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Earth Science Workshop After Five Years

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Article abstract

The earth science workshop at the University of Western Ontario has now completed five summer sessions and over 100 teachers from across Canada have attended. During the last three years, two Canadian teachers have supervised the development of a Canadian program, with emphasis on methodology with development of classroom exercises and field projects. Approximately one-third of the course is devoted to field trips. Visiting speakers discuss relevant matters of current interest. Present financing is provided by Shell Canada Ltd. Although this workshop is providing a need in the short term for earth science teachers, university-trained teachers will be required as the demand for a course on earth science increases at the secondary school level.

geographic position. The system was used successfully on the Mid-Atlantic Ridge to study micro-earthquakes in the median valley. The problem of positioning sea-floor sampling devices such as rock core drills and sediment corers was discussed by D. L. McKeown (Bedford Institute of Oceanography). The principal advantage of the acoustic technique he described is its ability to function accurately in areas of very rugged topography such as the median valley of the Mid-Atlantic Ridge.

General Assembly

The program concluded with a general assembly where invited speakers presented an overview of the conference and speculated on future trends in oceanography. The session was chaired by A. E. Collin, Assistant Deputy Minister, Ocean and Aquatic Affairs, Government of Canada. Before introducing the invited speakers, Dr. Collin outlined what he believed to be the overriding objective of any ocean resource policy namely the preservation of the oceans' ecological system. He stated that, if environment management coupled with international regulations governing ocean activities were instituted, other components of resource protection would fall into place. He also stated that development of the significant oil and gas industry off Canada's East and Arctic coasts calls for a major commitment in the next five years and that Canada's research activities in this and other oceanographic fields should be in concert with international oceanographic undertakings.

Dr. Frank Snodgrass, a research associate of the Institute of Geophysics and Planetary Studies suggested that the trend in ocean engineering was toward scale oceanographic experimentation. He cited a paper describing installation of the Woods Hole Oceanographic Institute's three-legged mooring as an outstanding example of such work bringing to bear on a major program elements of mechanical engineering, electronic instrumentation, data processing, positioning, and ship handling. He highlighted the extensive use of COSMOS type logic circuits in equipment described at the conference and suggested that this was an indication of the techniques likely to be seen in the future in the development of more complex and reliable electronic systems.

Professor E. M. Wilson, a tidal power consultant from the University of Salford reviewed the conference proceedings concerning tidal power generation, discussed the economic factors associated wtih these projects and discussed the feasibility of power generation by wave action. He suggested that both the technical and economic feasibility of such proposals changes with time and projects such as the Bay of Fundy tidal power proposal should be periodically re-assessed to determine whether or not they have an advantage over alternate sources of power generation.

Dr. Lloyd Dickie, the director of Dalhousie University's Institute of Environmental Studies, stated that the future of ocean engineering research lies in improving resource management rather than devising means of exploitation. He felt, as a biologist, that oceanographic instruments are improving but there is still too little communication between engineers and biologists. He drew parallels between engineering systems and ecological systems and suggested that the engineer could contribute much more to biology than just instrumentation development.

Dr. Joe MacInnis of Underwater Research Ltd. and an adviser to the Ministry of State for Science and Technology provided justification for his belief that it was most important to keep the public informed of oceanographic science and its impact on their lives. He emphasized that the average person should be "as excited about the sea and its potential as the marine scientist himself".

Note:

Copies of the conference proceedings are available from the Institute of Electrical and Electronic Engineers Inc., East 47th Street, New York, New York, 10017 at a cost of $12 for members and $15 for non-members.

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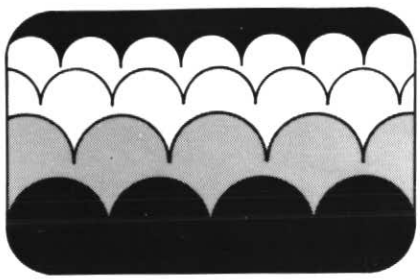

Earth Science Workshop After Five Years

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Summary

The earth science workshop at the University of Western Ontario has now completed five summer sessions and over 100 teachers from across Canada have attended. During the last three years, two Canadian teachers have supervised the development of a Canadian program, with emphasis on methodology with development of classroom exercises and field projects. Approximately one-third of the course is devoted to field trips. Visiting speakers discuss relevant matters of current interest. Present financing is provided by Shell Canada Ltd. Although this workshop is providing a need in the short term for earth science teachers, university-trained teachers will be required as the demand for a course on earth science increases at the secondary school level.

Introduction

In 1970 the Science Council of Canada in its Report No. 18 "Earth Sciences Serving the Nation" recommended that the provincial departments of education encourage the introduction of more earth science into secondary schools and that these departments support the training of teachers to provide them with an adequate knowledge of earth sciences. These recommendations evolved from a brief by the Geological

Association of Canada which, in addition, recommended that the Earth Science Curriculum Project (ESCP) be used in Canadian secondary schools primarily because it is available. The GAC brief also recommended that because qualified teachers were not too numerous that summer institutes or workshops should be organized with invitations going to teachers in all provinces. It was recognized that a program with a Canadian content should be developed.

The first workshops held at the University of Western Ontario in 1970 and 1971 did have instructors from the United States who were actively teaching ESCP. Comments from the participants soon made it evident that a summer workshop is inadequate to make a teacher proficient in teaching this program.

