July 3-7, 1995, St. Petersburg: Important Mining and Mineral Museums of the World.** Contact: Stanley J. Dyl II, Seaman Mineral Museum, Michigan Tech. Univ., 1400 Townsend Dr., Houghton, MI 49931-1295 USA; e-mail: jaszczak@phy.mtu.edu

**August 6-11, 1995 Lund, Sweden: 16th European Crystallographic Meeting.** Contact: A. Oskarsson, Dept. of Inorganic Chemistry, 1, Chemical Center, Lund University, P.O. Box 124, S-221 00 Lund, Sweden.

**August 13-28, 1995, Vladivostok, Russia: 8th International Symposium on Water-Rock Interaction.** Numerous topics; field trips to Baikal Lake and Kamchatka Peninsula. Contact: Dr. Oleg Chudaev, Secretary General WRI-8, Far East Geological Institute, 690022 Vladivostok, Russia. Phone: 7-4232-317567; int'l fax: 7-50985-12430; domestic fax: 4232-317840; e-mail: fegi@visenet.iasnet.com

**August 19-25, 1995, Leuven, Belgium. European Clay Groups Association - Euroclay '95.** Contact: Prof. P. Grobert, Secretary Euroclay '95, Centrum voor Oppervlaktechemie EN Katalyse, KU Leuven, K Mercierlaan 92, B-3001 Heverlee, Belgium. Tel: (32) 16 220931; fax: (32) 16 295126.

**October 1995, St. Petersburg: International Symposium on the History of Mineralogy, Mineralogical Museums, Gemology, Crystal Chemistry, and Classification of Minerals.** Contact: Prof. Vladimir G. Krivovichev, Fac. of Geology, St. Petersburg Univ., Universitetskaya Emb., 7/9, St. Petersburg 199034, Russia; phone: 812-218-94-81; fax: 812-218-13-46; e-mail: Anna@dean.geol.lgu.spb.su

**October 1-4, 1995, Dallas, Texas: Society of Petroleum Engineers.** Box 83386, Richardson, TX. Tel: 214-952-9393. Fax: 214-952-9435.

**November 6-9, 1995, New Orleans, Louisiana: Geological Society of America, Mineralogical Society of America.** GSA, PO Box 9140, Boulder, CO 80301. Tel: 303-447-2020.

**June 15-20, 1996, Gatlinburg, Tennessee: The Clay Minerals Society Annual Meeting.** Contact: S. Y. Lee, Environmental Sciences Division, Oak Ridge National Laboratory, P.O. Box 2008, Bldg. 1505, MS-6038, Oak Ridge, TN 37831-6038, USA. Tel: 615-574-6316; fax: 615-576-8646; e-mail: syl@ornl.gov

**August 4-14, 1996, Beijing, China: 30th International Geological Congress.** Abstract deadline: Nov. 1, 1995. Contact: Prof. Zhao Xun, Deputy Secy. General, 30th I.G.C., P.O. Box 823, Beijing 100037, P.R. China. Tel: 86-1-8327772. Fax: 86-1-8328928.

**October 6-9, 1996, Denver, Colorado: Society of Petroleum Engineers.** Box 83386, Richardson, TX. Tel: 214-952-9393. Fax: 214-952-9435.

**October 28-31, 1996, Denver, Colorado: Geological Society of America, Mineralogical Society of America.** GSA, PO Box 9140, Boulder, CO 80301. Tel: 303-447-2020.

**June 15-June 21, 1997, Ottawa, Ontario, Canada - Joint AIPEA/CMS Meeting.** Contact: Jeanne B. Percival, Geological Survey of Canada, 601 Booth St., Ottawa, ON K1A 0E8, Canada.

**October 5-8, 1997, San Antonio, Texas: Society of Petroleum Engineers.** Box 83386, Richardson, TX. Tel: 214-952-9393. Fax: 214-952-9435.

**October 20-23, 1997, Salt Lake City, Utah: Geological Society of America, Mineralogical Society of America.** GSA, PO Box 9140, Boulder, CO 80301. Tel: 303-447-2020.

### Positions Available

**Senior Scientist, Clay Applications,** for an international leader in specialty clay technologies, which is expanding their R & D activities. The successful candidate will supervise a small group of people who will work in clay surface modification and colloid science to create new products for new applications.

