

# Learning about the Earth as a System: The Second International Conference on Geoscience Education

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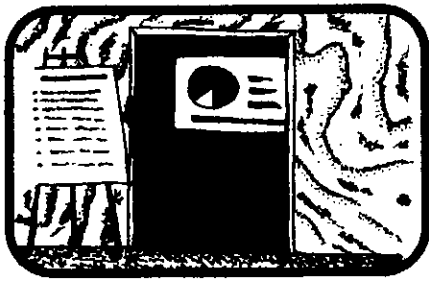
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# CONFERENCE REPORTS



## Learning about the Earth as a System: The Second International Conference on Geoscience Education

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### INTRODUCTION

In retrospect, although the first GEOSCIED Conference (GEOSCIED I) in Southampton (Morgan and Ferguson, 1993) was a great success — a wide range of topics was covered by excellent presentations, and the full proceedings of the conference were eventually published (in an 800+ page volume!) — one of the failings was that no mechanism was adopted to ensure that future conferences would take place. A second shortcoming was that there was a

failure to provide some sort of linkage between conferences through a newsletter, or some other form of general communication. These matters became the focus of the business activities (as opposed to the presentations) for the second GEOSCIED Conference (GEOSCIED II), held in Hilo, Hawai'i, 27 July–1 August 1997.

### GEOSCIED II

The Second International Conference on Geoscience Education was a great success. It attracted nearly 240 participants from 25 countries, including six Canadians. The theme, "Learning about the Earth as a System" was chosen "... because it emphasizes the importance of re-examining the teaching and learning of traditional Earth Science in the context of the many environmental and social issues facing the planet and the advent of remarkable technology that can assist in data management and science instruction."

Just how did the organizers undertake this mission? It was accomplished by three excellent field trips, three days of presentations and discussions, a number of really excellent public lectures, and a lot of after-hours brainstorming. I would like to summarize each of these in turn.

### THE FIELD EXCURSIONS

These were held on Oahu and on Hawai'i. The first two were held immediately prior to the conference and run from Honolulu. The Saturday field trip was designed for middle school and high school earth science teachers as well as college and university teachers.

This was "big-picture" geoscience, where the party of about 40 persons examined the interactions between volcanism, the biosphere, ocean, and atmosphere. We were treated to a wonderful array of striking geomorphological features (breached craters that had slumped into the Pacific, abandoned shorelines and sand deposits) as well as the potentially interesting prospects of what might happen should active volcanism re-commence on this now densely populated island.

The following day, a smaller party examined Global Change evidence at Kaena Point, Oahu. This was a half-day inquiry-based field trip especially designed for introductory geoscience college instructors. Participants examined evidence for global change in coral reef deposits that parallel modern volcanic deposits. This was a fascinating excursion for a Quaternary geologist, and I learned a great deal about putting together "observations" and "interpretations" in a matter of about six hours before the group broke to head across to Hawai'i.

Less than five hours after leaving the north coast of Oahu, the participants reconvened on the campus of the University of Hawai'i at Hilo. On the following day a field trip was conducted by professional staff of the United States Geological Survey. This was centred on the Kilauea Caldera. Five superbly orchestrated stops within the National Park illustrated the interaction of volcanism, atmospheric processes and biological adaptations. The aptly named Devastation Trail highlighted microclimates, soil formation, and adaptation

of plant species in an area of recently active volcanism. A stop at the Thurston Lava Tube focused on cave invertebrates in a habitat formed by volcanic activity. Demonstrations of micro-seismicity and recent rifting were provided at two other stops, and Madame Pele taunted us all with a distant display of fireworks from the Pu'u O'o crater in eruption on the south flank of Kilauea. (Most of the conference participants were lucky enough to see this eruption. A few of us were extremely lucky and later overflowed the volcano in one of its eruptive phases. At the conclusion of the meeting, a small group (about 35) managed to walk on the new flows near Kalapana.)

