

CMS News

A Publication of The Clay Minerals Society

Summer 1993

Turning Point—A Letter from the President

I would like to discuss some of the things I have done as your president, as well as some of the things I failed to do, or did wrong. I'd also like to share with the membership some of my thoughts, and fears, about the future of the Clay Minerals Society.

First, some general comments.

Background

Two attributes distinguish us from many similar organizations: diversity and voluntarism. We are diverse in both geography and discipline. A glance at the Membership Directory shows a third of our members are from Canada, Europe and Asia, as well as a scattering from the rest of the globe—in essence, we are an international clay society. Further, there are few societies in which geologists, soil scientists, ceramicists, chemists, and engineers from government, industry, and academia are so equally represented. We are also a society of volunteers, perhaps due to our relatively small size. We have no salaried employees, although our contract office manager, Jo Eberl, seems to do the work of three. The Clay Minerals Repository, voluntarily run by Bill Johns and the University of Missouri, hires students, and volunteer Editor Ray Ferrell at Louisiana State University has a contract assistant. Otherwise, the CMS has always been run by its elected officers and councilors, and by appointed individuals and committees. Diversity and voluntarism are the strength of



D. R. Pevear in Columbia, Missouri, 1990.
High Iron Photos

our society, and I would not like this to change, but they also create certain problems—to be discussed later.

Publications and meetings are the most important things we do. Our publications, particularly *Clays & Clay Minerals*, are a permanent record of clay research, and as such are probably the Society's most significant endeavor. Our Annual Meeting, a dynamic forum for clay science, is surely the other reason to have a CMS. In a way this meeting is the CMS. Historically, the meeting came first, and the initial *C&CM* was a proceedings volume for the annual meeting. The journal as we know it started in 1968. If *C&CM* is our brain and the Annual Meeting our mouth,

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Linus Pauling to speak in San Diego

The CMS is pleased that Linus Pauling will be the Pioneer in Clay Sciences Lecturer at the annual meeting to be held in San Diego from September 25-30, 1993.

Other highlights of the meeting will

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Two new volumes to be published in September

Two new volumes will be available from the CMS in September. The first is Volume 5 in the CMS Workshop Lectures; the second is *The Keller '90 Kaolin Symposium*, CMS Special Publication No. 1.

For the first time, the volume associated with a workshop will be distributed at the workshop. *Computer Applications to X-ray Diffraction Analysis of Clay Minerals*, Volume 5, is edited by

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The Clay Minerals Society



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Many thanks to our advertisers this month, **Digital Instruments, J. S. Technical Services, and Siemens Analytical X-ray Instruments**, for helping make the newsletter possible.

Letters

Important Advice

Editor:

**Remember, the first five letters count;
not the last seven!**
LABORATORY

Years ago one of my graduate students found this kernel of Missouri wisdom and posted it in our lab. It has been maintained ever since then, and still commands attention. Being senile, I do not recall who the student was. So—write down and record things you will want to remember fifty years from now.

Walter D. Keller
Columbia, Missouri

Four associate editors recruited

Editor-in-Chief Ray E. Ferrell, Jr. has named four Associate Editors. Serving two-year terms, the Associate Editors are: Dave Bish, Los Alamos National Laboratory; Jean Hemzacek, Oil-Dri Corporation of America; Wayne Hudnall, Louisiana State University; and Ron Stoessel, University of New Orleans. Their major responsibilities are to select reviewers and offer opinions regarding the suitability of articles for publication. Ferrell welcomes suggestions for other associate editors.

Come to Saskatoon next summer

The 31st Annual Clay Minerals Meeting will be held in Saskatoon, Saskatchewan, from August 14-19, 1994. The workshop, Scanning Probe Microscopy of Clays, will be co-led by Kathryn Nagy and Alex Blum. A mid-meeting field trip is planned to visit a potash mine shaft and Tertiary and Cretaceous clays of Western Interior basin in southern Saskatchewan. For more information, contact Ahmet Mermut, Department of Soil Science, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0, Canada. Telephone: 306-966-6839; fax: 306-966-6881.

Newman volume out of print

Previously available to CMS members, *Chemistry of Clays and Clay Minerals*, Monograph 6 of the Mineralogical Society, by A. C. D. Newman, has recently gone out of print.

This newsletter printed on recycled paper.

Committee Corrections

In the last issue of *CMS News*, there were two mistakes in the list of committee personnel. Jean Hemzacek, who originated the Regulatory Issues Committee and has been one of its guiding lights, was left off the list of members of that committee. She is still very much involved. Second, the name of Carolyn G. Olson, Councilor and Nominations Chair, was misspelled.

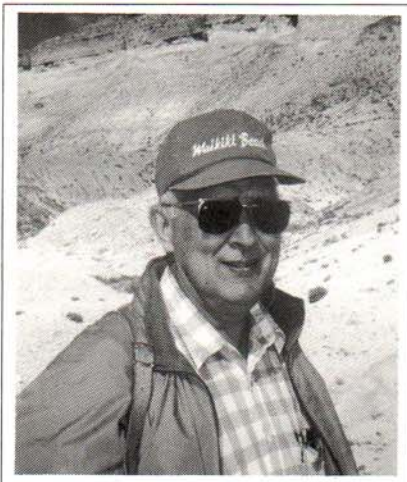
Thanks...

To the following people who contributed to this issue:

David Brown
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Dave Pevear
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Gray Thompson
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Jeff Wilson

Clinoptilolite cookies, anyone?—Zeolite '93

Z eolite '93, the 4th International Conference on the Occurrence, Properties, and Utilization of Natural Zeolites, was held on June 20-28, 1993, in Boise, Idaho, and the meeting lived up to its title in every way. The conference was truly an international event with more than 200 participants present from at least 27 different countries. In addition to the international diversity of the attendees, there was an exciting diversity in the professions of the conference-goers, including people with backgrounds in geology, soil science, biology, engineering, horticulture, chemistry, mineralogy, nutrition, and even marketing and commodity brokering. We all came together for a week of discussion



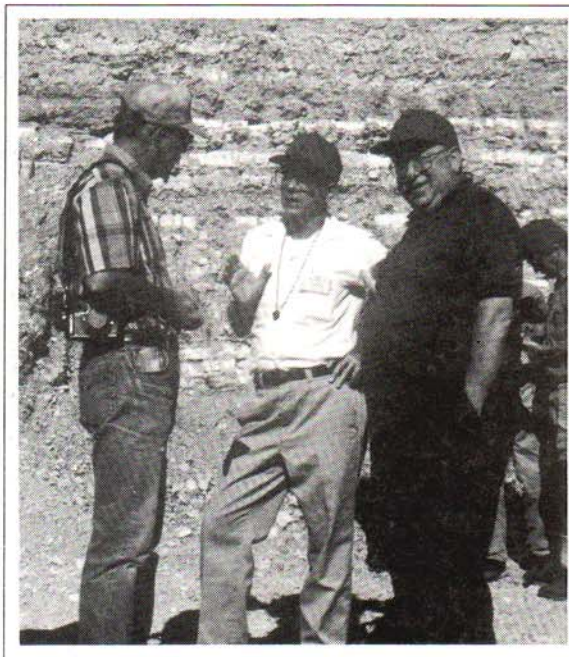
Wally Parham on the Idaho field trip, 1993.
Dennis Eberl

about natural zeolites and some recent advances made in the understanding of the ways that they form, how they are used, and our improved understanding of their properties. The format of the meeting was especially conducive to abundant discussion and sharing of ideas, with formal, invited oral presentations in the morning and a poster session, unopposed by oral presentations, each afternoon (accompanied by plenty of drinks and snacks).

Newly discovered occurrences of natural zeolites, especially clinoptilolite, mordenite, analcime, laumontite, and phillipsite, were the topic of numerous oral presentations and posters, and these papers were interesting from the point of view of exploitation as well as identifying conditions necessary for zeolite formation. The new occurrences that were presented are worldwide in distribution and occur in either tuffaceous or non-tuffaceous rocks and soils. Further, the zeolites found along fractures in Nevada and California, topics of both talks and posters at the meeting, provide important information concerning the nature and timing of fluids from which they formed.

Many new data were presented describing the properties of zeolites. Not only was there ample discussion of the crystallography of natural zeolites, but there was also discussion of the stable isotopes and radiometric ages of zeolites, as well as the transformations and the behavior of zeolites at various pressures and temperatures. There was even a poster on equilibrium modeling of some zeolites; the thermodynamic data necessary for the modeling were approximated due to the absence of any experimentally determined data. It was clear from the papers presented on the properties of zeolites that there is much interest, perhaps even increasingly so, in such studies.

How zeolites are being used around the world was the topic of a wealth of papers, giving the participants a very



Steve Peterson, Dick Sheppard, and Fred Mumpton, bentonite pit of Teague Mineral Products, Adrian, Oregon, July 1993.

Courtesy Dick Sheppard

clear indication of the critical role that zeolites play in our lives. Posters and talks were given on the use of zeolites as a building and construction material, the use of zeolites in the treatment of water and waste water, the role of zeolites in counteracting the effects of radioactive fallout from the Chernobyl nuclear accident, the application of zeolites in agricultural and horticultural settings, and the use and application of zeolites in livestock and poultry health and nutrition. The role of zeolites in improving the health of humans exposed to radionuclides was also discussed. In fact, samples of cookies containing 10 weight percent clinoptilolite were available at the meeting; the cookies are being fed to people exposed to fallout from the Chernobyl accident, and the contained clinoptilolite apparently is effective in removing radioactive isotopes of Sr and Cs from those affected. Actually, they did not taste too bad either!

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Interviews with the clay scientists

M. J. Wilson

This interview was conducted by Dennis Eberl and Gray Thompson on November 4, 1992, at the CMS Annual Meeting in Minneapolis. Dr. Wilson is the Head of the Division of Soils at the Macaulay Institute in Aberdeen, Scotland.

CMS: The first thing to ask about is interparticle diffraction. What is the idea? What is the history behind it? Do you still believe it? Some people don't believe it, and others think it is a break-through.

WILSON: Before I answer that, I'll give you a little background history of interparticle diffraction. It started essentially in 1982. There was a problem with the Magnus Oil Field in the North Sea where the engineers were measuring permeability in the sandstone in the field which did not correspond with the permeability that was being measured in the laboratory. How was this difference to be reconciled? No one seemed to have very much of an idea about this, but in a discussion at one of our Clay Minerals Group meetings with Nadia Pallat from BP, I suggested that what we should do is look at these sandstones after they had been critically point dried, in order to look at the fabric of the sandstones as it occurred *in situ*. The cores used were in a preserved state.

Well, when we did that, the answer to this problem was obvious. What the lab staff had been doing previously was drying their samples and then measuring the permeability. Drying caused the illite fabric to shrink and to become plastered against the pore walls. But if you actually looked at these cores in the preserved state, the illite completely fills the pores. Then we decided to do some further work, transmission electron microscopy and x-ray diffraction, upon these illites, which were very well-defined lath-shaped particles. In the course of this work, we measured the thickness of these particles, and they turned out to be between 20 and 30 angstroms thick. At the same time, they gave an x-ray diffraction pattern which indicated they were interstratified illite-smectite,



Drawing by M. J. Nash

with proportions of smectite greater than could be accommodated in the particles observed under the electron microscope. So we were faced with reconciling these differences. In order to do this, I suggested, and at the same time Bill McHardy came up with the same idea, that what was happening was that on the X-ray slide the particles were sedimenting one on top of the other, and that the interface between the particles was capable of absorbing glycerol or glycol, so behaving like a smectite layer. We did actually call that interparticle diffraction

in the initial paper. Well, that was a one-off explanation; but when Paul Nadeau came to the Institute, he took up this idea, developed it, and generalized it with respect to pelitic sequences, with the help and support of the staff at the Macaulay, including myself. So that's the background.

CMS: When I visited Macaulay and you told me about the idea, my first reaction was that I did not believe it. The next morning, I believed it, but thought it was trivial. Now I think it has touched off a revolution in our understanding of illites. What led you to measure the thicknesses to start with?

WILSON: We were led to measure the thicknesses, because when we actually observed the laths under the TEM after they had been dried down, you could see that some of them had actually flexed and twisted; so they gave the impression of being exceedingly thin. We thought it would be an interesting exercise to measure the thicknesses.

CMS: A lot of people don't believe in fundamental particles. What is the problem?

WILSON: I think part of the problem is that the layer by layer transformation theory has been imbedded in the geological literature for such a long time, and what we are

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Wilson, continued

suggesting is simply another way of looking at illite-smectites.