**Vice President and General Manager** of a Fortune 500 manufacturer of specialty chemicals and minerals. Responsibilities too numerous to mention in this limited space. For both positions, contact Bob Shanley at 713-680-9132.

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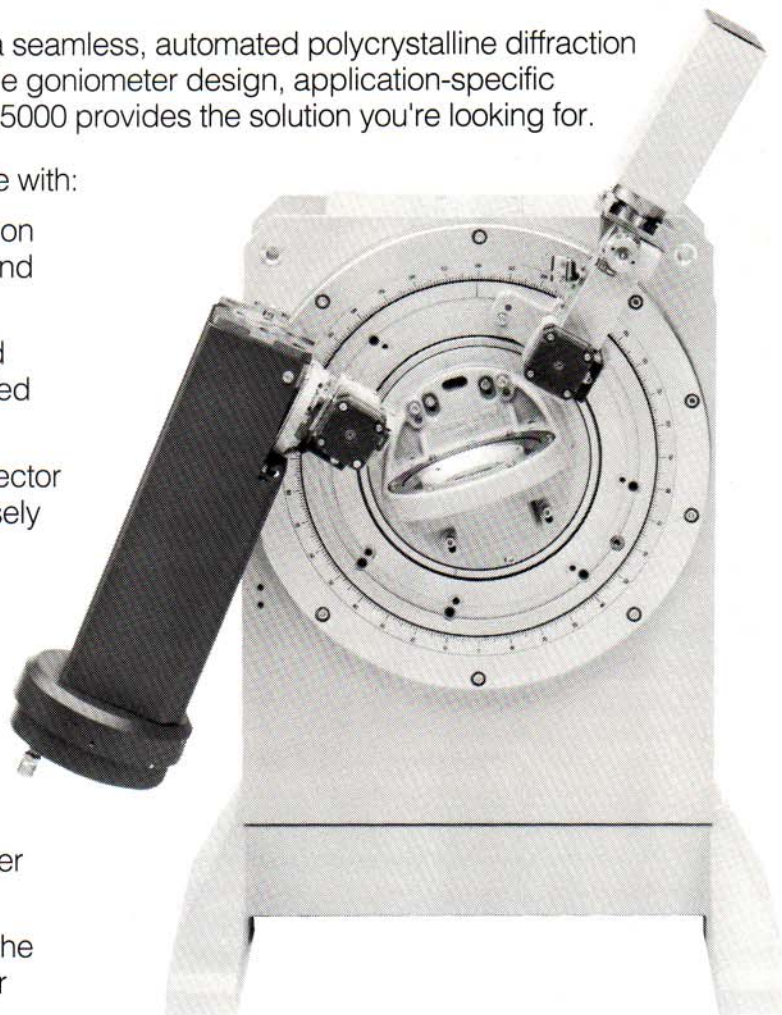
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Saskatoon, *continued from page 1*

shop Lecture Series, now available from the CMS office. There were exhibits by Digital Instruments, Parke Scientific, and TopoMetric of their latest equipment. I was especially impressed when Kevin Kjoller, from Digital, ripped a corner off a magazine page and stuck it in his SPM—within a moment we were looking at an array of hexagonal kaolinite crystals coating the paper!

The technical program was competently chaired by P. M. Huang, K. Kodama, and A. R. Mermut, and included symposia on: Smectites, Isotope Geochemistry, Fundamental Properties, Environment, and Geotechni-



Steve Guggenheim, flanked by the donors, holds the certificate commemorating his Marion L. and Chrystie M. Jackson Mid-Career Clay Scientist Award lecture in Saskatoon. S. W. Bailey, left, made the introduction to the lecture. *High Iron Photos*



R. C. Reynolds, Jr., presents the George W. Brindley Lecture at CMS '94, Saskatoon.

*High Iron Photos*

cal Engineering. The Plenary Session was held in Convocation Hall, a gem of an old building with a great vaulted ceiling, and the perfect place for Steve Guggenheim to give his Jackson Mid-Career Lecture on Oxidation and Dehydroxylation of Chlorite. Steve—it's half over! Bob Reynolds' Brindley Lecture on XRD and Disorder in 2:1 Clays was elegantly constructed and delivered on a subject that was a favorite of George Brindley's. It also showed the capabilities of his new Wildfire program. Joe White's Pioneer Lecture gave a fascinating and entertaining historical perspective on his life and work.

