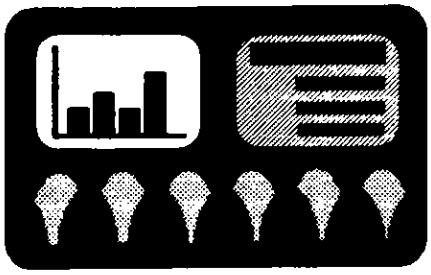

International Conference on Geoscience Education and Training (GEOED)

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The Association of Geoscientists for International Development (AGID) and the Commission on Geoscience Education and Training (COGEOED) of the International Union of Geological Sciences held an extremely successful meeting at the University of Southampton in Southampton, England, 20-24 April 1993. Since this was the first international conference of its type in Britain, a number of organizations banded together to provide leadership and financial support. These included the International Council of Scientific Unions Commission of Teaching Science, The International Council of Associations for Science Education, the Earth Science Teachers Association of the United Kingdom, the Geological Society, the Geographical Association, and the British Geological Survey. Additional financial support was provided by The Royal Society, The British Council, The Commonwealth Foundation, UNESCO and several oil companies, such as BP and Mobil.

The Canadian representatives (Sandra Barr, Acadia U; Alan Beck, U of Western Ontario; Laing Ferguson, Mt. Allison U; Derek Hodson, Ontario Institute for Studies in Education [OISE], Toronto; Alan Morgan, U of Waterloo; David Rudkin, Royal Ontario Museum; Des Wilson of Douglas College, New Westminster; and Karen Yong, a private consultant from Delta, British Columbia) formed a strong contingent among the 236 delegates at the conference. Approximately 60 countries, from Australia to Zimbabwe, were represented, making this a truly international gathering. It was especially encouraging to see a high proportion of delegates from the developing nations, although it was both interesting and disconcerting to see the commonality of problems facing educators in the earth sciences, whether they come from Bulgaria, Canada, Denmark or Wales, the former Yugoslavia, or Zambia.

The delegates were welcomed to Southampton by the conference convenor Dorrik Stow, formerly of Dalhousie University in Halifax, by Ken Barnes, Dean of Science at Southampton University, and by Nelsen Ellert of Sao Paulo, the AGID Chairman. The Vice-Chancellor at Southampton University, Sir Gordon Higginson, pointed out that this meeting was different, since the university normally hosted research gatherings, rather than teaching conferences. The opening plenary session keynote speaker was Sir Ronald Oxburgh, the science advisor to the Ministry of Defence. Sir Ronald pointed out that earth science literacy is not high, although there are major attempts to rectify this in the British science curriculum (Canadian science educators, please note). He entertained the delegates with a summary of how the earth sciences have progressed during the last 200 years, emphasizing the changes from the early workers and their problems with religious ideas, through to the mistrust expressed more recently by physicists and chemists, who insinuated that geologists were trying to re-write natural laws to support their geological hypotheses. This was before the emergence of the unified approach of the earth sciences with the solid underpinning of continental drift and plate tectonics. What the chemists and physicists had failed to realize was the long time frames in which earth processes take place. There had been radical advances since he was a student, and geology had changed from a sterile to a sexy subject.

Diane Warwick of the Westminster Foundation for Democracy recognized that the "ivory tower" approach of academics had largely kept troubles away from the universities, but that the last decade had opened a Pandora's box for academia. The universities are now beset by increasing student numbers, pressure on finances for books and research, and salaries that have fallen behind most other professions. In fact, she compared the universities to the definition of a new bride, "... a person with a fine prospect of prosperity behind her." She offered little hope for the near future. The social upheavals in the world, with the decline of communism in the former eastern bloc and Soviet Union, coupled with problems in the former Yugoslavia, military regimes in central America and Africa, and the pressures of migrating population will not permit an easy return to the former conditions. Individual states were being forced to allow the free development of the full potential of each individual.

Jeremy Leggett, science director for Greenpeace, concluded the session with an interesting address advocating an holistic view for the geosciences. (Although he did not state it, this is the earth system position now being undertaken by the Americans in their approach to the K-12 educational initiative advocated by CESE; Nowlan and Morgan, 1993). He demonstrated in quite convincing style, the need for politicians to understand what is happening in terms of global change, and the importance of the long-term view, so uniquely represented by the geosciences. His projections are well represented in the literature (the amount of global warming, sea-level rise, potential natural catastrophies, *etc.*), however, what was particularly interesting was the recent impact of just a few of these concerns to the insurance industry. Leggett pointed out that the relative atmospheric calm in the two decades from 1967-1987, during which the insurance companies amassed more than $1.3 trillion in profits, has been counteracted by just 16 major storms from 1987 to 1993, which have resulted in well over $1 trillion in losses.

