

The Geological Society of America Looks at Earth Science Education

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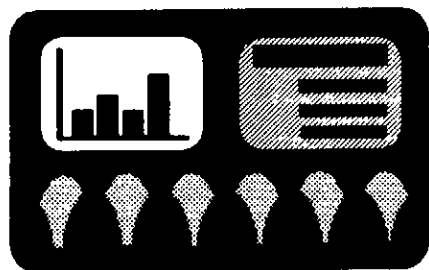
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Conference Reports



The Geological Society of America Looks at Earth Science Education

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INTRODUCTION

It is significant that the very first Presidential Conference of the Geological Society of America (GSA) should be entitled "Earth Science Education: Crossing the Precollege-College Barrier". It is not surprising, however, that it was called by immediate Past President E-an Zen, internationally renowned laboratory and field scientist and Day Medallist. Both E-an's first and last presidential communications in the newsletter *GSA Today* contain urgent calls for geoscientists to move beyond their research preoccupations and become involved in education and other forms of public outreach. He has long practised what he preaches and is well known to school teachers and environmentalists across the United States.

Together with Ed Geary, GSA's dynamic co-ordinator of educational programs, E-an raised money from the National Science Foundation (NSF) to bring 50 people to Wingspread, near Racine, Wisconsin, 14-17 January 1993, where the Johnson Foundation do-

nated meals and meeting facilities. (For fuller details and different emphases, the reader is referred to a report written by the organizers that appears in *GSA Today*, v. 3, n. 4, p. 86-87.)

The participants covered the complete spectrum from elementary school teachers to a university president. Several held senior posts in national scientific and science teaching organizations. Curriculum specialists and school science co-ordinators were also present. Participants had also been chosen to represent active pockets of interest in earth science education across the country so that they could band together as catalytic pilot groups after the conference. Your reporter was the lone Canadian and was generously permitted to move between focus groups as an observer.

The conference addressed key issues limiting the effectiveness of earth science education as a mechanism for promoting scientific literacy. This involved concerns such as:

- 1) perceptions that earth science is "second-class" science;
- 2) promotion systems that fail to recognize good teaching;
- 3) inadequate preparation of teachers at all levels: elementary, high school and university (*i.e.*, K-16); and
- 4) the need for opportunities for teachers at all levels to enhance their knowledge of what to teach and how to teach it.

These concerns were addressed through plenary sessions involving panels or individual speakers, followed by focus groups (*i.e.*, workshops) that tackled specific topics and then reported back to the plenary. Some of the points made (including those at the table and at the bar), conclusions drawn, and actions projected are reported below.

THE JOY OF TEACHING

An elementary school teacher from

New Orleans inner core stated that she had very little time to prepare from one class to the next, no budget for equipment or supplies ("I'm lucky if the kids have pencils and paper"), and only one professional day per year. Earning an MSc was rewarded with a raise of \$17.00 per month. "I love the kids and my job," she said, "but I wish someone would recognize what I'm trying to do and would help".

A teacher from a Colorado high school said that her school district is at the bottom of the financial heap. Her charges include sexually abused kids and gun-toting young ruffians (one committed a murder over the last holiday season). She and her colleagues work a great deal of overtime, they are constantly criticized, and morale is low. She was almost in tears as she listed the host of extraneous problems that impinge on her earth science teaching.

An inner city California high school teacher claimed most of his students and their parents have no interest in learning. He plugs on for the benefit of a handful who are interested in science, and his reward is the few who break out of their environment. He sees no hope for a change in this situation until economic improvements and a related drop in birth rates reaches into city cores.

Almost all teachers present are frustrated by having rules, dictums and curricular changes handed down from on high with no chance for input. Several participants were sufficiently moved by these accounts to pledge to take up their pens when the next wave of teacher bashing reaches their local newspapers.

STATUS OF EARTH SCIENCE IN THE SCHOOLS

Earth science (ES) in American schools consists of geology with varying amounts of astronomy, oceanography and meteorology. The United States

school system is even more chaotic than the Canadian: 16,000 independent districts have mathematics and science programs of their own selection. Approximately 14% of students in grades 7-9 are enrolled in ES courses, but only about 3% of schools with grades 10-12 now offer ES courses. Still, it is a big country and that means more than one million students take ES each year. Participants agreed that ES was treated as a "second-rate" science in most schools. At entrance, it is not accepted by most universities as a laboratory science credit. This angers teachers who say that, where qualified teachers are available, it is a much more rigorous laboratory course than chemistry or physics. The AAAS Project 2061 and other proposals for a national science curriculum seem to have little sympathy for the inclusion of ES in a revised curriculum.