Talks were in two concurrent sessions, conveniently located in adjacent rooms; posters were up for the entire week, giving ample time to peruse many excellent displays. My favorite was Chip Malcolm's on the nature of illite in Georgia kaolins—it's

all detrital. In the Smectite Symposium, Victor Drits and co-workers presented their extensive crystal chemistry work—especially interesting was the variation in dehydroxylation behavior between cis- and trans-vacant structures. Successful developments in molecular dynamic



Jill Banfield.

*High Iron Photos*

and Monte Carlo computer modeling of the hydration behavior of smectites was described by N. Skipper. It appears likely that computational chemistry tools will be increasingly important in predicting behavior of the clay-water system.

The Isotope Symposium was diverse, with experimental and field studies of K-Ar and Rb-Sr dating, and O, H, and N stable isotopes. Roxane Fagan and Fred Longstaffe had a go at the "single mineral" kaolinite geothermometer (fractionation between tetrahedral and

*continued on next page*



Ken Towe and Amos Banin during a coffee break.

*Jo Eberl*

octahedral oxygen), but found a complex of exchange and precipitation reactions during laboratory fluoridation that made measurements all but impossible. Brian Sheldon (well-deserved student talk awardee) and Claudia Mora used oxygen isotopes to unravel pedagenic from subsequent diagenetic minerals in Paleozoic vertic paleosols. Kurt Kyser and others showed evidence for continued hydrogen isotopic exchange in clays after precipitation. Peter Ryan and others described authigenic illite and serpentine/chlorite that are in oxygen isotopic equilibrium in the Tuscaloosa Fm (Gulf Coast wells). At depths below those where illite precipitates, serpentine continues to react to



Del and Chris Fanning and Blair Jones before the banquet.

High Iron Photos



The good guys always wear white hats: Bill Moll and Don Scafe on the field trip.

Dave Pevear

form chlorite, and equilibrium ceases. The importance of this discovery is a possible isotopic geothermometer for sandstones.

For me the highlight of the Fundamental Properties Sympo-

sium was George Guthrie's computer modeling of the Opal-CT series using a modification of Wild-fire. He modeled a whole series of experimental XRD patterns using disordered and R-1 ordered intergrowths of cristobalite and tridymite layers. Breakthroughs like this are especially easy when Bob Reynolds

and Dave Bish are your co-authors. Good teamwork! Another high point was Jill Banfield and Bull Bailey's identification of long-period serpentine/chlorite interstratification and non-standard serpentine polytypes. At TEM scale, and using electron diffraction, our "good old friends" turn out to have quite complex personalities indeed!

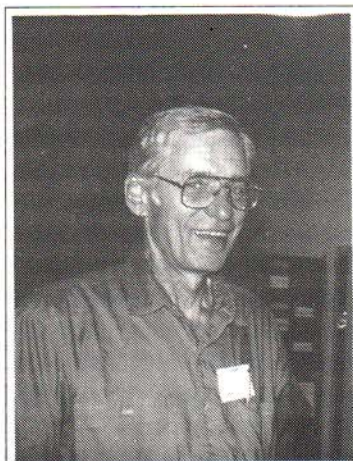
Environmental symposia will likely be a permanent part of our meetings for some time; the upcoming Baltimore meeting has the strongest-ever environmental emphasis. In Saskatoon, James Warren showed that chlorite, a common

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P. M. Huang introduces Pioneer Lecturer Joe White.

High Iron Photos



Richard Hay.

Jo Eberl



Necip Güven and Hideomi Kodama.

Jo Eberl

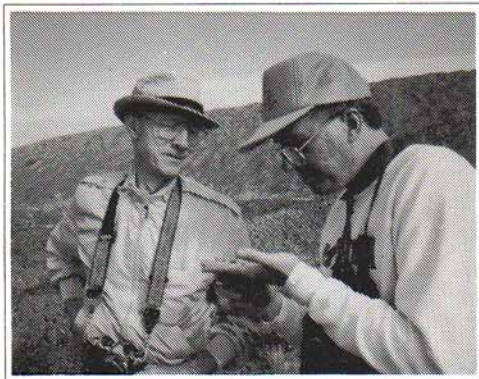
**Saskatoon,** *continued from previous page*

detrital clay in glacial sediments, can dehalogenate chlorine-containing organic ground water contaminants. In the Geotechnical Symposium, Del Fanning and others warned against using pyritic clays as landfill covers, as subsequent acid sulfate weathering can cause pollution and may disrupt the barrier.