In summary, the messages which were delivered by the three keynote speakers are well known to earth scientists. The geosciences are unique in their ability to provide long-term information about the Earth and the role of our species in a geologic time frame. The geosciences are poorly understood by the public and politicians. The geosciences must be taught to raise knowl-

edge of a science that is fundamental to our understanding of the way in which this planet works. The education process must be undertaken in a time of relative social upheaval as different countries come to grips with the breakdown of long-established regimes, and with major economic depression. Finally, it must be done soon, since with rapidly increasing world population and all the potentially disastrous effects inherent in global change, our reaction time is probably limited to the next 50 to 100 years. With these sobering thoughts, the educators departed to their respective workshop sessions.

Four main conference themes were offered to the participants: Geoscience Education in Schools; Higher Education; Geoscience Training for Business, Industry and Public Service; and Public Understanding of Geoscience. Each conference theme was conducted in a workshop format, with an additional workshop entitled Women in Geoscience: The Role of Education. Four pre-conference field trips, and one conducted in a late afternoon session enhanced concepts that were discussed during the sessions and Geowalk.

A very wide spectrum of questions was addressed in the workshops: How should we teach geoscience at school and where is it provided for in different national curricula? How are we coping with the challenges that face higher education today and are we keeping pace with the dramatic changes in educational technology? Why do so few girls choose to study geology at university and how can we redress the pyramidal decline of women geoscientists moving up the career ladder? Does the quality of geoscience degrees worldwide match the needs of society, and how do we further meet the training needs of business and industry? Is geoscience education responding adequately to the very real and live issues of global environment and development? How do we as geoscientists translate our knowledge and concerns to the language of politicians and planners? What are the ways in which we can raise the general profile of geology in society? What role is there for geotourism, ecotourism, *etc.*?

Because several sessions ran concurrently, it is not possible for us to report in detail on all of them and we have, therefore, based the following observations on the summaries of the sessions as presented in the final plenary session of the conference. The Conference Proceedings will include most of the papers presented and should provide a valuable record of this unique gathering.

Theme A:
Geoscience Education in Schools

The papers and discussions were summarized by David Thompson (U of Keele) in the final plenary discussion. There was much discussion on the purpose of school curricula: was it education for citizenry or to produce potential earth scientists? The conclusion he reached was that it was both. There were many accounts of practices in various countries, some good and some bad. Karen Yong gave a lively talk on the situation of earth science education in Canada and pointed out that some of the problems emanating from having ten provincial Ministers of Education and no national curriculum might be overcome by encouraging more teachers to participate in the EdGEO workshops across the country sponsored by the Canadian Geoscience Council. There was much discussion on what should and should not be done, and it was clear that what suited one culture might not suit another. John Carpenter (U of South Carolina) noted that there had been two distressing themes presented: a) a cry from the developing nations to get more geoscience into their school curricula, and b) a desire in the developed nations to change what is in the conventional curriculum to an earth systems approach so that all students would be "earth process literate". He urged the representatives of developing countries to learn from our mistakes, to listen to what doesn't work, and not to do it. There was strong support from the United States and Argentina for the holistic approach to teaching, related to environmental demands. Opinions were divided on the merits of national curricula. The case was advanced for state control on curricula, for regional control (province, district, *etc.*) and for school control. Arguments were advanced for an international body to fight on behalf of various groups, but a warning was given that the case must be very well prepared, or as much might be lost as gained. Pre-service geoscience education was an important topic, and opinion was divided whether it should be in the course structure or a post-graduate option. Much thought was given to the professional development of teachers in geoscience: through additional resources or interaction between tertiary and secondary educational organizations? Constructive approaches to teaching geoscience were discussed: with the learner "at the centre" learning what they wish to know rather than studying what the teacher wishes to teach. There was much discussion of the merits of practical and field work. There was a need for more interchanges and co-operation with other "subject associations" ("so that they work with you rather than do you down"). Global environmental awareness for schools was considered to be an essential aim of geoscience education, now and for the future.

In the Laboratory and Field Investigations: Resource Materials and Teaching Strategies sessions, there were several Canadian contributions. Derek Hodson of OISE gave a keynote address entitled "New thinking on the role of practical work in science teaching", and Alan Morgan presented a paper, "Presenting geological information using a CD-ROM", while, in a related poster session, Laing Ferguson's presentation, "The use of 'sieve models' in introductory geological mapping" attracted a lot of interest.