CMS: There are two ways of looking at the same thing, and the technique seems to be tied to the nomenclature. With the TEM one sees fundamental particles, and by XRD one sees stacks of fundamental particles, which is illite/smectite.

WILSON: Yes, I think that is a problem.

CMS: There is something else to think about. Reynolds says that when he looks at illite/smectite in rocks, he sees by XRD a lack of stacking order between fundamental particles across interlayer space, which would imply that the fundamental particles in stacks of particles are not related crystallographically. On the other hand, Drits told me he has seen nontronite having crystal terminations that are congruent throughout the entire stack, as if the particles know about each others' existence. Ahn and others, and also Veblen and others, found cross fringes on the HRTEM that go through adjacent particles, right across swelling interlayers, as though the particles are ordered with respect to each other.

WILSON: Well, there's no doubt that some smectites are ordered. This has been shown in the literature a long time ago, nontronites and some beidellites. This finding doesn't contradict the theory, in my opinion. I discussed the other things you mention in a recent paper in *Mineralogica et Petrographica Acta*.

I never could accept the idea of layer by layer transformation of smectite to illite in a diagenetic sequence.

This study has been a peripheral interest of mine rather than a major research interest. I got into this because I never could accept the idea of layer by layer transformation of smectite to illite in a diagenetic sequence, because it seemed to me to involve very complicated transformations, not just the absorption of potassium into the interlayer, which is easily done, but also changes to the fundamental silicate sheet, which are certainly not so easy. Also it would have to involve some kind of structural reorganization or rearrangement of the silicate sheets, because you're going from essentially a turbostratic arrangement to a regular three-dimensional arrangement.

So it isn't just a question of adjusting the chemistry.

CMS: Right. Also, Drits says that the structure changes from cis vacant to trans vacant when expandability drops below fifty percent. It would be hard to do this in a solid state transformation.

WILSON: I agree. Anyway, if nothing else, this fundamental particle debate has persuaded many people that more emphasis should be laid upon neoformation.

CMS: Your work was based on sandstones, and now people are trying to apply this to shales. Maybe shales are different.

WILSON: Well, I don't have too much experience in shales, apart from noting that in the Magnus sandstone, which has shale intercalations, when we looked at the shales, the particles in the shales were very similar to those in the sandstone. If what you're asking is do the same processes occur in shales, I think they might.

CMS: You said that the original work saved the oil companies a lot of money.

WILSON: Oh, I would guess it certainly did, because they had to amend their recovery strategy in order to take into account the fact that the sandstones, where this filamentous illite occurred, were impermeable; so pumping water into those formations, where the illite was blocking the pores, in order to stimulate the further recovery of oil would have been totally ineffective. So I reckon they did save a lot of money.

CMS: Did they find another technique for recovering oil?

WILSON: I think they just avoided these particular sandstones.

CMS: So this isn't your main line. What is your main work?

WILSON: Well, most of my work has been connected with mineral weathering in soils, the formation of clay minerals in soils, the decomposition of primary rock-forming minerals, including their decomposition by biological mechanisms, the effects of this on soil properties and behavior.

CMS: We were having a discussion about the origin of smectites the other evening, and a number of people expressed the feeling that vast quantities of smectite, the greatest bulk of smectite, forms by weathering of volcanic

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Wilson, continued

ash. Other people expressed the opinion that maybe it just forms by weathering of anything. Do you have a feeling on that?

WILSON: Well, I do, in that I'm sure that smectites can form heterogenetically, not simply by the alteration of volcanic ash. I know that there are many soils in the United States which are influenced by volcanic ash, and that this could be a precursor to smectite in the soils. But there are many situations described throughout the world

When you look at the lichen-rock interface, it's very clear that the organic acids, particularly oxalic acid, which is secreted by lichens, have had a major role in decomposing the rock-forming minerals beneath.

where smectites are clearly formed in the soil under circumstances where there is no volcanic ash contribution.

CMS: No one was really questioning that smectites formed from practically any precursor materials as long as it's an aluminum silicate, but people were talking about the origin of most of the world's smectite, which seems to be most of the stuff that gets dumped into the big sedimentary basins, like the Gulf Coast, the Niger Delta, and so on.

WILSON: We're talking about the origins of smectites in sediments essentially? It's not clear to me just how much of these smectites have been contributed from soil, and how much contributed from the weathering or the alteration of volcanic ash. I would certainly expect that the smectite from soils would be somewhat more iron-rich than the smectites that developed from volcanic ash. This simply reflects the fact that bentonitic-type materials develop from acid volcanic rocks, where the amount of iron is originally rather low.

CMS: Your work on weathering under lichens was very interesting. How did you get interested in that?

WILSON: Well, we became interested in that because we saw it as a model system for studying the decomposition of particular minerals by a single organism. Basically, we were trying to draw conclusions as to the importance of biological weathering in soils. The situation with crustose lichens is that there is a very close

contact between the under part of the lichen and the rock surface, and really nothing much else is interfering with the process of weathering related to that. In the soils, however, you have a very complicated interaction between physical, chemical, and biological weathering, so you don't really know what is happening. When you look at the lichen-rock interface, it's very clear that the organic acids, particularly oxalic acid, which is secreted by lichens, have had a major role in decomposing the rock-forming minerals beneath.

It's very interesting from this point of view, and also from the point of view of the formation of bio-minerals. The usual mineral that you get is calcium-oxalate, whewellite or weddellite, but if you have a substrate where there is no calcium, you can get unusual oxalates, for example, magnesium oxalate, which is a mineral called glushinskite. We've also found manganese oxalate, where lichens grow on manganese ores, and other people have found copper oxalates; so there is a whole range of minerals which have not previously been described, which may be found in association with these lichens.

CMS: Did you discover some of these minerals for the first time?

WILSON: Well, glushinskite we thought we had discovered for the first time. We went out deliberately and sought it in a lichen-encrusted serpentinite. We thought it was a new mineral, but it turns out a Russian scientist had found magnesium oxalate in some Arctic coals in 1960, and he had named it. But it was regarded as a doubtful species, because he presented no X-ray data. Since the work that we did on magnesium oxalate has been published, it has now been recognized as a valid mineral species. The copper oxalate is a mineral called mooloolite, which was discovered by people in the British Museum.

CMS: And these are called minerals even though they have a biological origin?

WILSON: Oh, absolutely. There's no reason why they should not be.

CMS: Speaking of discovering minerals, you discovered a mineral called Macaulayite.

WILSON: That started with the lab books of Dr. Isaac Steven. I inherited these books after he died. He had been working first in Rothamsted, and then in the Soil Science Department at Aberdeen University. He had noticed that there was a high spacing (he had recorded this from some deeply weathered granite) of about 18 ang-

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Wilson, continued*M. J. Wilson in Minneapolis, 1992.**High Iron Photos*

stroms, in the untreated, air-dry state. We confirmed this. In the course of trying to explain this observation, we characterized the material by x-ray diffraction, infrared, transmission and scanning electron microscopy, and chemically. It turned out to be a new mineral which was basically silicated iron oxide which actually had a 36 angstrom layer spacing, which we only observed when we were looking at it under the transmission electron microscope. When we went back to our x-ray diffraction system after that, and put in a finer divergence slit, we managed to record the 36 angstrom spacing. It's never been recorded anywhere else.

CMS: Didn't you use magnetics to separate it?

WILSON: That's right. That was the key. We used a high gradient magnetic separator, and separated enough of it in the pure state to characterize it. Certainly if we hadn't been able to do that, we would not have been able to characterize it.

CMS: How was your institute founded, and how did it develop such a strong program in clay science?

WILSON: The Institute was founded following a gift by T. B. Macaulay, who was the founder of the Sun Life Insurance Company of Canada. He was a Scotsman who had been born in the Western Islands. After he had immigrated to Canada and made his fortune, he had never forgotten that the state of agriculture in the area where he grew up was very poor. He wanted to do something about

it, to improve agriculture. He apparently contacted the Scottish Department of Agriculture and offered an endowment for this purpose. He was persuaded that, rather than simply improve the agriculture in the Western Isles, it would be a better idea to found an institute for soil research whose remit it was to improve soil fertility for Scotland as a whole.

As to how the institute developed a strong reputation in clay mineralogy, we were very fortunate in that quite a number of the pioneers in clay mineralogy in the 1940's and 1950's worked at the Macaulay Institute. I have only to mention Douglas MacEwan, who worked there for a number of years, also George Walker, who did his early work on vermiculites as a Ph.D. student, R. C. Mackenzie, who developed differential thermal analysis at Macaulay, and Colin Farmer, who developed infrared as a technique for studying clay minerals. It was largely due to the efforts of these people that the reputation for clay mineralogy at the Macaulay was founded.

In later years, the remit of the institute to improve the fertility of the soils in Scotland began to seem increasingly irrelevant, because the UK in the 1980's had a surplus in agricultural commodities. The thinking was that in these circumstances we did not need to improve the fertility of the soils in order to grow more crops. The Institute was then amalgamated with another institute, the Hill Farming Research Organization, to become the Macaulay Land Use Research Institute, and this obviously necessitated a complete revision of the institute's program of work.

To begin with, it certainly looked as if there was no place for clay mineralogy in the remit. But as things have

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developed, it's become increasingly apparent that not only does one need to take a very holistic view of land use, but one also needs to study in some detail the fundamental processes which are important to land use science as a whole. As far as agriculture and forestry are concerned, the point is to understand the properties of the soils. If we hope to understand how pollutants are absorbed and move through soils, it is important to study in some detail the soil components, including clay minerals. In a way I think there is now a much clearer opening for clay mineralogy

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Wilson, *continued*

in the Institute than there was during the early days of the program.

CMS: The work at Macaulay brings to mind the work at Rothamsted. Is there a rivalry between these two institutions?

WILSON: Well, it was always a friendly rivalry. Rothamsted had a very high reputation, of course, in soil mineralogy and clay mineralogy. MacEwan moved there and did his famous work on interstratified clay minerals at Rothamsted. Of course we have to mention people like George Brown, who really did some tremendous work during his career at Rothamsted. He has now unfortunately retired. Alan Newman, Alan Weir, Oscar Talibudeen, they really had a tremendous group of people in Rothamsted. They justifiably had a high reputation in soil mineralogy. Unfortunately, that is all gone now, and no mineralogy is being done at the Rothamsted.

CMS: How did you get interested in soil mineralogy?

WILSON: I'm a geologist by training. I did my thesis on the underclays of the South Wales coal fields, which were fireclays. These were reckoned to be fossil soils. In the course of that work, I read quite a lot of the soil science literature, and became more interested in soils. When I saw a position advertised for someone to study the weathering of soil minerals up at the Macaulay Institute, I felt I was quite well-qualified to take that on. So...

It's become increasingly apparent that not only does one need to take a very holistic view of land use, but one also needs to study in some detail the fundamental processes which are important to land use science as a whole.

CMS: So you packed up from Wales and moved to Aberdeen.

WILSON: That's right. I've always lived on the Celtic fringe of the UK, but I've never regretted that. Working at the Macaulay Institute has certainly given me a tremendous opportunity to broaden my horizons by talking to people in many different disciplines.

CMS: How would you compare the British Clay Minerals Group to the Clay Minerals Society?

WILSON: Well it's very much smaller, of course. This is the first Clay Minerals Society meeting that I've attended.

CMS: This is unfair, because we are attending a joint meeting with the Soil Science Society of America.

WILSON: Even so, I'm absolutely staggered by the scale of things. Our meetings tend to be very cozy. When we meet as a group, we're maybe lucky to get 50 people. But quite often we organize joint meetings with other societies who have peripheral interests in clays, and then they can be quite well-attended. We held a meeting with English China Clays at St. Austell, Cornwall, this year, and I think we must have had about 100 people attending, a very successful meeting. People are constantly surprised that the Clay Minerals Group organize two, sometimes three meetings a year. I don't know how many meetings you organize in the Clay Minerals Society.

CMS: Just one.

WILSON: We may have to review the number of meetings we hold.

CMS: Or maybe we should. Except it's such a long way to travel in the United States. Maybe we could have regional meetings. What is your approach to science? Do you have a way that you like to work? Some scientists like to have a hypothesis in mind and go out and prove it. Others like to go out and measure everything and find the problem...

WILSON: I probably fall into the hypothesis category. When I start a piece of research, I generally have an idea of what I hope to get out of it, and what hypothesis to test. At the same time, I've often found that the initial hypotheses have been quite wrong, so I've had to revise my views half-way through.