Other interesting developments include Bob Ylagan and others' study of hydrothermal illite and I/S from Ponza, Italy, in which they provide evidence that I/S has formed directly from glass without a smectite precursor, and Drits, Eberl, and Srodon's "final" word on the Warren-Averbach technique for determining thickness distributions and scat-



*Amos Banin, Alain Manceau, Simeon Tsipursky, and Victor Drits at the student reception (Ahmet Mermut and Ken Towe in the background). High Iron Photos*

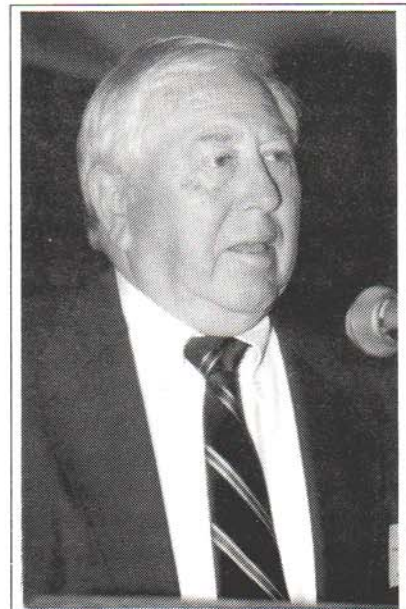


*Joe Dixon and Michael Velbel on the field trip. D. Pevear*

tering domains, including their critique of the Siemens software. Lastly, Warren Huff and others continued global correlation of Paleozoic K-bentonites from the "largest...

eruptions in the... stratigraphic record." I thought it interesting that they correlate the Ordovician Millbrig (or Deike) bentonite with the Kinnekulle of Sweden.

At the traditional Tuesday banquet, we feasted on tasty Canadian beef, and were entertained by a delightful string ensemble. President Eberl presided with a characteristic lack of formality and graciously received the memorial plate from incoming President Giese. Eberl then made two special presentations, one to Ahmet Mermut, for the fine organiza-



*Joe White delivers the Pioneer in Clay Science lecture at Saskatoon. High Iron Photos*



*What, me president?! CMS Presidents from 1991 to 1997: Bob Reynolds, Ross Giese, Dave Pevear, Ken Towe, Dennis Eberl, Steve Guggenheim. High Iron Photos*

tion of the meeting, and the second, the Citation of Special Recognition, to Ken Towe, for his many years of extraordinary service to the Society. A good time was had by all.

The field trip took us south to Regina over flat-lying Cretaceous sedimentary rocks, typical of the prairie provinces, and many Pleistocene glacial features. We stopped at a bentonite pit, and at an interesting fireclay mine and brick plant in the Whitemud Formation. The tour through the old processing plant, now a park, made me realize just how far we have come in improving industrial

*continued on next page*

**Saskatoon, continued from previous page**

safety standards. Lunch was served inside one of the old beehive brick ovens. But the best part for me was the bedrock thrust moraines. The kaolin-bearing shale, sand, and coal strata have been thrust into vertical attitude by the force of the



Georgie Scafe and Jessica Elzea. *High Iron Photos*



Steve Chipera and Alanah Fitch before the banquet. *Jo Eberl*

Pleistocene ice sheet, forming hills which now have hundreds of feet of relief. Amazing! The last stop was the Kallium Potash "mine," where subsurface Paleozoic

evaporites are dissolved by hot fluids circulated through wells from the surface, and precipitated as potassium salts in the processing plant.

*D. R. Pevear  
Houston, Texas*

## Ken Towe awarded Citation of Special Recognition

Ken Towe was the recipient in Saskatoon of a special CMS award, the Citation of Special Recognition. In making the award, President Dennis Eberl had the following to say:

"It is my pleasure to present a special award to Ken Towe, who, as you know, has served this Society faithfully, competently, and above and beyond the call

of duty for at least 13 years as Society Treasurer, and for one year as Journal Editor. Ken has been an outstanding Treasurer, a veritable dam behind which the assets of the Society have accumulated, a veritable Hoover Dam, a big, strong, Republican dam, behind which lies Lake Towe, deep and green. Now that Ken is stepping down, the lake is under some pres-



CMS President Dennis Eberl presents the Certificate of Special Recognition to Ken Towe at CMS '94, Saskatoon. *High Iron Photos*

sure. There are those in the Society who would want to let Lake Towe grow ever deeper, and others who might want to drain the lake, and others who may want to let some water flow through the dam, to begin to generate power. Whatever may happen, the Society owes a deep sense of gratitude to Ken for what he has accomplished. The award reads: 'Pre-

sented in deep appreciation to Kenneth M. Towe for 12 years of dedicated excellence as Treasurer of The Clay Minerals Society (1982-1994), which included one year as Editor-in-Chief. Under your guidance, the Society prospered and developed a strong foundation from which to further clay mineral science.