Theme B: Higher Education

This was summarized by Bill Gaskarth, (U of Birmingham). The state of higher education in the earth sciences in Britain had been well summarized by Bob Nesbitt: after rationalizing following the Oxburgh and O'Hara committees, Britain had been left with a handful of schools of excellence, devoted to research and teaching (which would get the best students at all levels), about ten departments combining some research with teaching, and a large number of teaching departments. Strangely, after reducing the number of university geoscience departments, a new wave of universities (former polytechnics, *etc.*) had increased the number of the latter. Nesbitt suspected that there might be further protests and further reviews, but Dr. Gaskarth believed that the pattern was firmly established and there would be "more of the same". National financial stringencies would lead to political pressures, and student number increases would also put strain on geoscience departments. There was, there-

fore, a strong pressure to review the content of geoscience degrees and to eliminate some "sacred cows": petrology, mineralogy and even field work. The accent should be on the teaching of skills rather than the learning of facts. There were arguments for specialized post-graduate or in-service courses in these eliminated aspects for those who needed advanced petrology, mineralogy, field techniques, *etc.* Interesting suggestions were made for passing the responsibility for his/her field training to the student (making him/her prepare a field log of a number of classic areas as part of the course qualification, on their own). From Portugal had come the idea of just taking students out in the field and dumping them there to make what they could of it in the first instance. An alternative was multi-university directed "mega field parties", as was practised in the United States. Some of the problems with field work were the escalating costs, the growing numbers, problems of health and safety, and problems with landowners. There was an obvious need to produce graduate students who were flexible and could adapt from one employment channel to another. Problems of the "black box" in teaching were discussed, possibilities of self-instruction systems in teaching generally, and problems of assessment. One contributor to the discussion was alarmed by the amount of time young people now spent in front of one box or another, and thought that there could be too much of a supposedly good thing, particularly as there were doubts about the capacity of the student to take in the lessons at the speed they were given to them through the box: there was a strong case for not abandoning paper altogether. Dr. Gaskarth concluded by saying that the challenge of rising student numbers had to be accepted, and we had to find ways of bringing on the weaker and leading on the brighter at the same time. The message was that geoscientists in tertiary education had to get their act together, but they also had to obtain worldwide recognition for the present-day importance of their discipline.

Theme C:
Geoscience Training for Business, Industry and the Public Service

Dr. Tony Reedman (Head, International Division, British Geological Survey [BGS]) reviewed this theme. The fundamental questions were, "What sort of education in geoscience is being provided, and what sort should be provided? What sort of product is required?" Presentations and discussion touched on the moral obligations of employers and academics, the need to ensure that graduates had transferable skills and were not boxed in a small professional compartment all their working lives. This was particularly important with the present-day volatile responses to market forces and recession. The need for multidisciplinary communication was stressed, as was the success of a large variety of professional linkages between universities, research institutes, international organizations, geological surveys, and commercial organizations. Such linkages should be increased. Geoscience aid to developing countries could be an increasing outlet for graduate geologists, but there was a need for national core programs to be operated internally within these countries, programs to which western countries could add a small amount of specialist input without distorting or replacing the national survey effort.

The session on the "Greening of Earth Science" had been very interesting. Dr. Reedman believed that the term "environmental science" was probably a misnomer, as the truth was that a wide variety of scientific disciplines were involved in environment-related activities. There was no separate entity "environmental science", merely the application of chemistry, physics, zoology, botany, geology, *etc.* to environmental problems. There had been a swing in the international aid programs from basic geoscience programs to those that are environmentally based. There was an excellent presentation by David Richards on the role of the geoscientist in a mining operation, from initial exploration, to evaluation and construction, operation, closure and management. He showed how the environmental requirements had to be followed stringently throughout, and that the geologists involved, more than any others, could contribute information to environmental impact assessment because they obtained an overall picture of the operation; geologists were often involved from start to finish, whereas other specialists tended to be involved for short periods only. A topic that came up frequently in discussion was the damaging effect on the mineral and petroleum industries of extremist and unrealistic environmental lobbies, which found easy political support. Such activities had caused a virtual shut-down in large parts of the minerals and energy industries in the United States and Canada, yet it was an inescapable fact that the escalating world population would continue to require large amounts of both mineral and energy resources. This activity was similar to the "not-in-my-backyard" (NIMBY) problem faced by land use planners. Another point emphasized in discussion was the need for land use planners to be educated in the importance of involving geoscientists for consultation early in the formulation of development programs, not bringing them in when development programs had gone wrong (*i.e.*, due to construction on unstable terrain.)