CMS: Prepare to be surprised.

WILSON: Absolutely.

CMS: Here is a question that you may not be comfortable with. One reads about rates of global soil loss increasing since the advent of industrial agriculture, and about the rates of global loss exceeding the rates of soil renewal by natural processes. Do you work on that sort of a mass balance of global scale?

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Wilson, continued

Keith Goulding and Jeff Wilson, Warsaw, 1989.

Dennis Eberl

WILSON: No, we haven't up until now. Perhaps the reason for that is that there doesn't appear to be a serious problem of soil erosion, possibly in the UK context, but certainly not in Scotland. There is soil erosion, of course, but, generally speaking, it's regarded as rather minor. In the global context, it is obviously an extremely serious problem, with the population of the earth increasing as it is, and with the soil resources of the earth shrinking for one reason or another, through erosion and soil pollution.

CMS: One soil pollution problem in the UK is the Chernobyl accident. How has that affected agriculture?

WILSON: The fall-out affected agriculture mainly in upland areas. The previous models on radiocesium in fall-out had all been based upon agricultural mineral soils, and confidently predicted that the cesium would be fixed in these soils, and there wouldn't be too much of a problem. Unfortunately in our upland areas, most of our soils have a thick organic upper horizon, and this upper horizon, as it turns out, doesn't have the capacity to fix cesium, and so we're left with a situation where the cesium is actually just cycling from the soil to the vegetation and from the vegetation to the soil. In fact, some of the areas which were polluted by this fall-out are still as radioactive as they were just after the time of the fall-out. The consequence of this is that there are still certain areas in the highlands of Scotland and in the Lake District of England and Wales where the farmers are not allowed to sell lambs that are grazed on these pastures. They can decontaminate the animals, but cannot sell them directly from the pastures.

CMS: How do they decontaminate them?

WILSON: It's a question of moving them to other

pastures. Decontamination can also be done directly by feeding mineral supplements to these animals, like clinoptilolite, which has a capacity to absorb and fix cesium. There has been some research done on that, but I don't think that it has been adopted as a practical measure.

CMS: I saw an abstract from the coming international zeolite conference about feeding clinoptilolite-laced cookies to children who live near Chernobyl.

How did you get interested in geology? Was your father a Welsh miner?

WILSON: No. Wales is one of the few places where one can do geology as what we call an O-level subject. This is an exam that you tried when you were 15 or 16 years old. What this meant was that we had to travel from the place where I was at school, a place called Merthyr Tydfil, to the National Museum of Wales in Cardiff for practical instruction once a week. The person who taught us there was an excellent teacher; and also the geography teacher at my school was an excellent teacher. Between them they inspired my interest in geology.

CMS: And where did you do your Ph.D.?

WILSON: I did my Ph.D. at the University College of Swansea in the geology department there, which is now unfortunately closed.

We're left with a situation where the cesium is actually just cycling from the soil to the vegetation and from the vegetation to the soil. In fact, some of the areas which were polluted by this fall-out are still as radioactive as they were just after the time of the fall-out.

CMS: There was a recent consolidation of geology departments?

WILSON: That's right, yes. Many of the smaller geology departments had to close. I think there is only one major geology department now in the University of Wales, and that's at Cardiff.

CMS: Do you think this is a good thing? A lot of students in the United States are having trouble getting jobs now, and maybe we are producing too many geologists.

continued on next page

Wilson, continued

WILSON: Well, that may be so, but I'm not sure that I agree with the philosophy that says bigger means better. Because what has happened is that most of the expensive equipment has been concentrated in a few centers of excellence in the UK. Many of the smaller departments, which were actually very productive and which have good reputations in certain areas, have had to close down. I'm not really sure that this means that the quality of geological science in the UK has necessarily been improved. I rather get the feeling it hasn't.

CMS: Don't be afraid to speak out, Jeff. We'll find you another job! When I visited Scotland, I was surprised at the level of research at your Institute, because I thought of Scotland as being a wild place. Maybe it's the weather. But I guess I shouldn't have been surprised, because that's where geology started, with James Hutton at King Arthur's seat, and the Scottish Enlightenment, of course. There is a strong scientific tradition in Scotland.

WILSON: Absolutely right, particularly in Edinburgh, of course.

CMS: What is the scientific reputation of Aberdeen?

WILSON: I think it's got a good reputation, because we have a large number of research institutions in Aberdeen, as well as the University. The University is probably on the small side, but in addition to the University we have the Macaulay Institute, and the Rowett Research Institute, which is an institute for animal and human nutrition, which has a well-deserved international reputation, an Institute for Marine Sciences, an institute for fish processing, and an institute for terrestrial ecology. We also have two universities, as Robert Gordon Institute of Technology now has been given university status. So we do have a collection of academic research institutions in Aberdeen which I think is quite a powerful combination.

CMS: Is there communication between these institutes?

WILSON: Very much so. As far as our own institute is concerned, we have very good collaboration with the University, with the Plant and Soil Science Department in



*Jeff Wilson and Blair Jones at the banquet in Minneapolis, 1992.
Jo Ebert*

particular. In fact, we teach some courses, and we take a lot of students. But in addition to that, there is now a move to form a graduate research school between the research institutes that I mentioned and the universities, looking at certain areas where we feel there is the possibility of developing an international reputation. Land use and the environment would be one area, and we're currently developing a graduate research center with the

university in this context.

CMS: It's a problem that's just going to get bigger and not go away. Do you have children?

WILSON: Yes, two daughters.

CMS: Will they become geologists?

WILSON: No, I couldn't persuade them to take any interest in science at all.

CMS: Do you see any differences between the way science is done elsewhere and in Britain? Do you see anything that other people are doing right that you're not, or the other way around?

WILSON: I don't think so. I think we are all basically converging, insofar as our paymasters are now wanting scientists to become accountable, and they want to have a greater say in what scientists are doing. I see this as a general trend. There's a much greater tendency than there used to be to define the subject areas on which scientists are working, certainly in the agricultural field, much more rigorously to make sure that it applies in some ways to government policy, as well as being interesting science. You see this particularly with respect to environmental work. We are doing a lot of work on problems like acidification of soils and surface waters by acid rain, and heavy metal pollution from sewage sludge. These topics have a strong policy connection, which is the reason the research is supported. I see this as a trend which I've observed in other parts of Europe as well.

CMS: Do you think it's a good thing?

continued on next page

Wilson, continued

WILSON: I'm not sure if it is a good thing with regard to the quality of science, but you can't deny that the people who pay us have every right to have a say what we do. I'm not sure whether the same thing is happening in America, but I would rather suspect it is.

CMS: You've got at least one book published, *A Handbook of Determinative Methods in Clay Mineralogy*. Any other books on the way?

WILSON: We are trying to update that book, and publish a second edition. It will be a two-volume edition, where the techniques that we left out in the first edition, NMR, EPR, Mössbauer, and so on, will be included in a separate volume. The philosophy will be the same as in the first edition, which seemed to be reasonably successful in that it sold out. The philosophy was to try to simplify these methods to the extent that someone who has no previous experience in these methods as applied to clay mineralogy would be able to start from scratch.

CMS: Did you use M. L. Jackson's procedures as a guide?

What has happened is that most of the expensive equipment has been concentrated in a few centers of excellence in the UK. Many of the smaller departments, which were actually very productive and which have good reputations in certain areas, have had to close down.

WILSON: No, we didn't. We actually stuck to the instrumental determinative methods. We did describe some chemical procedures though for cleaning up clays, removing the iron oxides and organic matter and that sort of thing.

CMS: I was sent your book to review, and I never got around to reviewing it. I hope they will send me your two-volume set! Anyway, it sold out, so I guess you didn't miss the review.

What are some of the other scientists doing at Macaulay?

WILSON: Most of our work is now devoted to the environment. The two major themes are acidification and

pollution, by heavy metals and other things like radio nuclides and organics. With regard to the acidification program, obviously mineral weathering is very important because it neutralizes the incoming acidity. It's also very important in the context of the critical load concept, which tries to find how much acidity an ecosystem can accept without incurring some kind of damage. This concept is based upon the weathering rates, the release of base cations from the primary rock forming minerals. Derek Bain is involved in research on these weathering rates with respect to surface water and soil acidification. I think that we actually need to get much more into the fundamental processes of weathering of minerals in order to not just measure the rates, but to understand what is going on.

CMS: A letter from Colin Farmer to *Nature* suggested that acid rain might actually help agriculture by releasing trace elements.

WILSON: How can I be diplomatic about this? I think that this is not generally accepted. Obviously, there will be an increase in the rate of weathering. Weathering is pH dependent, so the lower the pH, the greater will be the weathering rate, the more base cations will be released, the more trace elements will be released. But if the rate of that process does not keep pace with the incoming acidity, then, all other things being equal, the soil will acidify and lead to the adverse consequences of acidification.

So far as the other research projects are concerned, with regard to heavy metals, it's important that we understand the surface interactions between heavy metals and mineral components in the soil, between the clay minerals and hydrous metal oxides and amorphous materials.

We have a number of people working on this, including Eddy Paterson, and also a new recruit, David Lumsdon, who is also working on speciation of heavy metals and of aluminum in soil solutions. Bill McHardy is our expert electron microscopist, and he does a lot of work on clay minerals. Jim Russell retired, but fortunately his right-hand man Tony Fraser is still with us, and I certainly regard him as our expert in infrared spectroscopy. He's worked with Jim and Colin Farmer for many years, and he's an extremely valuable member of the staff. Talking about Colin Farmer, he has now rejoined the institute as a retired member of the staff, and is heavily involved in the synthesis of smectite clays and other clays, so we are very pleased that he has been able to do this. He certainly adds strength to our group.

Turning Point, *continued from page 1*

then the Society Office and Newsletter are our heart. The expanded role of the Office in recent years has not only added a needed measure of professionalism to the Society, but has also greatly improved communication at all levels—both within the Society and with the outside world. It seems obvious that we should concentrate our fiscal and human resources on ensuring the continued success of our publications and meetings, as well as toward a Society Office with a strong and necessary record of service.

Things Done and Undone

To help certain of our *ad hoc* committees run more smoothly, I have consolidated several into a Grants and Awards Committee and a Contributions and Membership Committee, as reported in the last newsletter. I have also created an *ad hoc* Society History Committee to build on the successful history symposium held in Minneapolis. The idea is to organize and preserve our early "memories" before the members who lived them are gone. I dissolved the Publicity Committee and asked our Office Manager to take on the job as part of her duties. The reason is the sometimes erratic performance of this committee in terms of getting meeting announcements out, and because the job of keeping the addresses current and communicating with the public will be more consistently handled by a central office. More on this subject later.

Jeff Walker, as Chair of Continuing Ed, has agreed to be the editor of our Workshop Lectures Series. This position has been essentially abandoned since Fred Mumpton retired, except for a brief stint by Rich Pollastro, who helped with Volume 4. Jeff is presently working on the Neutron Scattering volume; note that this workshop was held in 1990, so we are late again. Without Publications Chair Reed Glasmann's gracious volunteer help in editing, formatting,

and dealing with printing companies, our recently issued and very fine Volume 4 of the Workshop Lectures (Rheology, held in 1989) would have suffered further delay and increased cost. Thanks, Reed! On an even brighter side, Walker and Bob Reynolds are furiously editing material for the 1993 workshop, and it looks like, for once, we will actually have the printed book finished in time for the meeting. Progress! Colin Harvey, newly appointed to the Publications Committee, immediately became involved with the Keller Volume, CMS Special Publication Number 1, which he and Glasmann, with co-editors Haydn Murray and Wayne Bundy, are currently preparing for camera-ready printing. They may have a mock-up to display at the AIPEA meeting in Australia. We need more committee members like Colin—hats off to Colin Harvey!

Editor Ray Ferrell informs me that the Geothermometers issue of *C&CM* will be No. 2 for 1993; you probably have it by now. This issue is based on the Symposium convened by Eric Eslinger and Reed Glasmann at our '91 meeting. Ray encourages others to consider organizing special topics for individual issues of the journal. We are expecting the journal to regain its proper schedule by Fall.

What I did not do, or have not yet done, is to diversify our Endowment Fund's investment portfolio. Presently all our resources are in a single mutual fund: both Treasurer and Council last fall suggested that it would be prudent to split between two or three investment instruments. We are waiting for the Finance and Budget Committee to recommend specific funds. This committee has been rather inactive in recent years, probably due to our very active and able Treasurer, Ken Towe. But this may have to change now that Ken is soon to be Vice President Elect. I would like to take the diversification step, approved by the Executive Committee, before our next Annual Meeting.