### THE CONFERENCE

The formal presentations at the conference started on the Tuesday morning with an overall theme of "Earth Systems/ Science Programs," co-ordinated by William Hoyt and Victor Mayer. This primary session was subdivided into four principal themes.

**Theme Session I A** involved "Academic, Government and Society Partnerships in Developing Science Literacy," with Edward D. Geary and Beverly T. Lynds as moderators. The 14 presentations in this session illustrated how colleges and universities as well as government science and geoscience agencies, and professional societies, are starting to develop approaches to science literacy. The presentations were highly biased toward the United States (11 out of 14) with one each from India, Venezuela and the United Kingdom. The authors provided descriptions of new courses and curricula for higher education, and programs for teacher enhancement at the K-12 level. Several examples of collaboration among diverse colleges and universities were identified.

**Theme Session I B** was entitled "College and University Curricula" and was moderated by Donald R. Johnson and Geoff Taylor. The aims of this session were ambitious. It was pointed out that the post-secondary curriculum is critical since it should provide students with the ability to think along interdisciplinary lines, understanding the "Earth Systems Approach" through the process of understanding models. Upon graduation, these students should provide society with geoscience skills for dealing with 21st century science needs, technologi-

cal tools, and social responsibilities. The 12 papers in this session represented the innovations being made by college educators on four continents. They included presentations from Australia, Canada, South Africa, Zambia, the United Kingdom and the United States. Almost all depicted curriculum modifications specifically designed to serve non-majors, introducing them to an earth systems science approach.

University faculties illustrated that collaboration across regions is conducive to the development of course modules, entire courses, faculty development, and models of faculty-student interactions to facilitate learning. Several papers in the session showed that field needs is an important topic within summer sessions for high school students, as well as integrating different subject areas in the field. Dileep Athaide and Carlo Giovanella (University of British Columbia) gave a presentation entitled "Earth Sciences Articulation in the College/University System, in the Province of British Columbia."

**Theme Session I C** was aimed, as its title suggested, to "K-12 Curricula," and was moderated by Dan Jax and Masakazu Gotoh. This poster session described twelve K-12 programs that typically require periods of weeks to years of instructional time while pulling together large components of the school curriculum. Presenters provided models of how science can be integrated with areas in math, social studies, and the arts using studies of rivers, rainforests and earth representation through satellite images. Many of the posters dealt with field experiences to promote synthesis of information and establish cognitive frameworks for construction of knowledge. It is hoped that students in these programs may emerge with the ability to think globally based on local experiences. Again most of the presentations were from the United States, with one from Australia and one from Japan.

**Theme session I D** dealt even more specifically with "K-12 Programs" and Judith Riestra and Norikazu Osumi, acted as the moderators. This was the most international session with presenters from the Philippines, Japan and New Zealand, as well as from Brazil, Venezuela, Russia, South Africa, India and the United States. It is interesting to observe that state and national curricu-

lum restructuring throughout many of these jurisdictions is opening up a need for training and retraining teachers for new ways of teaching, and methods for integrating content. The session presentations illustrated the importance of regional and local information for relevance to K-12 students.

Theme Session II, entitled "Earth Systems/Science Instruction and Learning" ran on the second day and was coordinated by E. Barbara Klemm and Nir Orion. Again this was divided into four theme sub-sessions.

**Theme Session IIA** "Using Technology for Learning at the College and University Level" was moderated by Ian Clark and Edwin L. Shay. The 12 presentations in this session highlighted technological tools for learning and teaching earth systems science. Some involved simple tools (email and video) for remote areas while others dealt with national courses developed for the internet. New educational tools such as GIS, CD-ROMs, virtual reality, and data visualization were demonstrated as means of making information relevant, establishing interdisciplinary connections, and providing data access for problem-based learning.