Thank you for sharing your leadership and perceptiveness with us."

Anyone who has served on the Council in the past many years knows that Ken richly deserves thanks not only for his skill as Treasurer, which has served to make the Society financially strong, but for his dedication to the Society in almost every facet of its operation.

## Sustaining Member Profile

### Alpha Earth

**J**o Eberl called a few weeks ago and said, "Eric, I want to apologize, but I put the wrong phone number in the CMS Directory for you." I said something silly like it doesn't really matter because nobody calls me anyway (not true—people actually call me looking for a job; also, for some reason, brokers keep calling me to see if I would like to invest \$10,000 or so in the latest, hottest offering—I have learned to laugh like a madman and hang up quickly!). Jo then proceeded to ask if I would consider writing a Sustaining Member profile for the CMS newsletter. She felt that it would be easy for Alpha Earth to do this, since there weren't a lot of owners and managers that would have to carefully read and approve what was written. She was right.

Alpha Earth, Inc. was initiated in March, 1991, and is comprised of two people (Jacqueline Smith and me), plus our part-time helper and my full-time wife, Trudy. In 1989, our family moved from Tulsa, OK, after nine years with Cities Service Oil & Gas Co./OXY USA/Occidental Petroleum to a suburb of Albany, NY, and I went to work for a small, family-owned environmental company. This company was mostly involved in the oil-spill cleanup and tank maintenance business. I was hired to do hydrogeology (I could swim!)—hydrogeologists perform an oft-needed support function for companies in the spill business. After working there almost two years, I decided to enter the business world, and leapt, not knowing exactly where or when a landing would occur. I hired geologist Jacqueline (Jacquie) Smith to help with our first job, and she immediately became and has remained an invaluable part of Alpha Earth.

We work out of my home—a basement area which is but a short com-

mute from my kitchen. We have acquired the normal requisites of a small business: computers, fax machine, copier, telephones, filing cabinets, junk mail, an accountant (when necessary), an attorney (when necessary), creditors, debtors, client lists, potential client lists, competitor lists, insurance bills, headaches, failing eyesight, an alienated family, inquisitive neighbors, and several aged automobiles. Ah, but do we have fun!?

Our first job was to evaluate an abandoned railroad yard for a potential purchaser. We installed several monitoring wells, took soil and water samples, had the samples analyzed, evaluated the results, and produced a report. We did no clay analyses, although we did penetrate a beautiful blue-black clay that was deposited during glacial Lake Albany time. Not only did we do no clay analyses, we did no soil mineralogy or textural analyses. A simple field description of the soils withdrawn by the split-spoon sampler is all that is usually done on studies of this type. The goal of this study was to determine if the soil or water was contaminated by fuel hydrocarbons, heavy metals, or PCBs.

Most of our environmental studies are termed Phase 1, Phase 2, or Phase 3 environmental assessments. Our clients mostly are gasoline station owners, fuel oil distributors, banks, attorneys, realtors, and miscellaneous small businesses. A Phase 1 is a current and historical survey of a site to evaluate its potential liability for the owner. This is usually done when a property is being sold; a bank will require a Phase 1 before lending money to a purchaser. Usually, no sampling is involved. A modified Phase 1 may involve sampling for asbestos, radon, lead paint, or maybe minor soil or water sampling. A Phase 2 involves sampling. For instance, if the Phase 1

study results in the discovery that the site was used as a gasoline station in the past, installation of monitoring wells may be required by the bank or potential purchaser to check for subsurface contamination of soil or water. A large percentage of old underground storage tanks have leaked, and this is a no-no. In New York state, for instance, groundwater is not permitted (by state law) to contain more than 0.7 ppb benzene.