Another problem is that after scrapping the Publicity Committee, I discovered that what we really needed was more publicity! We were a little slow in transferring the files of contact people at other societies from the now defunct committee to the Society Office, resulting in late release of information on our upcoming meeting. My fault—sorry. The good side is that a mechanism for sending future announcements is now firmly in place at the Society Office.

Our journal enjoys wide circulation through libraries, but our other publications are almost unknown outside the CMS. This is largely because we do not advertise them except in *C&CM* and the newsletter, and at our meetings. We now have four volumes of the Workshop Lectures with two more nearing completion, not to mention the Keller Kaolinite Special Publication, also soon to go to press. These must be advertised and sent out to other journals for a published review. We owe it to the authors to do this; otherwise their contributions remain buried in obscurity. To my knowledge only Volume 1 of the Workshop series was ever reviewed: this did receive several favorable reviews in international journals. I don't really know if the others were even sent out for review. Whose responsibility is this? I'd say the Publications Committee.

As for advertising—we have begun. I have asked our Office Manager to take on this responsibility as part of her duties relating to publicity. Copy must be prepared and arrangements must be made with other societies, journals, and newsletters. Some will charge us; others, like MSA, will agree to a reciprocal arrangement. We have a full page ad in the recent *Lattice* (MSA newsletter), and ads will soon appear in other publications. Our new Rheology volume is so good, I feel it deserves to be widely publicized. This may cost up front, but I think we can easily recoup

continued on next page

these costs through increased sales. Even if we do not, we have a responsibility to the authors and the discipline to make these publications more widely known. I have not done enough here, but at least we have made a start.

A Turning Point

From several perspectives the CMS has reached a turning point, due both to outside changes, and to our own increased size. First, there has been a major downsizing in the petroleum business, resulting in shrinkage and reorientation of geoscience departments at universities. We are seeing a significant reduction in the number of oil industry-related people in our society and at our meetings. Concurrently, there is an increase in emphasis on environment both in the CMS and at universities. In response, the CMS formed the Regulatory Issues Committee in 1990, a committee that has successfully produced the required MSDS documents for our Source Clays. We look forward to further contributions from this committee and its able chair, Jessica Elzea, as well as Jean Hemzacek, another active member of the committee. I would like to see more environmental papers in *C&CM*. Let's hope that our long, and desirable, relation with industry does not discourage submission of such manuscripts.

We are no longer the cozy little society we once were. Many may regret this—but we have changed. Overall these changes are for the best. Our membership remains at an all-time high of around 980, and our net worth, mostly in the Endowment Fund, is about a million dollars. Our meetings may draw hundreds of people and have several concurrent sessions. Another trend is the increased internationalization of our membership and of journal authors. We need to serve our international members. To reserve our student grants only for Americans, as was done until rather recently, seems petty and xenophobic. The time may soon

come when we run two candidates for vice-president elect instead of the traditional one, unopposed—a real (gasp!) election. There is nothing in the By-Laws against this.

Our way of running many aspects of Society business is no longer in line with what we have become. Specifically, we need more consistency, organization, and professionalism in some of our activities. We can no longer expect our Editor to handle *C&CM* and our other publications and the advertising of all of them, as Fred Mumpton did. We have relied in the past on a very small number of Super Volunteers, the acme of whom was Mumpton. This worked very well: authority was centralized, decisions were made easily, and coordination was ensured. Mumpton's long tenure as editor provided a continuity not found in presidents, councilors, or committee chairs. I don't know how many of you remember or realize how much Fred did for the CMS besides being a very effective editor for more than a decade. He produced the Membership Directory, now done by the Society Office. He represented us at meetings of other societies with a poster display that he made (yes—the same one we are used to seeing Jo Eberl behind), he obtained nicely labeled samples of the Source Clays to give out with an advertising brochure. He was our ambassador around the globe. Today we can't even find anyone to set up a CMS booth at AIPEA in Australia.

However, reliance on the Super Volunteer is risky, as we found when Fred resigned. We come to depend on them, and the parts of our society that might have done some of their job atrophy. A current example is the long-term inactivity of the Finance & Budget Committee, likely due to Super Volunteer Treasurer Ken Towe, who for years did "everything" because it worked smoothly. And is he doing a great job! If we could have him forever, I'd say let's do it. Note that in true Super Spirit he also

served as interim Editor for a year. Unlike the first case, Ken began to see that he was becoming indispensable, and started the process of shifting responsibility to others so he could someday do something else. For example, the Office Manager now creates the budget of the Society Office (including IRS information) as part of her contract.

I've noticed that it is nearly impossible to find another Super Volunteer to replace a retiring one. They don't appear on demand. Thus Normal Volunteer Ray Ferrell, doing an outstanding job as Editor of *C&CM*, has no desire to assume responsibility for any of our other publications, nor should we expect him to. Fortunately, there have been other volunteers, as discussed above. Still, the lines of responsibility for our increasing number of publications are far from clear.

The world is changing: Super Volunteers and even Normal Volunteers are harder to find. It's the mean part of Lean and Mean. Parts of the U.S. Geological Survey now discourage its employees from being editors for professional societies. Many universities no longer value having a volunteer editor on the faculty—what they want is grants. Being the president of a professional society no longer means much if you don't also bring in grant money. In short, most societies like the CMS now have salaried staff and paid editors. Although we will probably not go this far right away, we need to continue the shift of a number of activities, especially those requiring organization, continuity, and communication with the outside, to our Society Office. This means that the Office Manager's contract is going to increase somewhat for a couple of years—but I think this is money very well spent. Which brings us to the inevitable subject of finance.

A surprising fact—the value of our Endowment Fund is similar to, or greater than that of two much larger

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Turning Point, continued

sister organizations: MSA and SSSA. For many years we have been running the CMS from library subscriptions and dues while the Sustaining Member contributions and interest/dividend income were put back into the Endowment. Since we started with practically nothing, this was a sound initial policy for a small, growing society like the CMS. The combination of astute management by Ken Towe and his predecessors with 10 years of a bull market has left us in an enviable financial condition. But... it is not the purpose of the CMS to accumulate assets, but to use them... wisely.

Most CMS people with whom I have spoken, including many long-time members, feel that with about a million dollars in the Endowment, we should now adjust our finances to allow the Endowment to grow at a rate slightly above inflation. Any remaining income should be used to grow, nurture, and benefit clay science. This is not to say that our Endowment is a bottomless slush fund. In fact, a recent downturn in our library subscriptions, likely reflecting global financial conditions, is cause for proceeding cautiously. But proceed we will.

We are not a for-profit business. Our real dividends are publications, meetings, scholarships, and ultimately a vigorous clay science. Our real investments, then, are not in the stock market, but in people—students, members, office managers, editors. I have asked the Finance & Budget Committee to do what it says in the By-Laws that it should do: to investigate our current financial condition and to consider recommending a policy in line with that described above. I do not expect to hear anything from them this year. Maybe, with some changes in the treasurer and committee, next year will be a more opportune time to formulate a new financial strategy. Without ade-

quate financial support for our publications, the Source Clays project, scholarships/grants, meetings, and the Society Office, without reaching out to the changing world, we could die an old, shrinking, but wealthy society.

What do we do now?

I see three areas of concern for the near future: 1) Facilitating and empowering committees, 2) Outreach, publicity and advertising, and 3) Diversity and membership.

I guess inactive committees are a universal concern for presidents of non-profit organizations such as ours. Some say when you use volunteers you get what you pay for. But the problem lies not so much in lazy committee chairs as in the structure of our organization: our committees can meet only once a year. Generally the chair does all of what gets done. There are exceptions: the Nominations Committee typically has lots of communication between members as they work out a slate of candidates. Possibly an electronic "Clay Bulletin Board," as proposed by Eric Eslinger in the first issue of *Clays n' Stuff*, could facilitate communication amongst committee members.

As we reach out, as a society, to the rest of the world, we need to present a high standard of professionalism. Our publicity and advertising need to be consistent and organized (files, letters, lists, etc.). These tasks, which include our Newsletter and Directory, are obviously best done by a permanent entity such as our Society Office. The cost of our office has increased lately, and this trend will very likely continue for a time as long as we keep adding to the office workload. Remember, we don't have Super Volunteers any more! Happily, I think most of us can agree that the CMS has never shown higher quality in endeavors relating to the Society Office than it does today.

The SSSA produced a little book recently called *Opportunities in Basic Soil Science Research*. Its purpose is to reach out to the academic

community beyond just agronomists with exciting news about research. I thought it was very well done. In fact, several CMS members were involved in its production. A similar pamphlet could be produced by the CMS, stressing the environmental, chemical, material, and geologic challenge of clay research.

Diversity is our second name—we need to keep our varied membership involved in Society affairs. Our founders were concerned about this too; that's why the Nominations Committee is specified in the By-Laws to be made up of government, industrial, and academic members. I'm worried because, starting with Reynolds last year, it looks like we'll have six geoscientist presidents in a row. I asked this year's committee to try to pick a non-geologist, but they felt the best qualified just happened to also be geological. This is especially worrisome because it is the geologic part of us that is shrinking—we need to increase involvement of soil scientists, chemists, materials scientists, environmental workers, and civil engineers. Our joint meeting with SSSA last year in Minneapolis is a good example of the kind of outreach activity I am talking about. We can thank Pat Costanzo, chair of Program Development, for helping make this possible. With our growing international membership, we need to find ways of making it easier for them to attend our meetings, and to effectively serve on CMS committees. The Eastern European Liaison Committee is a start in this direction, as is our decision to hold the 1994 Meeting in Canada.

We are at a turning point. Our Endowment Fund is large for a society of our size. The nature of our science is changing: more chemistry—less geology, more environment—less agriculture. We need to use our resources wisely to reach out to and nurture the next, global generation of clay mineralogists.

*D. R. Pevear, President, CMS
Houston, Texas*

Annual Clay Minerals Society Meeting Workshops

Since 1982, the Clay Minerals Society has held a workshop before the annual meeting. The overall theme of the workshop is the application of techniques and methods to the study of clay minerals. A listing of the past workshops are as follows:

1982 Hilo, HI	Sample Preparation Techniques
1983 Buffalo, NY	Infrared Spectroscopy Techniques
1984 Baton Rouge, LA	Use of Clay Minerals in Petroleum Well Logging
1985 Denver, CO	Quantitative Mineral Analysis of Clays
1986 Jackson, MS	Electron-Optical Methods in Clay Science
1987 Socorro, NM	Thermal Analysis in Clay Science
1988 Grand Rapids, MI	Spectroscopic Methods for Clay Analysis
1989 Sacramento, CA	Rheology of Clay/Water Systems
1990 Columbia, MO	Neutron Scattering Technology for Clay Mineral Investigation
1991 Houston, TX	Mössbauer Spectroscopy Techniques
1992 Minneapolis, MN	Layer Charge Characteristics of Clays

In addition, "Computer Methods for Analysis of Clays" will be presented at the 1993 meeting to be held in San Diego. Two other topics that will be presented in the future are "Isotopic Methods Applied to Clays," and "Atomic Force Microscopy," although the dates and locations have yet to be determined.

In order for us to better serve the needs and desires of the membership, we are soliciting input for future workshop topics. Some of the suggestions we have received for workshop topics are as follows:

- Interaction of organic compounds with clays and metal oxides
- Transport of clay minerals with adsorbed substances in the environment
- Pillared and organically modified clays
- Environmental applications of clays
- Practical engineering and commercial uses of clays
- Clay mineral structures and crystallography
- Practical centrifugation, size separations, and size/surface area measurement
- Methods of processing industrial clays
- Synthesis of clay minerals
- Advanced X-ray diffraction methods
- Thermal reactions of clays; applications to ceramics
- Thermodynamic properties and modeling of clay reactions
- Clays as environmental indicators

Are there any previous workshop topics that should be repeated? Do you have any suggestions as to how the workshops can be better conducted? Please forward your comments and suggestions, or just register desire for any of the above potential workshop topics, to Steve Chipera, Los Alamos National Laboratory, Mail Stop D469, Los Alamos, NM 87545. Your comments will be compiled together with the invaluable input we have already received from the workshop attendees and used both to improve the workshops and to make future selections of topics.

In addition, would any of our membership wish to help convene a workshop? A workshop can be held only if there is someone willing to organize and lead it. This would be an excellent opportunity for you to serve both your Society and the advancement of clay mineralogy.