There are several projects underway designed to change this state of affairs.

- 1) ESTEEM (ES Teachers Exploring Exemplary Materials) is a Harvard-based program that will bring 120 master teachers to intensive, three-week workshops. They will then return to their own schools to teach, but with the added responsibility of conducting ESTEEM workshops for other earth science teachers in their districts or states, introducing them to new methods, new examples, and new display materials.
- 2) A nation-wide NSF program called the Statewide Systemic Initiative (SIS) is designed to reform mathematics and science education. Twenty states have already qualified for funding. One of the leaders is Virginia. Its VQUEST program is tackling science teaching on many fronts (e.g., teacher training, communications technology, and instructional materials reform).
- 3) Another project is Program for Leadership in Earth Systems Education (PLESE), which operates out of Ohio State University. It uses the subject of all scientific investigations, namely planet Earth, as the unifying theme of K-12 science curricula. Any physical, chemical or biological process can be taught in the context of its earth subsystem. Pilot projects to test earth systems education have been successfully carried out in a central Ohio high school.

For your reporter, hearing and read-

ing about these ES initiatives was one of the highlights of the Earth Science Education meeting at Wingspread.

ES TEACHER PREPARATION

There is a distinct shortage of well-trained ES teachers. Many of those teaching ES come from other backgrounds, particularly biology. This leads to heavy reliance on textbooks and a dearth of field trips and hands-on laboratory exercises.

There are many causes of inadequate preparation: teacher certification requirements vary widely from state to state, and some are less than rigorous in the sciences. A common complaint in Canada was echoed at Wingspread, namely that there was often more emphasis on pedagogy than content in university courses. There were, however, also legitimate complaints levelled at university and college science courses that did not satisfy the needs of potential K-12 teachers.

Many positive suggestions were made for improvements. For example, it was suggested that K-12 master teachers be invited to help plan and teach ES content and methodology college courses, and that college professors be invited to serve as aides or co-teachers in order to become or remain aware of the needs of the K-12 classrooms. Some university administrators present promised to attempt to follow through on these suggestions. I was impressed to find out that, in some enlightened universities, science teacher training actually takes place in science faculties. Also, a few institutions (e.g., the Center for Science Education at the University of South Carolina) have developed model programs at both undergraduate and post graduate levels that are closely integrated with the needs of K-12 teachers.

THE REWARDS FOR GOOD TEACHING

There was almost universal agreement that good teaching in the entire K-16 sphere was seldom appropriately rewarded. At the K-12 level, recognition by peers or principals was rare, financial or other incentives, nonexistent. At colleges and universities, professors are still convinced that if you know your subject, there is no trouble teaching it, and they pride themselves on their lack of training. Universities profess to recognize research, teaching and ser-

vice equally, but in practice, only research productivity is rewarded.

Everyone agreed that ES teachers at all levels should be eligible to have their professional teaching contributions recognized by peers and by society. To effect this, scientific societies and educational institutions must develop techniques for establishing and evaluating quality classroom teaching.

A much-cited Syracuse University study of rewards shows that faculty priorities are first determined by their disciplinary associations and second by their departments. Societies such as GSA can best revise tenure and promotion guidelines by communicating with their members and with chairs of earth science departments. GSA and other societies should also establish ES teacher awards at various levels in the K-16 system. Of a dozen other recommendations for action, one by President E-an Zen stands out. He said it should be desirable for assistant professors aspiring for tenure to spend one day per week for a term with a K-12 master teacher in both school and university classrooms. At least one dean, of a prestigious science faculty, stated that he would attempt to implement this at his university. We shall see!

A university president and a couple of deans said there is no better time than the present to foster interactions between the universities and the K-12 system. Universities are under fire from all sides and are looking for new initiatives.

TEXTBOOKS AND CURRICULA

There was much criticism of ES textbooks in use in K-12 across the country. Some teachers went so far as to suggest that textbooks be eliminated and replaced by CD-ROMs!

However, many recalled the success of the American Geological Institute's Earth Science Curriculum Project that led, in 1967, to publication of the text *Investigating the Earth*. It was adopted by many schools across the country and, although now very out of date, is still used by some school districts.