Monitoring wells are commonly made by augering with a hollow-stem auger and then inserting a 2-inch diameter PVC (via the hollow stem) down to perhaps 10 feet below the water table, which in this area is generally 5 to 25 feet below the surface. We subcontract a mobile rig and crew to install the wells. A field photoionization detector is used to monitor soil cuttings and split-spoon samples for volatile hydrocarbons during drilling, and soil and water samples are taken and analyzed in one of several local certified labs. We survey the well locations (with tripod-mounted level and stadia rod), measure the depth to water (with a "water tape"), construct a groundwater gradient map, evaluate the results of the analyses, and produce a report. If contamination is discovered, it is reported to the Department of Environmental Conservation (DEC). Such reporting is, by NYS law, to be done within two hours of discovery of a spill (spills include old subsurface contamination). After a spill is reported, we act as environmentalist for our client and as arbiter between our client and the DEC. If the project advances to remediation (cleanup of soil or water or both), it is then termed "Phase 3."

Where does clay mineralogy fit in? It usually doesn't, at least to the extent of needing to know the minerals present. Where does science fit in? There usually is not a lot of sophisti-

cated science involved in assessing a property, but the science that is involved is very important. A major goal is to keep the client in business, which means—if the site is contaminated—cleaning it up sufficiently to abide by the regulations without undue cost. Remediation design necessitates that the site be sufficiently evaluated such that an appropriate cleanup system can be installed. If only the soil is contaminated, sometimes it is simply excavated and taken to a landfill. Soil vapor extraction, either *in situ* or after excavation, is also popular. Contaminated water typically is more difficult to manage. Traditionally, pump and treat systems have been installed—the water is pumped to the surface and then treated, commonly by air stripping. It is during the design, system installation, and monitoring stages of remediation that the magic happens, and where geology, chemistry, and engineering are melded.

The days of installing a simple pump and treat system and then pumping away for years are nearly gone. Experience has taught that a significant proportion of contaminants below the water table may be adsorbed onto the soil matrix—*in situ* organics and clays—and that desorption of these contaminants to the point of meeting groundwater standards may never occur (at least within a reasonable time—i.e., 3-5 years). So, "newer" methods (air sparging, bioremediation, etc.) are being used, studied, and discussed in the literature and at conferences. This is the challenge for clay mineralogists in the environmental clean-up field. How does one use his knowledge of stratigraphy, mineralogy, porosity, permeability, organic chemistry, biology, kinetics, engineering (pumps, gauges, and valves), and computer modeling to help a "responsible party," the local



Alpha Earth: Jacquie Smith, Eric Eslinger, the dog, Trudy Eslinger.

Courtesy E. Eslinger

state environmental agency, and any impacted adjacent property owners solve the problem (of eliminating the contaminants)?

Litigation is a major facet of environmental problems. The megabucks environmental litigation cases may be the only ones reported in the newspapers, but there are many litigation cases that, although relatively small in terms of monetary liability, are sufficiently large to put a small business—if deemed to be the responsible party for contamination—out of business. We have become involved with several of these situations, and the work is very satisfactory from a scientific viewpoint. Our client is either an affected party or an attorney who has been retained by the affected party; data are collected and studied, a conclusion is reached, and an argument is presented. A persuasive argument from either side generally results in an out-of-court settlement. Each of these cases is similar to a mini-Master's thesis. Hard data and good science are respected, and circumstantial evidence is not respected.

Environmental geology is interesting and certainly challenging. However, with the type of environmental work that we do, one does not have the opportunity to peer at thin sections, to pick peaks on an XRD pattern, or to puzzle over a 10,000-foot well log. I think that the enigma of

naturally-contaminated sandstones will always be more interesting to me than the search for spilled gasoline in near-surface soils. So, in the interest of both challenge and making a living, we do what I call "straight" geology, in addition to environmental geology. That is, we do petrography, XRD, SEM, core description, and special "research" projects for oil companies. We have

also become involved with the use of multivariate statistical analysis for analyzing well logs; in particular, for classification of flow units and for predicting ("estimating" is perhaps a more accurate verb) permeability. In this respect, we are collaborating with a former graduate school friend of mine, now a physicist at a research company in the Boston area, whose specialty is pattern recognition. We hope to develop a code for well log analysis that will knock your socks off.

And now a comment about the diverse backgrounds of clay scientists. As we all know, the clay literature has been scattered among many journals during the last few decades. The more recent onslaught of interest in the environmental field, in all of its aspects (not the least, the availability of funding), has resulted in even more journals that contain papers that touch peripherally or profoundly on the properties of clay minerals. For instance, how many scientists are conducting studies on the sorption of some particular heavy metal or some species of hydrocarbon onto some kind of soil? Definitely more than a few. In how many of these reported studies is the soil carefully characterized in terms of mineralogy? Well, fewer than one might expect (except in *Clays & Clay Minerals*, of course).