**Theme Session IIB** "Teaching at the College and University Level" was moderated by Michael Walsh and Donald L. Oakley. The participants in this session emphasized alternative methods of instruction in higher education: teaching about interactions, developing writing skills, and using constructivist methods with very large class sizes. Many of these activities are aimed at increasing the science literacy of non-majors, using national parks, newspapers, local examples, and creative sequencing of topics. Students in their classes were taking on the big problems of pollution and natural disasters, and examining recent huge anthropogenic impacts in comparison with the impact of longer-term natural processes.

**Theme Session IIC** was entitled "Using Technology in the K-12 Classroom" and was moderated by Daniel Barstow and Asta Thorleifsdottir. Here the presenters tried to provide examples of interdisciplinary interactions of earth systems that might otherwise be difficult for students to visualize. A number

of national (United States) programs involve students in the use of technology for data access and collection, and in numerical and image manipulation. In addition they also have access to data bases that scientists can use. Other initiatives teach the use of model-building software for demonstrating linkages between earth processes and outcomes, or describe innovative multimedia presentations toward that end. The resources of the Internet offer access to earth images, real time data and cross-curricular links. Home pages for data access and information exchange were described with attention to their use by K-12 classrooms.

**Theme Session IID** "Innovative Approaches to Instruction about the Earth" was moderated by Lynda Samp and Yael Kali. The conference participants in this session used entire curriculum approaches that change the style of teaching and the look of education about the Earth. Posters in this session described the use of: art, music, mythology and other literature as instructional tools; outdoor laboratories and field camps as integrative experiences; maps, computer visualizations and remote sensing as aids to holistic learning; and co-operative learning techniques for team learning. Special attention was given to problem solving on earth system issues.

The third theme session, held on Thursday, encompassed "Public Information, Research and Innovation" and was coordinated by Rosanne Fortner and Dan Jax. This session had three sub-themes.

**Theme Session IIIA** "Research and Evaluation Studies of Instructional Innovations" was moderated by Alfredo Bezzi and Roger Trend. In this session researchers from Israel, Portugal, the United Kingdom, Korea, Italy, Venezuela and the United States emphasized that state and national curriculum reform efforts are having a variety of effects on geoscience education, from loss of autonomy by teachers to opportunities for including environmental awareness in the science curriculum. Student misconceptions about earth processes and events are being revealed by new assessment techniques such as concept mapping, and the same techniques can be used to help students structure their information into meaningful learning.

Posters illustrated exciting and relevant information that can assist practices in Earth systems teaching.

**Theme Session IIIB** involved "Public Information through Museums and Other Informal Education Entities" and was moderated by Art Sussman and Wen Wei. The organizers wished to illustrate that libraries, museum programs and exhibits, stage shows, and professional organization outreach can be valuable means of extending learning about earth systems beyond what classrooms and formal media can accomplish. Presenters from the United States, Canada, Australia, China and Norway described how their non-formal education efforts are designed and received by their special audiences. David Rudkin from the Royal Ontario Museum dealt with "Getting Down to Earth: Linking Museums, Museum Earth Scientists, Professional Organizations, and the Public."

**Theme Session IIIC** entitled "Innovative Activities for Teaching About Earth Processes" was moderated by Chris King and Leslie Gordon. Presenters in this session described high-interest activities for engaging K-12 students in learning about the earth system. Samples from national (United States) programs such as the Maury project, EPI-center and IMAGE are offered as demonstrations of how those projects combine disciplines and focus on interactions in the earth system. Examples from Canada, Spain and the United Kingdom reinforced the fact that systems thinking is becoming the world model for earth science education, providing relevant information for non-specialists as a basis for understanding and decision making. Dino Pulera, from North York, and David Rudkin presented "Picture This...Using Illustrations of Ancient and Modern Food Webs in Teaching."

Following each of the theme sessions on each of the three days, participants separated into discussion groups to talk about issues brought up in the session. This involved wide-ranging conversations on earth systems and earth science education and provided an opportunity for a truly international exchange of ideas on these topics by participants from different cultures and backgrounds. Space precludes a report on these topics, but the moderator's summaries will be available in the soon-to-be-released conference proceedings volume.

