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 Medalist. 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, GSAs 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 donated 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-18); 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 $1700 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 plucks 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. Ap-
proximately 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. Par-
ticipants 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 re-
turn to their own schools to teach,
but with the added responsibility of
certifying 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 math-
ematics 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, com-
munications technology, and in-
structional 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 pro-
cess 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 Edu-
cation meeting at Wingspread.

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

oratory exercises.

There are many causes of inade-
quate 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 em-
phasis on pedagogy than content in uni-
versity courses. There were, however,
also legitimate complaints levelled at
university and college science courses
that did not satisfy the needs of poten-
tial K-12 teachers.

Many positive suggestions were
made for improvements. For example,
it was suggested that K-12 master teach-
ers 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 pro-
mised to attempt to follow through on
these suggestions. I was impressed to
find out that, in some enlightened uni-
versities, science teacher training actu-
ally 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 close-
ly 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 re-
warded. At the K-12 level, recognition
by peers or principals was rare, financial or
other incentives, nonexistent. At col-
geges 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 re-
cognize research, teaching and ser-
vice equally, but in practice, only re-
search 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 edu-
cational institutions must develop tech-
niques for establishing and evaluating
quality classroom teaching.

A much-cited Syracuse University
study of rewards shows that faculty pri-
orities are first determined by their dis-
ciplinary associations and second by
their departments. Societies such as
GSA can best revise tenure and promo-
tion 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 recom-
endations for action, one by President
E-an Zen stands out. He said it should
be desirable for assistant professors as-
piring 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 be-
tween the universities and the K-12 sys-
tem. Universities are under fire from all
sides and are looking for new initiatives.

TEXTBOOKS AND CURRICULA
There was much criticism of ES text-
books in use in K-12 across the country.
Some teachers went so far as to sug-
gest 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 deci-
sions and revisions and also the vari-
ance in curricula and standards be-
tween school districts. Possibly there is
hope in the days ahead: the National
Research Council is attempting to es-
ablish 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 their 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 EcGEO 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.