*Steve Chipera
Los Alamos, New Mexico*

Archives

Me 'N Woody

I first met Woody, PFC Horace C. Woodring, in Camp Pickett, Va., sometime in August 1944. He was to be my jeep driver and constant companion for the next year. Woody was a happy-go-lucky GI from Chicago; quiet, efficient and completely dedicated to his job of getting me safely from point to point.

As a newly minted second lieutenant from Ft. Belvoir, I was assigned as a platoon leader in the 264th engineer combat battalion. We were preparing for deployment to the European combat zone.

After unit training and the North Carolina maneuvers under the critical eye of Col. Frank Forney, the officer after whom the Fort Leonard Wood Airfield is named, we were off to the big show.

We spent a relatively comfortable few weeks in England creeping down fogbound roads under blackout conditions and were spared the dangers of the Normandy campaign by our older brothers from previous MSM classes who carried the invasion ball.

Germany was a different story. We were assigned to General George Patton's Third Army. No doubt you've seen it all in the movies. But there were a few humorous and memorable times that were not documented... until now.

One evening at dusk, Woody and I were traveling alone down a road in one of these black, black German forests. We were miles behind German lines because that's how Patton's troops operated.

BANG!
We had a flat tire.

Did you ever see two frantic GIs change a tire in 30 seconds? Woody hit the jack and I dismantled the spare—and we were outta there. Pit crews at the Indianapolis 500 would have been proud of us.

Perhaps our most humorous escapade happened as the war was drawing to a close. We were several miles into German territory scouting bridge sites, when night fell and we were too tired to try a run through the forests to "home." We wheeled into a castle. Castles were mostly abandoned at that time. This one sported a brewery in the cellar and, as I recall, the product was most creditable.

Woody and I ended up in the office of the castle looking for a place to spend the night. We had pulled the jeep into the central castle compound and under an overhang for camouflage. As I think about it now, probably every eye in the town below was watching, but, at that stage of the game, most of the civilian population was beyond caring.

We found a concealed passageway behind a closet in the castle office leading between two of the rooms. There was just enough space in the passageway for one person to sleep.

I said, "Woody, here's your new home." And for me? Well, there was this giant roll-top desk. I crawled in and told Woody to roll down the top and call me in the morning. Fortunately, the night passed uneventfully, and when Woody rolled up the desk top in the morning, I rolled out as stiff as a frozen fish. After he straightened out my



Jack Burst (in foreground) and Woody (in driver's seat) in Germany in 1944.

Courtesy Jack Burst

arms and legs and stood me on my feet, me 'n Woody headed west.

We traveled over 15,000 miles together and then it came to an end when I was ordered to begin the long trek to Japan—a trek that never took place because of Hiroshima. Nevertheless, I left Woody, and he went on to perhaps greater things at Third Army Headquarters.

News Release: Heidelberg, Germany, Dec. 21, 1945.

General George S. Patton died today as a result of injuries suffered in an auto accident on Dec. 9. His driver, PFC. Horace C. Woodring, was uninjured.

Yep! That's my boy, Woody.

Now, when old soldiers reminisce, the talk eventually gets around to Patton and the question is always asked, "How could someone who was a fearless, almost foolhardy combat soldier, courting death in three wars, be struck down in a minor car accident?"

The answer is always the same... perhaps it was his time. My answer is, perhaps it was Woody's passenger's time. I'm glad I was outta there.

Jack Burst

Rolla, Missouri

(Excerpted with permission from MSM Alumnus)

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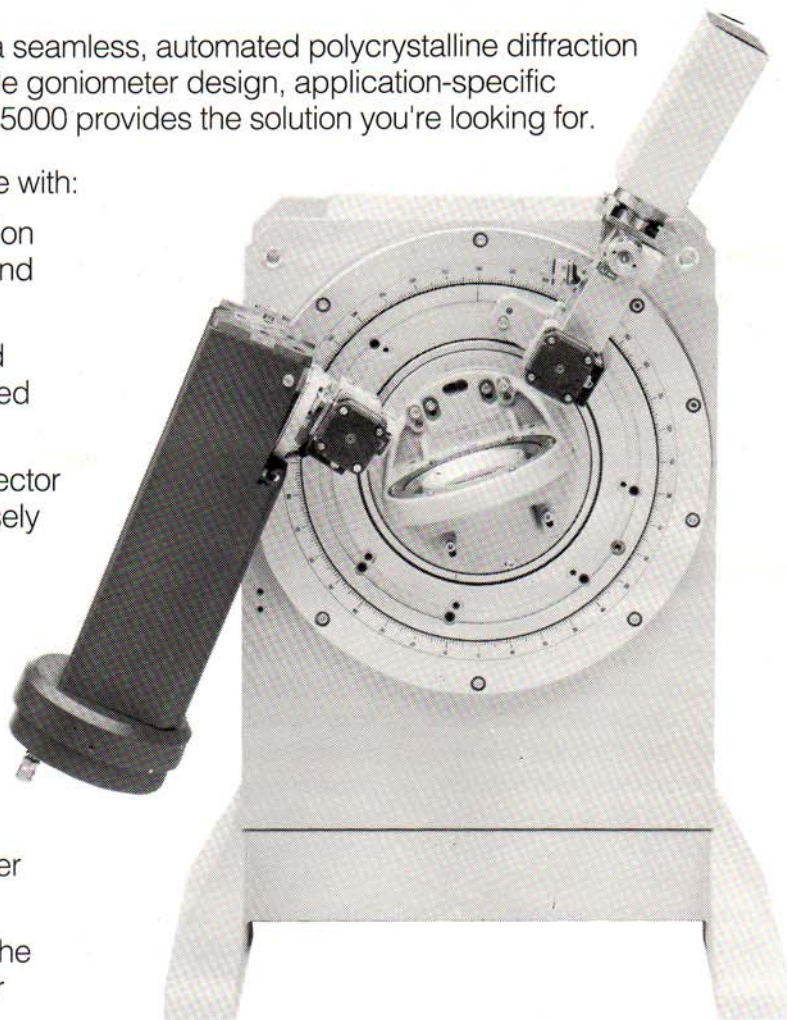
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*Student Profile***Sylvie Furlan****Nationality:** French**Place of study:**

Ph. D. (in progress): Strasbourg, Center of Surface Geochemistry, Université Louis Pasteur.

Thesis Advisor: Norbert Clauer.

Thesis topic: The effects of burial diagenesis in the delta of the Mahakam river (Kalimantan, Indonesia). This study has the interest of the French oil companies. One of the major purposes is an estimation of mass transfers during burial diagenesis, thereby allowing definition of the mechanisms. In order to trace and identify the different processes, I have extracted clay minerals from sandstones and shales. These clays were studied by XRD and geochemistry, and geochemical computer codes were used to quantify the changes. In the same oil-field, shales and sandstones were collected at different depths between subsurface and about 4200 m. I also studied detrital minerals such as feldspars and micas to find out which minerals are supplying what. The preparation of the samples was very long because we used a gentle freezing-thawing technique to preserve the natural size of the rocks' components. We think that this step is most important to obtain reliable results. I used XRD to determine the mineral types, and SEM and TEM observations for the morphology. I then used the K-Ar method to estimate the qualitative aspects of the transfer of K during burial diagenesis related to the process of illitization in the deep buried sediments. Furthermore, I developed a code to model the diffusion of Ar out of the clay depending on the paleotemperatures reached during burial. Presently, I am running Rb-Sr determinations on leachates and residues of fine clay



fractions, in order to differentiate the elements trapped in the clay fractions from those adsorbed or trapped in soluble metastable minerals associated with the clay particles.

Interest in clay:

Clay minerals are very little guys of so much interest because of their fantastic potential for geologic information and use. They represent complex systems because of their size, their structure, and their chemistry, and also because clay fractions often represent mixtures of different types, different generations and/or different origins. They reflect the influence of many parameters such as the chemical and physical conditions of their environment. They can give important information for geologists (chronology and duration of events, paleotemperatures, porosity of rocks, chemistry of fluids, and so on). Clay minerals are certainly the most representative minerals of sedimentary environments. Clays have been so closely associated with the evolution of mankind, pottery, medicine, soil, geology... In the world of geology, clays are associated with mining, oil, geothermy, soil science, waste deposits. It certainly is a material difficult to study, but which

definitely has its interests.

Favorite literature: Historical novels; 19th century French authors such as Hugo, Zola, Stendhal, deMaupassant, Baudelaire, and Verlaine.

Favorite music: Verdi, Rossini, French opera.

Favorite poets: P. Neruda, A. Machado, F. Garcia Lorca, and R. Alberti.

Favorite painters: French impressionists, El Greco, Goya, and Velasquez.

Favorite sports: Hiking and speleology. I prefer outside activities with my friends; my challenges are more



Sylvie Furlan and her advisor, Norbert Clauer, Minneapolis, 1993.
Jo Ebert

for myself. In sports, there is certainly a different mental aspect between French and American students. Indeed we have to learn from American educational system how to become really competitive, as we do not feel competition in the French education.

Favorite quotation: Pasteur (1883) to his parents: "Regarder en haut, apprendre au-delà, chercher a s'elever toujours," (Look to the top, learn beyond, and always try to grow.).

Favorite clay: Mixed-layer illite/smectite!

Health Effects of Mineral Dusts

What: Short Course sponsored by the Mineralogical Society of America
 When: Friday, October 22 to Sunday, October 24, 1993, prior to the GSA Annual Meeting in Boston
 Where: Harbor House Resort and Conference Center on Nantucket
 Who: Conveners: George Guthrie (Los Alamos National Lab) and Brooke Mossman (University of Vermont)



Although the asbestos minerals (fibrous serpentine and amphibole) are notorious as potential health hazards, several other mineral dusts have also been shown to be toxic, fibrogenic, and carcinogenic. The biochemical reactions that lead to disease occur at the mineral-fluid interface. Hence, a thorough understanding of mineral-induced disease requires an integrated approach that addresses mineralogical and geochemical concerns. MSA is convening a 2½-day short course that will bring together experts in both the mineralogical and biological communities to discuss current issues in mineral-dust hazards.

Mineralogical topics will cover: (1) natural occurrences and properties of minerals for which toxicological data have been determined, including structures, compositions, microstructures, and surface properties, (2) analytical techniques for characterizing biologically-important properties, and (3) potential geochemical mechanisms.

Biological topics will cover: (1) epidemiology of mineral-induced disease, (2) biological activities of various minerals, as determined by *in vivo* and *in vitro* assays, and (3) biochemical mechanisms.

Both areas will present sufficient introductory material for individuals outside of the discipline.

The scientific aspects of mineral-related regulatory policies will also be discussed.

The intended audience for this short course includes bioscientists and geoscientists actively involved in research on the health effects of minerals, individuals involved in formulating policies related to mineral regulation, and any individuals interested in an introduction to this topic.

For more information and registration call or write the MSA Business Office, 1130 17th Street, NW, Suite 330, Washington, DC 20036, (202)775-4344, fax:(202)775-0018.

Zeolites, *continued from page 3*

Bright blue skies and unseasonably cool temperatures paved the way for a very successful mid-meeting field trip to the southwestern margin of the Snake River Plain, which was attended by all participants. Among the sites visited were the Ben-Jel bentonite deposit and the Castle Creek zeolite (clinoptilolite) deposit, both of which are in the Miocene Chalk Hills Formation. The field stops painted a beautiful picture of the way in which variable alteration of silicic glass occurred after the ash was deposited in a lacustrine environment where the lake waters were laterally chemically zoned. The optional post-meeting, three-day field trip took participants throughout southeastern Oregon to visit several zeolite deposits in vol-

canigenic sedimentary rocks including the Succor Creek, Durkee (type locality of erionite), Sheaville, Rome, and Harney Lake zeolite deposits.

The organizers are to be complimented on putting together an excellent meeting. If I did not know better, I would have guessed, given the composition of the organizing committee, that the meeting was to have been one convened by the Clay Minerals Society. With CMS members Fred Mumpton (General Chairman), Jim Boles (Program Chairman), Dick Sheppard (Field Trip Chairman), and Doug Ming (Publications Chairman) involved, it is no wonder that I was confused about whether it was a zeolite or a clay minerals meeting. In addition to much of the organizing committee, there were many other CMS members in attendance as well.

Make no mistake, though, it was zeolite through and through, and I left Boise feeling that there is, indeed, a world out there beyond phyllosilicates.