Teachers are also concerned about their lack of input into curricular decisions and revisions and also the variance in curricula and standards between school districts. Possibly there is hope in the days ahead: the National Research Council is attempting to establish national standards in science education (i.e., to determine at what

levels we would expect children to know certain things). Projects such as Earth Systems Education also rely on teachers' input and are bound to influence any national curriculum. Finally, when GSA brings together representatives of scientific societies at Wingspread to form an educational coalition, it is probable that a revival of the ES Curriculum Project and production of a national textbook will be high on the agenda. (See the conference report by G.S. Nowlan in this issue, beginning on page 178.)

SCIENCE NETWORKS

Formally and informally, we heard a good deal about existing networks and the need for more networks to bring colleges, state authorities, and ES teachers into mutual aid pacts.

Possibly the best known and most successful network is the Colorado Alliance for Science, established in 1982 to mobilize a broad array of participants to improve science, mathematics and technology education. It is supported by every public university and four-year college in the state, and also by private foundations, corporations and individuals. It has personnel employed at key locations throughout the state to coordinate activities such as scientist-in-the-school programs and to operate hotlines. The Alliance sponsors industrial tours for teachers, in-service training, and job placement for minority and female students. Many similar networks have grown up across the country based on the Colorado Alliance, and the biology professor who founded it is in continual demand to talk about its roots, successes and problems.

Your reporter was reminded of the Calgary Science Network, which is involved in many of the same activities on a municipal scale. It has inspired the growth of similar networks in other Alberta cities, and a provincial body, the Science Alberta Foundation, is maintaining a benevolent watch on all of them. In contrast to Colorado, this is a bottom-up approach, but it is growing and thriving and might be a better model for Canada, with its widely scattered pockets of population.

GSA itself has successfully embarked on a networking operation, the SAGE program, which brings its members into contact with ES teachers in several ways. When formal structure is given to a coalition of societies in a

February 1993 meeting at Wingspread, it is likely that components of the SAGE program will be emulated by some or all of the societies joining the coalition.

It should be easy to find recruits for networks in Idaho. The Governor of that state has issued a proclamation urging all public servants to volunteer at least an hour per week to the school system. Can we prod other state (and provincial) leaders to follow this initiative?

WHERE DO WE GO FROM HERE?

At the first plenary session, participants made it clear that they didn't want this to be just another talk session, they wanted action. They needn't have worried with Ed Geary and E-an Zen masterminding the event. A full day was devoted to state and regional barriers to ES education, and the final half day to spelling out plans of action.

A few of the action decisions are:

- 1) A portrait of good ES teaching will be developed, first in a position paper, then in a video, to instruct teachers in the Rocky Mountain area, and elsewhere if it is successful.
- 2) The Rocky Mountain group plans to sponsor a state conference on implementation of national standards and other ES reforms.
- 3) The Gulf states, Louisiana and Texas, have much in common. They not only lack outcrops, but they share many geoscientific environmental problems. Many of the latter can be used as a basis for ES teaching. They intend to work together until early in 1994 to conduct training sessions and produce new programs.
- 4) All groups plan to do something about establishing a "clearing house" or tribunal to help teachers by assessing text and teaching resource materials that are available in the market.
- 5) The Eastern Seaboard group is also interested in K-12/university networks that will lead to teacher-in-residence and adopt-a-prof programs. They would also like to expand networks to include state survey scientists.
- 6) Past President E-an Zen, working through GSA Council, will contact university geology chairs across the country to point out the importance of rewarding good teaching and the need to begin dialogue with colleagues on this subject.
- 7) At least three of the five regional

focus groups set firm schedules and meeting dates within their regions, and they intend to have pilot training programs and networks operating shortly.

Ed Geary, never one to miss an opportunity, asked each participant to write down her/his choice of the three most important points made at the conference and what s(he) was going to do to implement them. He intends to contact everyone within a few months to get a report of progress on individual activity.

IS THERE A MESSAGE FOR CANADIAN GEOSCIENCE SOCIETIES?

Yes! We have done a few good things in geoscience education, but generally they have been ad hoc and short-lived (the EdGEO program of the Canadian Geoscience Council is a partial exception). It is time to take a leaf out of the book opened by GSA and either join it in the new Coalition for Earth Science Education or form a separate Canadian coalition with links to that of our American colleagues. Regardless, all our national geoscience societies must move education and public awareness of science to the top of their agendas. In the words of Martin Luther King (as quoted at Wingspread): The time is always right to do what is right.