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## CMS Council News

Several actions of interest to members were achieved at the 31st Annual Meeting of the Society in Saskatoon, SK. The Society plans to affiliate with the American Geological Institute (AGI). The AGI offers the opportunity for a focused voice for the earth community in Washington. AGI has a government affairs program for the advocacy of the geosciences, in addition to providing information to policy makers. An affiliation with AGI is a first step in an attempt to influence public awareness, provide basic information to policy makers about our profession, and to have a broad voice in addressing the needs of the profession and the nation.

The combined market value of the total endowment funds now exceeds one million dollars, but Society operating expenses again exceeded income, which continues to erode the year-end cash balance surplus. This surplus soon will be exhausted, and budgeting will require some combination of expenses reduction and income enhancement to prevent the undesirable use of endowment capital to pay the bills. Remedial actions are being implemented. Reciprocal advertising in the publications of several other societies is being pursued to bring our publications to the attention of more scientists interested in clay minerals.

Many of the 15 or so *ad hoc* committees currently deal with subjects that exceed the limits of "interim problems." Reappointing members each year is time-consuming and risks breaks in continuity. Converting some *ad hoc* committees to standing committees defines their duties in the by-laws. Committee membership also can be guided to ensure representation of industry, academia, and government. The *ad hoc* Awards Committee has been changed to a Standing Committee on Awards to recom-

mend to Council candidates for Distinguished Member, the George W. Brindley Award, and the Jackson Mid-Career Clay Scientist Award, and other awards as designated by Council, to judge (or appoint judges) for Student Paper Awards, and to undertake additional duties as designated. The Membership and Subscriptions Committee and the Contributing Members Committee have been combined into the Standing Contributions and Membership Committee to act as a liaison between Sustaining Members and the Society, to seek continued support as well as new Sustaining Contributors, to retain members, and to increase membership, including library subscriptions.

Current plans schedule the 1996 meeting for the third week in June in Gatlinburg, TN. The joint CMS/AIPEA meeting will be held in Ottawa in June 1997. Meetings in Cleveland (1988) and Lafayette (1999) are tentative.

The Society will send the back issues of *Clays and Clay Minerals* plus the Denver Proceedings volume as needed, from the last 10 years (without depleting the Society's archival supply of 20 copies of each issue), to selected Eastern European groups designated by the Eastern European Liaison Committee. The Source Clays Committee will ascertain which foreign clays would be desirable to exchange for subscriptions to *C & CM*.

The Source Clays Committee proposes that the terms "high Hinckley index" and "low Hinckley index" be substituted for the terms "well crystallized" and "poorly crystallized."

A video recording of Linus Pauling giving the Pioneer Lecture in San Diego, plus one of Wayne Bundy, Jack Burst, and Haydn Murray, and another of Max Mortland and Tom Pinnaiva, are being prepared, and the correspondence of Ralph Grim to

several people concerning the naming of illite is being collected by Society Historian Duane Moore.

The third draft of a definition of "clay" from the CMS and AIPEA Nomenclature Committees is under review, and a definition of "clay mineral" is next.

*Don Scafe*  
Edmonton, Alberta

## Alpha Earth,

*continued from previous page*

So, what does this mean? One possible answer is that there is a lot of careful, laborious, time-consuming work being conducted (and money spent) on sometimes poorly characterized materials. Might we not be missing an opportunity here? Should there be some standard set of analyses suggested for the samples used in these studies, so that a database gradually can be compiled wherein results obtained by different workers can be meaningfully compared? Ask the Clay Doctor!!

Final note: The environmental work, the "straight" geology work, the preparation of our *Clays & Stuff* newsletter, part-time teaching at local colleges, shoveling snow, the futile attempt to keep our Old English Sheepdog happy via frequent walks, all combined with the myriad of essential tasks required to run even a small business, provide a stimulating life. However, from a clay mineralogy perspective, for an interesting and satisfying life, there is nothing like a suite of samples to investigate, a properly aligned XRD unit, a sharp #2.5 pencil, a hot corned beef sandwich with kraut, and a vanilla milkshake.

*Eric Eslinger*  
Glenmont, New York

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