Neil S. Fishman
 Denver, Colorado

Bring announcements to the CMS meeting

Members who are looking for a position, companies who are looking for employees, and others with other kinds of announcements will have a space at the Society table to display their requests. Please see Jo Eberl at the Society display with your information.

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Not to be construed as an endorsement by the journal SCIENCE.

New Members

We welcome the following people who have recently joined The Clay Minerals Society.

Mr. James R. Armstrong
Arizona State University
Dept. of Geology
Tempe, AZ 85287-1404

Ms. Carrie J. Babcock
University of Hawaii
Dept. of Agronomy & Soil Science
1910 East-West Road
Honolulu, HI 96822

Mr. James L. Barton
2708 23rd St.
Lubbock, TX 79410

Mr. Thomas R. Benzing
A538 PSSB
Michigan State University
E. Lansing, MI 48824-1325

Dr. Sathy Chandrasekhar
Scientist, Regional Research Lab.
Thiruvananthapuram
Kerala 695019
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Dept. of Soil & Environ. Sciences
University of California, Riverside
Riverside, CA 92521

Dr. Marc A. Herpfer
Oil-Dri Corporation of America
P. O. Box 200A
Ochlocknee, GA 31773

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Cheney, WA 99004

Mr. Clayton L. Millard
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1005 E. 10th Street
Bloomington, IN 47405

Mr. Mike R. Moilanen
United Catalysts, Inc.
Rheology & Performance Minerals Group
6815 Scottsville Rd.
Floyds Knobs, IN 47119

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College Station, TX 77843-3136

Dr. Darlene Zabowski
College of Forest Resources AR-10
Univ. of Washington
Seattle, WA 98195

Ask the Clay Doctor

(Not a real doctor)

Dear Clay Doctor: I am very worried about my husband, who is a clay scientist. He thinks about clay *all* the time. Will this injure his brain?

Helpless, Boston

Dear Helpless: Your husband is what is known in the trade as a "clay head." Do not worry. The condition is not serious, so long as he does not try to drive a car. Just be thankful that he does not study X-ray diffraction theory. I know of one such scientist who became lost in reciprocal space. He was completely frustrated, because the farther he tried to go, the closer he got.

Dear Clay Doctor: Last year I made what I thought was an important discovery. Recently I discovered that I was wrong. My question is, can this be counted as two discoveries?

Lisa @

Dear Lisa: No, unfortunately, this cannot be counted as two discoveries, but it could be counted as two papers.

Dear Clay Doctor: Is there an equivalent of the Nobel Prize awarded in clay mineralogy? If so, why don't we hear more about it?

Undaunted in Denton

Dear Undaunted: Yes, as a matter of fact, there is such an award, although it has fallen into obscurity in recent years. A search of the archives revealed that in 1846 the Phaltzgraf Accolade, as it is called, was first awarded to the distinguished Brazilian scientist Hermione Munoz for her discovery that gem quality diamonds could be fixed in the interlayer space of some swelling clays. Practical application of this phenomenon led to the second such award in 1902, this time to an Austrian physicist for developing the now legendary clay laser. The next award was in 1924 to Meribel and Claude Aubergine. This talented husband and wife team who left their native France to take up residence at the world-famous Lemmings Institute in Stockholm devoted their entire professional careers to the synthesis of spherical clay crystals. As you know, their prototype led to the development of the Bucky ball. The last award was made posthumously in 1951 to Marvin "Sideburns" McSweeney, a little known but talented researcher whose diligent efforts created the first clay substitute for structural steel. His tragic demise during the

topping off ceremony of his first high-rise office building, when heavy rains caused the collapse of the superstructure, pointed to the one fatal flaw in his otherwise brilliant concept.

Dear Clay Doctor: At first I did not understand it. Then I did. Now I'm not so sure. What do you think?

The Big Kahoona, Hilo

Dear Big Kahoona: That's it exactly! I think.

Dear Clay Doctor: You know, as a Doctor, that carrying a mineral crystal will cure you of what ails you. How large a crystal of quartz is necessary to cure silicosis caused by inhaling clay dust containing 0.1% silica?

Mud Dauber, Columbia

Dear Mud Dauber: A quartz crystal cannot cure silicosis; however, together with the use of a respirator, it can prevent silicosis.

Dear Clay Doctor: Who is this man, what is he pointing to, and where did he learn to dress?

In Love, Boulder



Dear In Love: This creature just wandered out of the mountains into Boulder, carrying a clay tablet. I do not know his name or his clothier, but I do know that he is all heart, man.

Dear Clay Doctor: Are there clays on other planets?

Stargazer, Sandersville

Dear Wondering: Yes, definitely. This information was channeled from a reliable source on the planet Heutron in the constellation Pleiades.

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

Feats of Clay

S. W. Bailey and **R. C. Reynolds, Jr.** have both been awarded AIPEA's Gold Medal in recognition for outstanding contributions to the knowledge of clays. This is the first time the Gold Medal has been awarded.

Jean-Remi Butruille, **Tom Pinnavaia's** student, is the recipient of AIPEA's 1993 Bradley Award.

Haydn Murray has been selected by the Council of the GSA to be a Trustee of GSA.

Chris Canfield, student of **Michelle Hluchy**, was recognized by the Council on Undergraduate Research for the Best Undergraduate Poster Paper at the Northeastern Sectional Meeting of the GSA in March.



Alexander Olis Courtesy A. Olis

Sridhar Komarneni, Professor of Clay Mineralogy at the Materials Research Laboratory and Department of Agronomy, The Pennsylvania State University, has been elevated to Fellow of the American Ceramic Society.

Alexander Olis has taken a position with ABB Environmental Services, Inc., a part of Asea Brown Boveri, Inc., in Orange Park, Florida.

Jeff Walker was awarded an ACS-PRF grant to study disorder in chlorite.

Siva Sivalingam, environmental geochemist with TapanAm Associates, Inc. was an invited speaker at the University of Missouri, Kansas City, Civil Engineering Department, to lecture on "Clay-Chemical Interactions and Its Effects on the Permeability of Clay and Geocomposite Liners."

Lisa Heller-Kallai recently spent two months in Boulder working with **Dennis Eberl**.

Bill Benzel and his wife Julie are the proud new parents of Daniel Eliot Benzel, who joins Joseph Stephen, age 15 months.

Jessica Elzea has taken a position at Thiele Kaolin, gotten married, and moved to a 96-acre farm in Georgia.

Colin Harvey was in Gujarat, India, for 10 days and stopped off in London on his return to run the London Marathon.

Tom Pinnavaia recently had heart surgery and has recovered beautifully. **Herman Roberson** is recovering from heart surgery as well, and according to the latest report, is back on the tennis court.

Rich Pollastro is recovering from two serious episodes of back surgery which forced him to miss the Adelaide meeting.

Gray Thompson is climbing in Bolivia and China before spending his sabbatical year in Ecuador.



Bull Bailey in Minneapolis, 1992.

Jo Eberl



Lisa Heller-Kallai in Strasbourg, 1992,

Jo Eberl

The Society mourns the loss of two lovely and spirited women,
Mariana Johns, wife of **Bill Johns**, and **Bett Jones**, wife of **Blair Jones**.

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Clay Names Quiz

(From the Nomenclature Committee)

Answers from: Mitchell, R. S. (1979) *Mineral Names, van Nostrand*, 229 p.

Answers on page 25

1. PALYGORSKITE is named for
 - A. type of locality of Palygorskaja, Russia
 - B. Russian translation of *My Pal Joey*
 - C. inscription on statue commemorating Ukrainian freedom fighter
 - D. from the Greek (*paly*=linked; *gorso*=ribbons)
 - E. first female winner of Bulgarian kite-flying championships
2. MORDENITE is named for
 - A. Morden Likely, an amateur mineral collector in the 1800's
 - B. locality near Morden, King's County, Nova Scotia
 - C. occurrence as linings in "Cave of Death," Tuscany
 - D. for its use in mordanting, a dye-fixing process
 - E. Elsie Borden's cousin, Morden Borden
3. SERPENTINE is named for
 1. S-folds in Alpine massifs
 - B. Satan
 - C. mineral spirits distilled from turpentine
 - D. memorializes the first man to notice that each hand has five fingers
 - E. Latin *serpens* (=snake), in allusion to some serpentine rocks, which resemble the skin of a serpent
4. FERRIERITE is named for
 - A. iron-bearing
 - B. occupation of shoeing horses (they shoed horses, didn't they?)
 - C. Canadian geologist and mining engineer, W. F. Ferrier (1865-1960)
 - D. sparkling mineral water served in gay bars
 - E. Italian sports car

Gifts and bequests help the Society's programs

Some CMS members have requested information about making bequests or other gifts to the Society. Although it is possible for individuals to become Sustaining Contributors or to make donations to the Undergraduate Student Fund, other ways of financially supporting the Society exist as well. This article describes general estate and income tax planning techniques. We would like to emphasize that each individual's tax circumstances will determine whether any tax benefits are available.

Outright cash gifts, as mentioned above, are the simplest means of making a donation. Such was the case when a recent cash gift was made to fund a lectureship.

Smaller gifts can be made as well, either as a Sustaining Contribution, a contribution to the Undergraduate Student Fund, or as an earmarked gift. An earmarked gift, although welcome, would need to be approved by the Executive Committee before acceptance.

Other outright gifts include gifts of securities, real estate, and life insurance. A donor can make a charitable gift of a publicly-traded security which has appreciated in market value over the long term and pay no capital gains tax when the shares are

transferred to the Society. Closely-held securities can also be used for charitable gifts, with some restrictions. Appreciated real estate is another good asset for charitable giving because, again, the donor will not have to pay capital gains tax on the appreciation portion.

Life insurance can also be used to make a charitable gift that is beneficial to the donor. The donor can retain ownership and name the CMS as primary beneficiary of the policy; at the donor's death, the proceeds of the policy would go to the Society and would generate federal estate tax benefits.

Other types of gift assets include royalties and patents.

The other type of gift (differing from an outright gift) is a retained interest gift, which has two parts or "interests:" the charitable interest and the non-charitable interest. For example, the donor can make a gift to the Society but retain the right to receive income from the gift asset for the remainder of his or her life. Such a gift is partially tax-deductible.

The reverse of this plan is also possible, i.e., the donor keeps the asset but gives the income interest to the Society for the rest of his or her lifetime.

Retained interest gifts can help the

donor generate a significant income tax deduction or reduce potential estate tax exposure, increase retirement income through the conversion of low-yielding or non-yielding, highly appreciated assets, or facilitate the financial transition into a retirement community.

The easiest and most common method of charitable giving is by means of a bequest in the donor's will. Such a bequest is fully deductible for estate tax purposes. Bequests can take the form of specific dollar amounts, specific assets, and percentage of the estate.

The sound financial situation the Society now enjoys has its foundation in the initial and continued gifts of our Sustaining Contributors. As the Society has grown financially, it has also grown in its vision. The Officers and Council are increasing the scope of their efforts on behalf of clay science and the people who practice it, and this would be an excellent time to help the Society expand and work toward its goals.

For more information on making a gift to the Society, please consult the Society Office for guidance.

The information in this article is general and would have to be verified in individual cases by the individual donor's tax advisors.

Four student grants to Adelaide awarded

Four students received CMS travel grants to help defray the cost of airfare to Adelaide to present papers at the Xth International Clay Conference. The awards were made to the following students:

Jean-Remi Butruille, student of T. J. Pinnavaia at Michigan State, and recipient of AIPEA's 1993 Bradley Award, for, "Alumina Pillared Clays as Alkylation Catalysts;" Geging Li, student of D. R. Peacor at the University of Michigan, for "Origin of Clay

Minerals in the Proterozoic (1.1 Ga) Lower Nonesuch Formation at White Pine Mine, Michigan, USA;" Siyuan Shen, student of J. W. Stucki at the University of Illinois, for "Changes in Hydraulic Conductivity of Smectites by Different Reducing Agents and Interlayer Cations;" and Kirsten Verborg, student of Philip Baveye at Cornell University, for "Influence of Quasi-Crystal Formation and Intercrystalline Swelling on Cation Exchange Hysteresis."

Charter Members

The Society Office is trying to locate a complete list of Charter Members. If anyone has access to this information, please contact Jo Eberl.

Answers to Clay Names Quiz (page 24)

- | | |
|------|------|
| 1. A | 3. E |
| 2. B | 4. C |

ICDD Crystallography Awards

To encourage promising graduate students to pursue crystallographically-oriented research, the International Centre has established a Crystallography Scholarship Fund. Applications for the 1994 awards must be received by ICDD no later than 31 October 1993.