Theme D:
Public Understanding of Geoscience

This theme was summarized by Ian Sutton (Dept. of Education, Nottingham U). It was the least well attended session, but had been characterized by stimulating papers and very interesting discussion. He thought that Alan Morgan's profusely illustrated lunch time talk on global change had been particularly enjoyable and enthusiastically appreciated by all present. He made a plea for allowance of time for discussion to be expanded at any future conference. The first session, "Geoscience and Industry" included several papers dealing with the role of British Coal Opencast, JAPEC, the hydrocarbons industry, the Yorkshire Brick Company, and the sand and gravel (construction mineral) industry in conservation and geoscience education of the public. In the second session, the role of the national institutions was discussed: presentations included one from English Nature on regional cooperation in preserving sites, one from Professor Worsley on the British Association and its need to adapt to the demands of the present time, one from Brian Taylor describing the BGS's excellent and remarkably successful open days (now, alas, suspended because of financial stringencies), Brian Taylor again on the role of The Royal Society's Commission for the Understanding of Science (COPUS), and a talk by Ian Thomas on the National Stone Centre. There was a *tour de force* from Laure

Wallace of the United States Geological Survey describing their admirable and prolific input into geoscience education at all levels: an achievement that many countries would envy, and a contrast to the stringencies imposed on the BGS. The final session on Adult Education included papers by Eric Robinson on his original methods of bringing geoscience to the general public, on the university's role from Ian Sutton and John Stanley, and a visually exciting presentation by Jane James of South Australia on "geological tourism", a large number of sites having been developed there in all states and supported by excellent instructional boards and literature. The theme of "public awareness" recurred again and again throughout this conference and it seems to be critically important for geoscientists to find ways of raising public awareness of the importance of their science at the present time. It remains depressingly low compared to many other scientific disciplines.

A late-evening workshop, Women in Geoscience: the Role of Education, was very well attended. Jane Plant, Assistant Director of the BGS, profiled this largest employer of geologists in the United Kingdom, clearly illustrating the slow change toward equality between the sexes. Rosemary Enie recounted the struggles of being the only female geology student in her class in Nigeria, whereas Zane Amante-Roberts portrayed the higher profile of women geoscientists in the Philippines. An article on this workshop by Sue Forster will appear in *Geoscientist*.

As would be expected at a conference of this nature, the field trips, meal times and nightly social gatherings (especially the conference dinner which was held on a Blue Funnel cruise ship while cruising on the Solent) were times for the delegates to get to know each other, and to pursue discussion of the many topics of mutual concern in earth science education the world over.

The field excursions were in accord with the particular themes of the conference itself, and gave much food for thought regarding how field trips should be conducted for the various levels of participants, especially with regard to their individual active involvement and with regard to safety in the field. It was particularly interesting to note the concern for the environment shown by British industry. A stop on high land near Corfe Castle to look over the Wytch Farm oilfield (the largest onshore oilfield in Western Europe) revealed virtually nothing of the wellhead pumps, nor the 50-acre gathering station itself, as they have been designed with a low profile and do not protrude above the level of the surrounding forestry plantation. It was also gratifying to see the preponderance of traditional manual techniques used for splitting and dressing the Purbeck stone quarried at the Swanage Quarry.

CONCLUSION

The conference was excellent, but its ultimate success depends on the maintenance of the momentum that was achieved and on its conclusions and recommendations being brought before the decision-makers in the numerous countries involved. A set of conference recommendations is currently being prepared for publication in a forthcoming issue of *Geoscientist* and in *AGID NEWS*. The IUGS Commission on Geoscience Education and Training (COGEOED) met immediately after the conference, and is currently seeking formal proposals for the next GEOED meeting from the several who volunteered at the closing plenary. There is a strong likelihood that it will be in Bulgaria in 1996. A global network of corresponding members of the Commission is being set up using the network of national co-ordinators that had been very successful in promoting the Southampton meeting. Laing Ferguson has accepted the invitation to be the corresponding member for Canada. A COGEOED newsletter is being launched by John Carpenter, Director for Science Education at the University of South Carolina, and it certainly looks as if the momentum is being maintained. It is hoped that the newly formed Coalition for Earth Science Education in the United States and the Canadian Geoscience Education Board of the Canadian Geoscience Council will play significant roles in ensuring that North America will be able to continue making significant contributions to future GEOED Conferences.

ACKNOWLEDGEMENTS

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