In addition to the themes mentioned above, several other activities were conducted sequentially or concurrently with the main sessions. On the Monday, following the Kilauea field trip, the opening Plenary was entitled "Hawai'ian Native Perspectives on Natural and Cultural Resources" by Kapa Maly (Hawai'i). This was followed by other "Earth Systems" lectures on Tuesday by Rodger W. Bybee (NRC, Washington), on "Earth Systems Science and World Standards for Science Education" and by Yoshisuke Kumano (Shizuoka University, Japan), on "The Significance of Earth Systems Science (Education) in the Curricula of Japan and Other Asian Countries." On Wednesday, Thomas A. Schroeder (University of Hawai'i), spoke on "The Island of Hawai'i: Aspects of its Evolution and Earth Systems Interactions" and Ellen Mosley-Thompson (The Ohio State University) concluded with "Climate Histories from High Temporal Resolution Ice Cores: Changing Paradigms" on the Thursday.

"Engagement Sessions" were conducted on Tuesday with Laure Wallace presiding. Rebecca Slayden-McMahan and Lanette Gunderson (Austin Peay State University, Tennessee), presented "Rethinking Natural Science – An Interactive Earth System Secondary Level Curriculum" and Alan Morgan (University of Waterloo, Ontario) demonstrated "The Heimaey Eruption, Iceland: The First 24 Years...." On Wednesday Hiroshi Shimono presided over a presentation by John A. Fisher, (University of Bath, United Kingdom) entitled "Changes in the Culture of Science Education in the UK and Some Implications for Education about the Natural Environment," and on Thursday Stephanie Stockman (United States) presented "GLOBE – Global Learning Through Observations to Benefit the Environment."

## WORKSHOPS

Workshops were also conducted on the three days of the conference. These addressed either secondary schools or colleges and universities. The former group dealt with "Sharing the Science of the Earth's System: NASA's Mission to Planet Earth Education Program," by Stephanie Stockman (United States); "Meeting Earth Systems Education Standards Through Technology," by Ray Tschillard and William Hoyt, (University of Northern Colorado), and "United States Geological Survey Education

Resources," by Laure G. Wallace and Leslie C. Gordon, United States Geological Survey. The Colleges and Universities Workshops involved "Innovative Teaching Techniques For More Effective Geoscience Education – Ways to Actively Engage Students to Improve Learning," by Barbara Tewksbury (Clinton, NY); "Developing Technology Based Curricula in Earth System Science at the Undergraduate Level," by Sean Cash (University of Michigan), and John T. Snow (University of Oklahoma); and "Earth System Data Analysis and Visualization Tools for Classroom Use," by Daniel C. Edelson (Northwestern University) and Farzad Mahootian, Gonzaga College High School.

#### POST-CONFERENCE WORKSHOPS

Finally, two post-conference Instructional Design and Technology Workshops were conducted on Friday, 1 August. The first, hosted by Nir Orion, Weizmann Institute, Israel, and several of his graduate students, involved "Using the Computer as a Learning Tool in Studying the Solid Earth System," and the second by William Hoyt and Raymond Tschillard, University of Northern Colorado and Dr. Dan Jax, Bexley Middle School (Ohio) was on "Designing Earth Systems Education Curricula."

#### CONCLUSION

This intense spate of activity bodes well for the next Geoscience Education Conference that will be hosted by our Australian colleagues in Sydney in the third week of January in 2000. It also serves as a warning to the organizers of the Fourth Geoscience Education Conference (to be held somewhere in Canada in 2002) that much is expected at an international conference of this type.