Qualifications: A graduate student with major interest in crystallography (crystal structure analysis, crystal morphology, modulated structures, correlation of atomic structure with physical properties, systematic classification of crystal structures, phase identification and materials characterization). There are no restrictions on country, race, age, or sex. The term of the scholarship is one year. Application for one renewal may be made by the recipient at the end of the first year. Because a limited number of scholarships are awarded, renewal applications will be considered on a competitive basis in conjunction with all applications that have been submitted up to closing date.

Submit: A. A one-page proposal by the graduate student describing the type of crystallographic research to be partially supported by scholarship. B. A supportive letter from the sponsoring professor of an accredited university or institute of technology.

Restrictions: A. The scholarship stipend of \$2000 is to be used by the graduate student to help defray tuition and laboratory fees. A portion of the stipend may be applied to registration fees to accredited scientific meetings related to crystallography. B. No more than one scholarship will be awarded to any one accredited institution per year. C. The funds of the scholarship are not to be used for travel.

Applications should be mailed, prior to 31 October 1993, to: Secretary, International Centre for Diffraction Data, Newtown Square Corporate Campus, 12 Campus Boulevard, Newtown Square, PA 19073-3273.

Meeting Calendar

September 23, 1993, BGS, Nottingham, England: Image Analysis in Mineralogy (Applied Mineralogy Group). Contact: N. J. Fortey, Mineralogical Society, 41 Queen's Gate, London SW7 5HR, UK. Tel: 071-584-7516; Fax: 071-823-8021.

September 25-30, 1993, San Diego, California: CMS Annual Meeting. Contact: Dr. Richard W. Berry, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182. Tel: 619-594-6394; Fax: 619-594-4372.

September 28-29, 1993, Cambridge, England: Dehydration and Melting during High Pressure Metamorphism (Metamorphic Studies Group). Contact: J. Baker & M. Bickle, Mineralogical Society, 41 Queen's Gate, London SW7 5HR, UK. Tel: 071-584-7516; Fax: 071-823-8021.

October 25-28, 1993, Boston, Massachusetts: GSA and MSA Annual Meetings. Contact: GSA. Tel: 303-447-2020.

November 3, 1993, Manchester, England: Research in Progress (Geochemistry Group). Contact: Mineralogical Society, 41 Queen's Gate, London SW7 5HR, UK. Tel: 071-584-7516; Fax: 071-823-8021.

November 15-30, 1993, Santiago, Chile: Low temperature metamorphism: processes, products and economic significance.

Contact: Professor Mario Vergara, Universidad de Chile, Depto. de Geología y Geofísica, Casilla 13518, Correo 21, Santiago, Chile.

November 27, 1993, Manchester, England: The Geochemistry of Energy: a Workshop (Geochemistry Group). Contact: D.A.C. Manning, Mineralogical Society, 41 Queen's Gate, London SW7 5HR, UK. Tel: 071-584-7516; Fax: 071-823-8021.

April 13-15, 1994, London, England: EMPG-V - Fifth International Symposium of Experimental Mineralogy, Petrology, and Geochemistry. Contact: Dr. R. J. Angel, Dept. Geological Sciences, University College London, Gower Street, London WC1E 6BT, UK. Tel: 44-71-387-7050; Fax: 44-71-388-7614.

August 14-19, 1994, Saskatoon, Saskatchewan, Canada: CMS Annual Meeting. Contact: A. R. Mermut, Department of Soil Science, University of Saskatchewan, Saskatoon, SK S7N 0W0 Canada. Tel: 306-966-6839; Fax: 306-966-6881.

August 29-September 2, 1994, Edinburgh, Scotland: VM Goldschmidt Conference—An International Conference for the Advancement of Geochemistry. Contact: Dr. Peter Symms, Dept. of Geology & Geophysics, The University of Edinburgh, The Grant Institute, West Mains Rd., Edinburgh EH9 3JW, Scotland.

Ken Towe's theory supported

CMS Treasurer Ken Towe was mentioned in the August issue of *Scientific American*. A recent discovery suggesting that microorganisms had reached a significant degree of complexity at least 3.645 billion years ago backs up Towe's argument that cyanobacteria caused oxygen to build up in the atmosphere as long ago as 3.5 billion years, rather than the more common notion of two billion years.

Welcome, new sustaining members

The Society welcomes several new Sustaining Contributors this year: Alpha Earth, Inc., Golden Cat Corporation, Texaco EPTD, and Willamette Geological Services. The contributions of Sustaining Members help support Society programs such as student research grants and plenary speakers.

New Volumes, *continued from page 1*

R. C. Reynolds, Jr., and Jeffrey R. Walker. Chapters include "An Introduction to Computer Modeling of Powder X-ray Diffraction Patterns of Clay Minerals: A Guided Tour of NEWMOD[®]," by J. R. Walker; "Inverting the NEWMOD[®] X-ray Diffraction Forward Model for Clay Minerals using Genetic Algorithms," by D. R. Pevear and J. F. Schuette; "Three-Dimensional Powder X-ray Diffraction from Disordered Illite: Simulation and Interpretation of the Diffraction Patterns," by R. C. Reynolds, Jr.; "Studies of Clays and Clay Minerals Using X-ray Powder Diffraction and the Rietveld Method," by D. L. Bish; "Illite Crystallite Thickness by X-ray Diffraction," by D. D. Eberl and A. Blum; and "A Computer Technique of Rapid Decomposition of X-ray Diffraction Instrumental Aberrations from Mineral Line Profiles," by R. C. Jones and H. U. Malik.

The *Keller '90 Kaolin Symposium*, edited by Haydn H. Murray, Wayne M. Bundy, and Colin C. Harvey, is an outgrowth of the 1990 Symposium by the same name. It also includes an article by Haydn Murray and Walter Keller that was first published in 1937.

In part, Murray's draft introduction reads, "The *Keller '90 Symposium* was easy to organize largely because of the prestige of Walter Keller. How many geologists do we know who are still active clay mineralogists and geologists at the age of 90 plus? He is indeed a remarkable person. He was an outstanding teacher and a world-renowned clay mineralogist... This spring (1993) I gave a paper on the Minnesota River Valley Kaolins at the North Central meeting of the Geological Society of America held at the University of Missouri-Rolla. The person in attendance who asked the most questions and was most interested was Walter D. Keller."

Papers in the volume include the following: "Kaolins, Kaolins, and

Kaolins," by Haydn H. Murray and Walter D. Keller; "Review of the Structural Relationships of the Kaolin Minerals," by Sturges W. Bailey; "The Diverse Industrial Applications of Kaolin," by Wayne M. Bundy; "Theories of Origin for the Georgia Kaolins: A Review," by Thomas Dombrowski; "Recrystallization of Kaolinite in Gray Kaolins," by G. Norman White, J. B. Dixon, R. M. Weaver, and A. C. Kunkle; "SEM Investigation of a Lateritic Weathering Profile, Saline County, Arkansas," by Timothy L. Salter and Haydn H. Murray; "The Mineralogical and Geochemical Controls that Source Rocks Impose on Sedimentary Kaolins," by Robert J. Pruett and Haydn H. Murray; "The Genesis of China Clays of South-west England—A Multistage Story," by Colin M. Bristow; "Mobility of U and Granite Kaolinization in Southwest England," by B. B. M. Dewu and E. M. Durrance; "First Occurrence of Dickite in 'Varicolored Clays' in the Northern Apennines (Oltrepo Pavese), Italy," by F. Celle', P. Granata, M. Setti, and F. Veniale; "The Geology, Mineralogy and Exploitation of Halloysite Clays of Northland, New Zealand," by Colin C. Harvey and Haydn H. Murray; "Mineralogical and Physical Properties of the Maoming Kaolin from Guangdong Province, South China," by Jun Yuan and Haydn H. Murray; "Genetic Significance of Paramagnetic Centers in Kaolinites," by Jean-Pierre Muller and George Calas; "The Nature, Detection, Occurrence, and Origin of Kaolinite/Smectite," by R. E. Hughes, D. M. Moore, and R. C. Reynolds, Jr.; and "The Hydrothermal Synthesis of Kaolinite up to 350°C," by G. Lahodny-Sarc, Z. Dragcevic, and W. D. Keller.

Both volumes will be available from the Society Office—*Computer Applications to X-ray Diffraction Analysis of Clay Minerals* at a price of \$15.00 plus \$2.00 handling, and *The Keller '90 Kaolin Symposium* at a price of \$20.00 plus \$2.00 handling.

Clays & Stuff

Eric Eslinger has initiated a newsletter called *Clays & Stuff*. A first issue has been distributed, and a second will be out shortly. The primary purpose of *Clays & Stuff* is to provide short reviews (a sentence to a paragraph) of clay papers culled from a variety of geological, engineering, chemical, and other publications. The goal is to provide reviews that transect the several disciplines that are concerned with clays, clay minerals, and clay processes. Editorial comments and vignettes provided by readers will be included. Classified ads will be accepted, including solicitations for employment.

Six editions per year are planned. Subscription rates are: Professional—\$40/yr (add \$10 if non-U.S.); Corporate or Library—\$200/yr (add \$50 to Corporate subscriptions if non-U.S.). Corporate subscribers will receive up to 10 copies of each issue sent directly to addresses of the (up to 10) designated employees. Subscriptions can be sent (with check [in U.S. dollars on a U.S. bank] or international money order) to: Alpha Earth, Inc., 10 Sussex Road, Glenmont, NY 12077, USA. For more information, call 1-518-439-8447 or fax 1-518-439-8582.

Back issues available, back issues wanted

A member who has a complete set of back issues of *Clays and Clay Minerals* has requested that we make known the fact that he is willing to sell them. If anyone would like to make an offer, please contact the Society Office.

Meanwhile, the Society Office is looking for a donation of the Pergamon Press back issues. If anyone has a set of these and would be willing to donate or bequeath them to the Society, please contact the Society Office.

Sustaining Member Profile

Wyo-Ben, Inc.

Wyo-Ben, Inc., is a privately held Montana Corporation which, today, is engaged exclusively in the mining, processing, and marketing of Western or Wyoming Bentonite for the worldwide marketplace. It was founded by Keith Brown, father of President David Brown and Vice President Richard Brown, and is the only closely owned bentonite company left. Our corporate headquarters are located in Billings, Montana, while our production facilities are located at Lovell, Greybull, and Thermopolis, Wyoming.

The origin of the company stems from a partnership which was formed in 1950 for the purpose of mining and processing bentonite from deposits located in the Greybull area. In the company's first year of operation, it produced 15,000 tons of milled bentonite, which was sold for rotary oil drilling and well cementing. Over the next few years, the company's business grew steadily, supported by an expanding economy and a rapid increase in the growth of the oil well drilling industry. The plant at Greybull was expanded in the mid-1950's to a production capacity of 100,000 tons per year to meet the increasing demand for bentonite products from the drilling industry.

Beginning in 1954, Wyo-Ben provided bentonite to a pilot plant at Aurora, Minnesota, which was engaged in developing a process for concentrating and pelletizing taconite (low grade) iron ore. The development of iron ore pelletizing using bentonite as a binder proved successful, and the technology was adopted on a wide scale by the iron ore industry by the early 1960's. By the mid 1960's, both milled and un-milled (semi-dried crude) product was being demanded by the iron ore pelletizing industry. As a result, the production capacity of

the Greybull plant was again expanded, now to 275,000 tons per year.

By the late 1960's, the continuing expansion of both the iron ore pelletizing and oil well drilling markets had outstripped the production capacity of the Greybull production facility. As a result, a second production facility at Lovell was constructed in 1970-71. This plant, with an initial production capacity of

425,000 tons per year, was initially dedicated to producing both milled and semi-dried crude bentonite for the iron ore pelletizing industry. The production of oil well drilling products remained at the Greybull plant.

By the mid 1970's, a number of large scale pelletizing plants had been developed, principally in the U.S. and Canada, resulting in the iron ore pelletizing industry becoming the second largest consumer of Wyoming bentonite. By this time, Wyo-Ben was the largest supplier of bentonite to the iron ore pelletizing industry, with markets around the world.

The continuing increase in demand for Western Bentonite during the 1970's led us to construct our third plant at Thermopolis in 1979. With an initial capacity of 300,000 tons per year, this plant was primarily dedicated to satisfying the demand for iron ore pelletizing product. At the same time, the production at our Lovell plant was shifted to include a wide variety of specialty products.

