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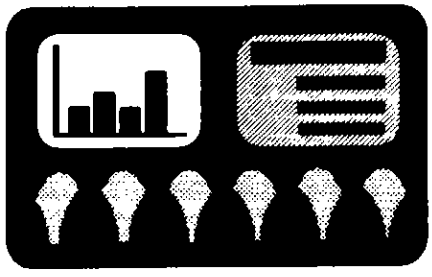

United States Geoscientists Target Earth Science Education: A Report on the Meeting to Establish the Coalition for Earth Science Education

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INTRODUCTION

A broad spectrum of geoscience societies in the United States sent representatives to the formative meeting of the Coalition for Earth Science Education (CESE) held 19-21 February, 1993. This fledgling organization has been incubating for the past two or three years and is now trying to spread its wings across North America. Appropriately, the meeting took place at the Wingspread facility of the Johnson Foundation in Racine, Wisconsin, an excellent facility for such brief intensive meetings. (Wingspread is the last and largest of Frank Lloyd Wright's "prairiehouses".) Three Canadians made the trip: Mike Kiel (Geological Survey of Canada [GSC], Alan Morgan (Canadian Geoscience Council [CGC]), and Godfrey Nowlan (Calgary Science Network and representing Canadian Society of Petroleum Geologists [CSPG] and the Geological Association of Canada [GAC]).

CESE is being formed to promote earth science education on all levels. The Coalition is sympathetic to an earth systems approach and defines earth science broadly to include geology, geophysics, hydrology, meteorology, oceanography and the space sciences. It is modelled on a similar organization that has been founded to promote education in the life sciences: the Coalition for Education in Life Sciences (CELS).

GOALS OF CESE

The purpose of CESE is to promote communication among its member organizations and to co-ordinate projects undertaken in earth science education. The membership includes earth science societies and educational groups. The Wingspread meeting showed that there is an enormous amount of activity in earth science awareness and public education across the continent, but that there is little mutual knowledge of these activities among the organizations developing and maintaining activities. Individual organizations will continue to develop their own projects, but through the Coalition, they will be able to find out what is going on elsewhere. This clearing-house function will enable members to develop better projects and provide opportunities for collaborative efforts. CESE will be a single contact for the teaching community so that they can have ready access to existing resources. The Coalition also plans to develop resources for groups that become active in the education field.

As the meeting was an attempt to fire up enthusiasm for forming a funded coalition, much energy was focussed on the actual nuts and bolts of the organization. What service will it provide to its members? How will it be funded? Where will the office be? When will it roll into action? Early discussion at the meeting centred on what exactly CESE could do for its members: communicate, co-operate and co-ordinate were the three watchwords. Communication will be with the education community and all interested parties, nationally and internationally. Co-operation will be through actual programs and the creation of new partnerships. Co-ordination will feature all member groups sharing approaches, facilities and outreach materials. A fourth watchword crept into the discussion: advocacy. There is a move in the United States for national standards in education, and it was felt the Coalition could do much to lead the revolution in science education reform. This might extend to the preparation of a white paper for presentation to American Vice President Al Gore, seen by many as a hope for attention to education in the country. The pitfalls of trying to combine advocacy for reform with delivery of programs were discussed at length.

HOUSING THE COALITION

Three formal proposals, along with an informal one, for housing the Coalition were made to the delegates. The first offer came from Frank Ireton, of the American Geophysical Union (AGU), who has been involved with the coalition from its inception. Another proposal came from a long-time activist with the Coalition, John Carpenter, who offered to host CESE at the Center for Science Education at the University of South Carolina. The last formal submission, from the American Association for the Advancement of Science, was to house the Coalition at their offices in Washington. Each of these proposals stressed that CESE would be a completely independent entity. The cost of the proposals ranged from approximately US $20,000 to $130,000. The informal proposal came from Marilyn Suiter of the American Geological Institute (AGI), which has been involved in this initiative since its inception in 1990. She informed the delegates that AGI was also prepared to host CESE, and she outlined what AGI was prepared to contribute. No decision was made because it was felt that the Steering Committee to be elected near the end of the meeting should have an opportunity to analyze each of the options in detail and make an appropriate choice, which would clearly be dependent on the level of funding available.