GEOSCIED II was sponsored by The Coalition for Earth Science Education, the Commission on Geoscience Education and Training of the International Union of Geological Science, and the Association of Geoscientists for International Development. Financial support was provided by the National Science Foundation, the National Aeronautics and Space Administration, the United States Geological Survey, the American Geophysical Union, the American Geological Institute, National Association of Geoscience Teachers, National Earth Science Teachers Association, The Ohio State University, the University of South Carolina, the Weiz-

mann Institute (Israel), the University of Hawaii, and Hyogo University of Teacher Education (Japan).

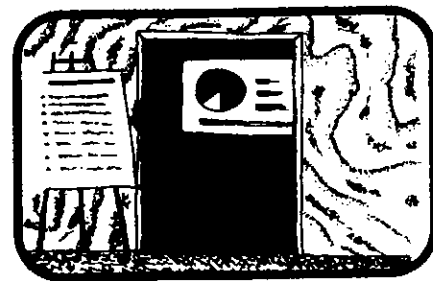
Additional support for editing and publishing the Conference Proceedings was provided by the Alphyl Memorial Endowment Fund of The Ohio State University. This is an endowment for support of earth systems education memorializing Victor C. and Phyllis C. Mayer.

Last but by no means least, all the conference participants owe a big vote of thanks to the respective committees involved with GEOSCIED II. The Conference co-conveners were John Carpenter (University of South Carolina), Victor Mayer (The Ohio State University), Nir Orion (Weizmann Institute), and Akira Tokuyama (Hyogo University of Teacher Education). The Program Committee consisted of Victor J. Mayer and Rosanne W. Fortner, Professor of Natural Resources (The Ohio State University), William Hoyt (The University of Northern Colorado), Dan Jax (Bexley City Schools, Ohio), and E. Barbara Klemm and Martha Sykes (The University of Hawaii - Manoa). The Arrangements Committee involved John Carpenter (University of South Carolina), Nir Orion (Israel), Laure Wallace (United States Geological Survey), and Frank Watt-Iretton (American Geophysical Union). Field trip leaders were Dr. Barbara Klemm and Dr. Martha Sykes (Hawai'i Institute of Geophysics and Planetology).

Many of the activities involving business were addressed during the meeting and are now in place. Some of these are mentioned above (locations of the next two conferences), and the first *Interconference Newsletter* has been distributed. Alan Morgan is acting as the Canadian contact for the next International Geoscience Meeting, and CGEN (the Canadian Geoscience Education Network) is looking at the arrangements for hosting the Canadian GEOSCIED IV Conference in 2002. If you wish to be kept informed of these developments contact the author at the email address above.

#### REFERENCE

- Morgan, A.V. and Ferguson, L. 1993, International Conference on Geoscience Education and Training (GEOED), University of Southampton, England, 20-24 April 1993: *Geoscience Canada*, v. 20, n. 4, p. 182-185.



## New Horizons in Mining: Seventh Annual Calgary Mining Forum

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#### INTRODUCTION

More than 300 people registered for this event, convened by the Calgary Mineral Exploration Group at the Telus Calgary Convention Centre, 8-9 April 1998: a first in attendance, and probably reflecting the high level of interest in diamond exploration in western Canada. Co-chaired by Hugh Abercrombie of Birch Mountain Resources Ltd., Calgary, and Mika Madunicky, Alberta Energy and Utilities Board, Calgary, the conference consisted of 18 talks, 16 posters, and 40 commercial exhibits. A novel feature was an afternoon session providing a corporate overview of Alberta diamond exploration (seven companies presenting). All sessions were well attended, particularly the papers on diamonds; there were also lots of discussions and possibly joint-venture deals (?) taking place in the hallways and exhibits area. For those of us working diligently over the past decade and more to persuade skeptics that there is more to explore for in Alberta than oil, natural gas, bitumen and coal, the talks, posters, commercial exhibits, interest level, and activity were gratifying. The 18 talks grouped as follows: ten on diamonds; three on metals; four were general; and one was on proposed University of Calgary minerals-related analytical equipment. A brief review of oral papers follows.

#### DIAMONDS

Interest level here is high. The front