By the late 1950's a civil engineering technique termed slurry trench excavation, with soil-bentonite backfill, was developed in Italy for controlling the subsurface movement of water using *in situ* vertical barriers.



David Brown, President, and Richard Brown, Vice President, Resources, Wyo-Ben, Inc. Courtesy Wyo-Ben

In 1959, Wyo-Ben's products were used in the first large slurry trench project in the U.S. during the construction of the Wanapum Dam on the Columbia River in Washington state. Also about this time, Wyoming bentonite began to be used in sealing surface structures such as ditches, canals, and sewage lagoons. During the early 1970's, this horizontal sealing technology was expanded to include the sealing of a wide variety of municipal, industrial, and hazardous waste containment structures.

Throughout this period, Wyo-Ben has been very active in both the civil engineering and environmental sealing markets. Today our products are regularly used around the world for all types of civil engineering and environmental sealing projects.

Other markets to which the company supplies bentonite products include the small bore (water well, mineral exploration, monitoring well, etc.) drilling industry, the foundry industry where bentonite is used to bind sand in the green sand molding process, in the animal feed industry for binding animal feeds, and as a feed

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Wyo-Ben, *continued from previous page*

supplement, and in hundreds of other industrial and consumer-related specialty formulations.

With a current combined production capacity at our three plants exceeding one million tons per year, Wyo-Ben ranks as one of the top two worldwide producers of bentonite products. This is accomplished with a work force of approximately 110 people, the majority of whom work in the Wyoming production facilities.

As part of our ongoing market development program, Wyo-Ben has always maintained an active product research program. The product research and development department, which is headquartered at our Billings, Montana, laboratory, is principally concerned with applied rather than pure research. As a result, most of our efforts are devoted to finding ways to improve our existing line of products and developing new products, all to meet the increasing diversity and sophistication of the worldwide bentonite markets. Product development work is carried out at both the Billings and the Greybull lab facilities. Additionally, labs in each plant, whose day-to-day task is quality control, also are used when new product technologies are ready for production testing and for scale up to full production.

We view the maintenance of an active research department as critical to the future success of our company. In the past, bentonite has been viewed by both producers and consumers as primarily a commodity mineral which is supplied to high volume users at

relatively low prices. For some time now, however, our research efforts have been directed toward the development of products to meet a variety of low volume, high price specialty markets. We see the development of these value-added, "high tech" products as being the key to our future success as a company, as well as the success of the bentonite industry as a whole.

Because of our very specific target of applied research, we view participation in societies such as The Clay Minerals Society as especially important to our research program. It is through these societies that we are able to stay in contact with researchers (primarily academic) who are engaged in conducting the bulk of pure research. The exchange of information and ideas with these researchers significantly assists our own research efforts. Although we could probably gain a significant amount of information by merely subscribing to journals like *Clays and Clay Minerals*, we feel strongly that it is important to give something back to the research community. This is why we have and will continue to participate as a Sustaining Member of The Clay Minerals Society.

One of the principal issues facing the bentonite industry, as well as the clay industry as a whole, is that of the presence of crystalline silica in clay products and its health and safety implications. For many years we have been told by both private and governmental experts in industrial toxicology that bentonite contains quartz, cristobalite, and even sometimes tridymite. Both cristobalite and

tridymite are known to be significant health hazards. Recently evidence has come to light which demonstrates that tridymite is not present in bentonite, and what was thought to be cristobalite is actually a form of opal. Because the toxicological implications for these discoveries are so great, they have potential to dramatically affect the salability of Wyoming Bentonite in all worldwide markets. Unfortunately, government regulators at OSHA and MSHA have yet to accept the evidence presented to them. Until the question of the presence of these hazardous mineral species in bentonite is resolved, there will continue to be a question about the safety of all bentonite products in the minds of many consumers.

Another critical issue facing the bentonite issue is the pending legislation to radically change the 1872 Mining Law, the law which regulates the mining of most of the Wyoming Bentonite which is sold. Here, bentonite and some other clay minerals have been lumped with the precious metals by mining opponents during the political debate about the legislation. As a result, the uniqueness of the clay minerals, such as bentonite, and their limited ability to bear additional federally mandated costs for holding mining claims or for production royalties has not been recognized. The passage of the proposed legislation in its present form, therefore, has the potential to significantly weaken the domestic bentonite industry in an increasingly competitive worldwide bentonite market.

ICDD Announces 1993 Crystallography Scholarship Awards

The International Centre for Diffraction Data is pleased to announce the awarding of two Crystallography Scholarships for 1993.

Janet M.S. Skakle, University of Aberdeen, Scotland, and Peter C. Burns, The University of Manitoba, Canada, have been selected as the recipients by the ICDD Scholarship Award Selection Committee. Janet Skakle is pursuing a Ph.D. degree studying structures of a variety of barium rare-earth titanates using neutron and X-ray diffraction. Peter Burns is conducting graduate studies on the stereochemistry of Cu^{2+} Oxsalt Minerals.

Commentary

Zeolites and Clay Minerals at Olduvai Gorge: a Look Back

The Olduvai Gorge in northern Tanzania was a most exciting place to do geology in 1962, when I made my first trip there. A lengthy sequence of stone tools had been documented by Louis and Mary Leakey, and in 1959 Mary Leakey discovered the skull of a hominid, first named "Zinjanthropus" (= *Australopithecus boisei*), associated with stone tools. Remains of a different hominid, designated *Homo habilis*, were found a short time later in equivalent deposits. These fossils were assigned an age of ~1.75 Ma in 1961 by two of my Berkeley colleagues, Jack Evernden and Garniss Curtis, who were applying the K-Ar method of dating to Pleistocene rocks. This dating was highly controversial because of the unexpectedly great age for tool-making hominids and for the Pleistocene fossils in these deposits. In 1961, the Pleistocene was generally considered to have a time span on the order of 0.4 to 0.8 Ma.

I was invited to work at Olduvai Gorge on the stratigraphy of Bed I, the oldest deposits with hominid fossils and stone tools, in order to help resolve the controversy over the K-Ar dating. To me, the greatest attraction at Olduvai was the zeolites, which were abundant in most of the samples that Garniss Curtis brought back for dating in 1961. My principal scientific interest was then in the zeolitic alteration of tuffs. Unknowingly, work with Rich Moiola (Mobil Research and Development) on drill cores from lakes in the Mojave Desert had prepared me for work at Olduvai.



Richard Hay, flanked by Eric Eslinger and Gray Thompson, in Minneapolis, 1992.

Jo Ebert

Particularly important were sediments from Searles Lake, California, which has been a saline and highly alkaline playa or lake for the past 1.3 Ma. Its water chemistry had left a distinctive imprint on the sediments. Authigenic K-feldspar is a common constituent of lacustrine clays, and siliceous ash layers are altered to the zeolite phillipsite or to K-feldspar.

At Olduvai Gorge, zeolites were even more abundant and varied than I had expected. Of paleoclimatic interest were the lake deposits of Bed I. The clays contain K-feldspar, and the tuffs are altered to phillipsite and K-feldspar, suggesting that the lake had been chemically similar to Searles Lake, and the climate relatively hot and dry. This contradicted Louis Leakey's pluvial-interpluvial scheme in which a fresh-water lake was associated with a humid climate for Bed I. Louis graciously accepted the disappearance of his fresh-water lake when I pointed out that the hippo, crocodile, and other Bed I fossils were situated where fresh-water streams entered the lake.

The first application of clay mineralogy was to Bed III, The Red Bed, which catches the eye of all geolo-

gists. In the 1930's, Leakey's geologist Hans Reck had attributed the red color to alteration of volcanic alluvium in an arid climate. Following the pendulum swing in redbed interpretation from arid to humid, the eminent Pleistocene geologist Richard Flint was among those who considered Bed III as probably reflecting a humid climate. To me, the content of analcime and illite, together with the absence of kaolinite, were unmistakable indications of aridity.

Though not well grounded in clay mineralogy, I made a study of clay and zeolite mineralogy, published in 1970. This erred seriously on the origin on the lacustrine clay minerals in Beds I and II. These are almost exclusively smectite and illite, both of which were considered detrital, the smectite from large volcanoes and illite from Precambrian granitic and metamorphic rocks on the other side of the lake. Searles Lake had one more lesson to give. Work on another drill core, begun at Berkeley by Sandra Goldman and others and finished at Champaign-Urbana by Jay Matthews, Rob Lander, and Mike Duffin, showed that the clays deposited in saline, highly alkaline phases of the lake consist largely of clay minerals formed in the lake: Mg-rich smectite and illite rich in Fe and Mg. A restudy of the Olduvai samples collected long ago, supplemented by more collected in 1989, showed that clays of the Olduvai lake are mineralogically similar to those of Searles Lake. Soil samples from the slopes

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Commentary—Keller's Occasional Brain Storms

(KOBs, the residue left after the kernels of wisdom are harvested from the "Ear of Knowledge")

Aphorisms on Teaching and Learning

It's not how much you teach, but how much the students learn and take away that counts. I first heard this from a board member of my elementary school, who said about his schooling in 1890, "The reason Mr. Smith was the best teacher I ever had was that he lernt me more than any other teacher did."

* Teach students first, and then subject matter. Remember "Mark Hopkins and his student on a log," the ideal University, as described by President Garfield.

* Teach concepts supported by facts, rather than the other way around.

* The most valuable thing you can teach in class is for the students to enjoy learning and to keep on learning on their own desire. This statement is based on an alumni poll, "What is the most valuable thing you learned in class?"

* Plutarch said, "The goal of effective teaching is not to fill a vessel but instead, to light a flame."

* Make teaching and learning a team effort: "We" rather than "you or them," which is more of a take it or leave it confrontation.

* Infectious enthusiasm for the subject by the teacher is an irreplaceable must to achieve learning by the students.

* To achieve learning of science by non-science majors, use a teaching approach beginning with tangible, familiar things such that the non-science student can personally identify with, and from them go to the more (indeed, most) theoretical concepts.

* Any subject, scientific or humanistic, is made interesting, and learned with enjoyment, when identified with the intelligent life of the potential student.

* In a classroom, the report of re-

search that I (the teacher) did stimulates far more interest than what Leonardo or Gallileo did. Likewise, a contribution from a fellow student to the class commands more attention than from possibly even the teacher. Teaching students is more effective than a "take it or leave it" subject-matter irresponsibility.

* What is/are the ultimate role, goal, and responsibility of universities in our American *democracy*? Is it not to serve as *leaders* in development of the finest human culture possible? The team of teachers with their students should serve as role models in responsibility for *Homo* indeed *sapiens*. Are universities, teachers, and students filling that role and adequately discharging that responsibility meriting "*sapiens*?"

W. D. Keller, Retired "Prof."
Columbia, Missouri

Olduvai Gorge,

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of the volcanoes that drained into the lake proved to be mostly of poorly crystalline and X-ray amorphous materials, quite unlike any of the lacustrine clays.

Thus the clay minerals now reinforce the zeolites and K-feldspar in documenting a saline, highly alkaline lake and a warm and relatively dry climate, ideal for habitation by our early, unclothed ancestors. From the standpoint of geochemistry, it is now clear that clay minerals and K-feldspar were the sinks for the SiO₂, Mg, Fe, and K dissolved in water of this closed lake basin.

Richard L. Hay
Ralph E. Grim Professor of Geology
Urbana, Illinois

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be the pre-meeting workshop on computer applications, led by R. C. Reynolds. The technical program, organized by Roger Burtner, Eric Daniels, and Marion Reed, will include General Sessions, Clays and the Environment, Hydrothermal Clays, Teaching Clay Mineralogy, and Industrial Applications of Clay Minerals.

Two field trips will be held: Rare Element Granitic Pegmatites of the Peninsular Ranges Batholith, and Waxy Bentonites of Western San Diego County.

The Distinguished Member Lecture will be given by Thomas J. Pinnavaia, the Brindley Lecture by Dennis D. Eberl, and the Jackson Mid-Career Clay Scientist Lecture by Jan Srodon.

In addition, there will be a banquet

and other social events, as well as spouse events.

For more information, please contact Richard W. Berry, Department of Geological Sciences, San Diego State University, San Diego, CA 92182. Telephone: 619-594-6394; fax 619-594-4372. If you would like a meeting registration packet, please contact the Society Office.

The Annual Meeting is traditionally a place where friends and colleagues, old and new, meet, and is an excellent opportunity for students and others new to the field to meet the patriarchs and matriarchs of the field. One of the distinguishing marks of our Society is the relatively small size of the meetings, which fosters a warm feeling among its attendees. We hope to see many of you there.