THE DELEGATES

The chief organizer of the meeting, Ed Geary (Geological Society of America) and his colleagues Frank Ireton (AGU), John Carpenter (U. of South Carolina), former AGI Director Chip Groat (Lousiana State U.), and Laure Wallace (United States Geological Survey) assembled a formidable group for the meeting. More than half of the 47 delegates (54%) were representatives of earth science societies. Most of the rest represented school teachers (20%), government agencies (9%), and what can best be termed education action groups (13%). Industry and museums were each represented by only one delegate. While it was obvious that the

long-time supporters of a concept such as the Coalition came from professional societies and government agencies, it was also clear that a significant effort has been made to co-opt teachers both at the elementary and secondary (K-12) and university levels. Some of the most poignant moments in the meeting were generated by K-12 earth science teachers who made their presence felt through descriptions of the difficulties they face in the classroom. These are the folks in the front line who are currently weathering a barrage of criticism from all quarters, especially the corporate world. They work for low wages in difficult circumstances and do their best to provide a quality education. From this came a strong message that we must support the teaching profession in whatever we plan to do, and that we must work through the teaching profession to bring projects to full value and effectiveness. Fortunately, the United States has long recognized excellence in teaching in the earth sciences through annual presidential awards, and there are "elite" educators who can be called upon for practical advice and common sense in putting the K-12 program together. Interestingly, a similar program has just been announced in Canada (see *Oyez*[3], April 1993 issue for details).

THE FOCUS GROUPS

Although the group concentrated its attention on the details of setting up CESE, several focus groups also met to try to decide on various courses of action for the Coalition. These focus groups dealt with five areas.

Curriculum

A national bulletin board, including listings of interested organizations and contact people, files of actual teaching methods and packages, and listings of available resources was proposed. Some wondered how many people were actually on E-mail; a straw poll revealed that a vast majority (about 40 delegates) were linked to Internet. It was felt that those who were not on E-mail now soon would be. Linkage for those without free access to Internet could be a service offered by established organizations to those who need help. This is an example of something concrete and valuable that an organization can contribute to other less fortunate groups, such as schools and volunteer organizations. For example, Mount Royal College provides an Internet address for Calgary's Science Hotline.

Development of new curriculum-related resources was deemed an important function for CESE, but even more important is the evaluation of existing resources. Such resources are abundant, but how good is an individual package? It was proposed that CESE also conduct workshops and field programs for teachers and others involved in curriculum delivery. This is the sort of activity that the Canadian EdGEO program has been involved with for a number of years. Finally, the group suggested that existing publication units of geological organizations, such as societies and geological surveys, should be involved in the process of developing new curriculum-related materials. In Canada, this would be particularly true for the Geological Survey of Canada, the various provincial surveys, and the different geoscience professional societies, many of which already have some involvement and interest in educational affairs. It was stressed that any new materials developed had to be prepared in consultation with education professionals, not prepared in isolation or ignorance of the actual curriculum.

Professional Development

Discussion ranged widely over this broad topic, and the group concluded that it was difficult to know all about what is already available. Collection, collation and evaluation of existing resources are again of primary importance. In particular, teacher education workshops will be of the greatest value. Some examples of groups and activities already under way were provided. For example, Alex Glover, a representative of Vulcan Materials Ltd. which is the largest producer of aggregate in the United States, indicated that his company is interested in developing educational programs through its numerous quarries across the country. The programs would combine geology and the engineering aspects of the quarried resources. Such an offer should not be ignored, and similar commitments should be sought from other resource companies. One point of interest is that in the Carolinas, Vulcan Materials has reversed the trend of keeping quarries off limits to school groups and the public, and is now actively encouraging involvement in the whys and hows of mining in the region. The public relations exercise has been so successful and well managed that the company has persuaded their corporate lawyers that the economic benefits of interaction with the public far outweigh the effects of any potential lawsuit.

Debby Harden of the Bay Area Earth Science Institute pointed out that soils represent an excellent topic for earth science education because they require integration of geology and biology. The fact is that most teachers have biological rather than geological training and this is a way to attract them to earth science.

Clearly, EdGEO fits well into this category and was mentioned during the course of the discussion.

National Standards

There is a considerable move toward the establishment of national standards for education in the United States. A report on national standards in science education is apparently available through the National Research Council. This focus group suggested that CESE, especially through scientists and educators working together, could critique the proposed national standards. They suggested that the Coalition could support educational restructuring, including integration of earth science for K-12 to university, and make position statements that reflect the views of both scientists and educators. The group also believed that CESE could attract industry to the discussion and direct their responses. They proposed a coalition task force to explore the teaching of earth science in the United States and elsewhere, and to investigate the state of earth science literacy. These are bold initiatives and they certainly need attention. Amazingly enough, the application of a national standard in the United States is even more difficult to apply than in Canada. There are, for example, more than 16,000 distinct school boards in the United States, and some states are adamantly opposed to teaching different elements of a national curriculum (evolution is one example). Recently, the state of Oklahoma has discontinued teaching earth science as part of the high school curriculum.

Partnerships

This group worked from the premise that education is necessarily a local issue. Standards and curriculum content are interpreted at the local school

district level and may be particular to individual schools. If there are to be partnerships, they must be at the local level. The Coalition, therefore, can function as a "national network of local partnerships". In this case, the word "partnership" is interpreted broadly to mean any initiative between scientists and educators. The partnership may be broadly based, involving scientists of all types with regional school boards (*e.g.*, the Calgary Science Network or the Colorado Alliance for Science), or a single institution or company in partnership with one school. Whatever the relationships, they need to be fostered and spread more widely.

In order to promote the creation of more partnerships, CESE could be active in a number of key ways. First, it is important to develop what might be termed "recruitment materials"; these are documents that convince individual scientists or institutions that getting involved in earth science education is important and worthwhile. Examples of successful partnerships could be shared to show how they have enhanced local educational systems. Second, CESE could provide the network for all the local partnerships on a national scale. Description of initiatives that work well, and those that don't, could be circulated to assist local networks to provide better services. Third, the Coalition could prepare and distribute training materials. These should focus on how to get involved in the educational system, how to get the most out of a partnership, and what you need to know to get involved effectively. There should be advice on how to interact effectively with teachers and students. There should be hints on how to prepare materials for different grade levels. Ken Eckelmeyer of Sandia National Laboratories circulated excellent drafts of such materials that could be combined into a valuable handbook with application across North America. Finally, this group suggested that CESE could help get people linked with suitable materials (a clearing-house role) and also prepare materials to convince employers that it is valuable, indeed essential, that scientific employees should be active in the education system. Sandia Laboratories has an active program, similar to that of the Calgary Science Network's Science Hotline, that links teachers and scientists and provides a growth experience for both.

Information Collection and Dissemination

A common thread throughout the proceedings was the need for the Coalition to play a clearing-house role, collecting and disseminating information. There is a necessity for communication among CESE members, with K-12 teachers, with earth scientists and their societies, and with government agencies. This focus group also suggested Internet as the medium of choice, and it certainly seems that most will be hooked to E-mail in the near future. However, it is not the only medium. As Darrel Hoff, a teacher from Massachusetts pointed out: the day you can buy a used car by E-mail will be the day that face-to-face meetings are no longer necessary. So the group also endorsed the "sneaker net", encouraging CESE to ensure that scientists and schools are connected directly.

It was recognized that there are several existing sources of information on earth science resources for education: the United States Geological Survey Centre, the Eisenhower National Clearinghouse for Math and Science, the American Geological Institute's volume on Earth Science Resources for Teachers, and many more. In this context, the need for evaluation of existing resources was considered essential. It is no good simply providing a listing of resources without screening and evaluating them. This could become one of CESE's key roles.

FUTURE FOR CESE

A provisional Steering Committee was established through a mixed nomination and volunteering process. This committee will be augmented in the coming months through additional nominations. The Canadian delegate to this committee is Alan Morgan. The committee's initial activities will be the development of a fund-raising drive and the selection of a housing option for the Coalition. The fund raising will probably take the form of requesting memberships ($1000 was suggested) from earth science societies and organizations. Some details of the membership structure need to be worked out to ensure that smaller societies and organizations can easily join.

The next full meeting of CESE will be in Washington in 1994, organized by Jim O'Connor of the National Marine Educators Association and probably hosted at the new AGU building that should be complete by then. In the meantime, the Steering Committee will be developing priorities along the lines recommended by the focus groups and working on them.

IMPLICATIONS FOR CANADIAN EARTH SCIENCE SOCIETIES

Involvement in science education and improving overall scientific literacy in the world must be a priority for all scientific societies. Earth science organizations have new opportunities because of an education reform movement that is encouraging the teaching of science in a societal context: often referred to as STS (Science and Technology in Society). Clearly, this kind of contextual education in science permits the use of examples from earth and life sciences in particular.

Through its Public Awareness of Science Committee, the Royal Society of Canada has been Canada's main instrument of progress in this important area. The Society hosted a series of highly successful conferences and workshops that brought together activists from across the nation in 1988 and 1990 that inspired several new regional developments. Prominent among the activists were a large number of earth scientists. The energy of these people and the organizations they represent can be harnessed to improve earth science awareness.

The recently established Canadian Geoscience Education Board, a unit of the Canadian Geoscience Council, should fill a role similar to that proposed for CESE in the United States. The board's stated purpose is to co-ordinate the educational and public awareness of science activities of the various earth science societies in Canada. This presumes that Canada's national societies have programs and activities in public awareness of science. In fact, there are few high-profile earth science education initiatives in Canada: EdGEO, a creature of the CGC, has recently taken a new lease on life under the guidance of Bob Greggs, and one could also point to the efforts of the Atlantic Geoscience Society (particularly their video series).

It is imperative that Canadian earth science societies and agencies get involved. Perhaps the new Board could provide some advice on how to do this, but the actual initiatives have to be run by society groups. Immediate matters

that require action at the national level are listed below. Please read through these carefully and select the most appropriate for action by GAC and other societies. These are practical initiatives that are urgent necessities.

1. A study of science curricula across the country to identify the curriculum style (integrated/segregated subjects) and content at all grade levels (particularly of earth science themes including geology, oceanography, meteorology and astronomy). Without such a study, it will be impossible to develop effective curriculum-enhancing initiatives.
2. Collection of information on earth science education resources and, more importantly, evaluation of the scientific validity and suitability of these resources. This will require education professionals as evaluators, and a mechanism for disseminating the information collected.
3. Formal contact with the teaching profession to draw in interested science teachers from across the country. Without participation of education professionals, we cannot develop appropriate teaching aids. The presence of K-12 teachers at the CESE meetings brought existing problems into sharp focus. Teachers have long been involved in EdGEO programs, and it is essential that there be a meeting of the minds at all levels of proposed earth science education.
4. Exploration of the desirability of proposing national standards for science education. Recent studies (*e.g.*, report in *Maclean's* of 11 January 1993) show wide variance in the scientific knowledge and ability of students in different provinces. Is this an acceptable situation or should national societies look toward national standards?
5. Encouragement of the development of local science partnerships between educators, scientists and the public, and co-ordination of these local partnerships on a national basis. The encouragement is surely the responsibility of national societies and could be undertaken through regional divisions or sections. The co-ordination could be the responsibility of the new CGC Board.
6. Development of materials that encourage and inform a) individual scientists on how to become involved in education, and b) employers on how and why to encourage and foster programs of educational assistance. No single local group can afford this on a national scale, but might be able to provide much of the copy.
7. Encourage the development of training materials for scientists and teachers. Scientists need training on how to communicate with the schools and the general public, and teachers need scientific training and assistance. This is possibly best done through discipline divisions or sections of national societies. They would be better if a series is co-ordinated through a single editorial process.
8. Development of an electronic bulletin board to disseminate information on teaching aids in the earth sciences. It might be best to go in with CESE on this and offer to provide data on Canadian materials. Consider especially French language resources.
9. Develop workshops and in-service training for teachers that allow them to teach the changing curricula better. Expand EdGEO or develop additional programs, particularly at national meetings.
10. Encourage corporations to offer educational experiences for teachers and students, particularly resource companies that have so many suitable facilities (quarries, mines, extraction plants, *etc.*). This could be done by societies that serve individual corporate communities.
11. Encourage the national and provincial geological surveys to participate more actively in education programs. Many of the best resource people for preparation of locally applicable materials are employed in provincial surveys or local offices of the national survey.
12. Encourage liaison with existing earth science education facilities (science centres, museums). These are a much-neglected resource which are often short of staff to complete educational initiatives, but have excellent facilities for production and expertise in the education field.

Canadian societies should agree to get started on some or all of these initiatives. The Canadian Geoscience Education Board can co-ordinate and act as liaison with CESE. Some CESE activities should not be duplicated, but enlarged: Canadians can benefit from knowing more about available educational resources that relate to North America.