The ESCP program was developed in the United States and introduced into American high schools initially for a period of five years. The text and laboratory manuals presented a challenge which probably many students found more than their capabilities were able to surmount. Some teachers attempted the program in Canada and in more than one instance, the results were less than desirable. In the United States, the reception after five years can be estimated from the revised edition of the books issued in 1973. The textbook now has only seven authors and the contents are approximately one-half that of the original. The materials clearly indicate that a complete re-writing was carried out and that the level of comprehension is noticeably lower. However, it is still evident that the program presents a challenge to the students.

In 1972 the workshop program at Western was completely modified. The duration of the workshop was reduced to four weeks from six weeks. Two Canadian school teachers, one of whom had attended a previous workshop, were engaged to develop a curriculum and laboratory sessions which would better fulfil the needs in Canadian schools. Although the workshop is called Earth Science the content has a strong geological base. Field trips constitute approximately one-third of the course. Participants are encouraged to contribute material from their own experience. Although much effort was devoted to curriculum development one year, the session in 1974 clearly identified that classroom exercises and field projects are the principal need. This same view has been expressed by John Usher in *Geoscience Canada*, v. 1, no. 1, p. 52.

Financing

The workshop at Western has received financial assistance from the Canadian Geological Foundation, International Nickel, Geological Survey of Canada, and Shell Canada Limited. The latter company made a commitment for complete financing for the years 1973, 1974 and 1975. Sufficient funds are available to invite 20 participants from across Canada, to finance their travel to London, for accommodation and meals at the University, other expenses in connection with field trips, and necessary supplies for the workshop.

Participants

The workshop is advertised by brochures sent to school boards, teacher federations and secondary school publications across Canada. During the last five years over 100 teachers have attended. In 1974 enquiries for the application forms were received from 206 individuals. By the deadline at the end of February, 118 applications had been received. The application form includes information on educational background, the courses the teacher is presenting, and recommendations from supervisory personnel and/or the principal of the school.

Criteria used in selecting the participants include: 1) present or future teaching of an earth science program, 2) representation from all areas in Canada including the northern territories, and 3) in a general way, the number of applications and the population distribution from each area. In one instance, youth was given preference between two candidates who seemingly had equal qualifications. In 1974, there were two women and 18 men.

The participants are required to live in university residence for the duration of the workshop. In 1974, the invitations to two persons who were accepted, were withdrawn because they were not prepared to comply to this policy, which has been heartily endorsed by all participants who have attended.

With respect to educational background the participants in 1974 can be categorized as follows:

1. University training in science, with no indication of any earth science (7)
2. A geology major or a geology minor (7)
3. Geography (7)
4. No science or geography (1).

The individual in the last category has a B.A. in psychology, a Bachelor of Education, and an M.A. in philosophy. His teaching includes courses at the grade 9 level in science, geography, and earth science.

The workshop does not carry any university credit.

Supplies

Each participant is provided with the following basic field equipment: hammer, Brunton compass (Cadet model), streak plate, magnet, acid bottle, safety glasses, field bag, notebook, pencil, and collecting materials. Each receives the rock and mineral collections sold by the Geological Survey of Canada. Examples of literature produced by provincial governments, the GSC and some industrial brochures are distributed. Examples of curricula and laboratory exercises are duplicated and handed out. Each participant has a copy of the ESCP text and laboratory books on loan with the option to purchase at a minimal cost. Many teachers already have these volumes. The Canadian Film Institute, Ottawa, provides a free copy of its catalogue of Earth Science films.

Each participant is requested to bring enough material of rock, mineral, fossil or other earth science materials for each other participant. One fellow in 1974 provided rock

samples from every formation exposed in the Niagara Escarpment in his area. Participants are encouraged to bring slides either earth science or otherwise for evening sessions. Subsequently some of these can be duplicated for those interested.

The participants are also encouraged to collect rock and mineral samples on the field trips. Thus the workshop provides the opportunity to expand collections but does not pay the cost of shipping the material home. One individual had almost 200 pounds.

Program

Before the workshop, each participant receives an outline of classroom activities and field trips. The curriculum is laid out under such general headings as Earth Materials, Geological Processes, Geological Structures and Special Topics, which are used for presentations of lessons by the individual participants. The daily classes are conducted by two secondary school teachers with degrees in earth science, each of whom have several years of experience. These individuals have an understanding of the level of comprehension which can be presented and provide exercises and approaches which have been tested. They can also report on problems which are encountered. All participants are encouraged to contribute their own experience. The approach is not learning factual material and interpretation, but the methodology in teaching the subject matter. It is assumed that each participant has some background but the level of competency varies considerably. One session in 1974 was devoted to the organization of a field trip as some participants have never done this. The headings which become evident are the objective, locations, permission from parents, principal and property owners, final reporting, etc. Problems were identified including such things as the teacher who indicates he would be available as an alternate guide but at the appointed hour had made other plans.

The development of classroom and field projects can be generalized to a certain degree but the teacher must adopt such activities to his own locale. One teacher in southern Ontario has an exercise to illustrate the layer-cake stratigraphy of the Paleozoic by cut-out overlays of the geological map. The teacher from British Columbia must take a different approach. One teacher demonstrated how to construct dinosaur models using light weight lumber, chicken wire, paper towels, wallpaper paste, water-base paint – and imagination. A game which has already been tested in the classroom and proven very popular is entitled "The Oil Game". A box is constructed using pegboard and straws as well locations and inserted with a stratigraphic column on each side. Oil occurrences on the "wells" are scattered over the area. The teacher acts as the government and sells property which must be eventually drilled. The whole procedure is comparable to the conduct of this business in western provinces.

These are the types of activities which need further development and refinement.

Field Trips

A trip to a local gravel pit is used to collect a variety of rock types for methods of identification in the classroom. Discussion is held on the location about collecting methods. In 1974, discussion also made it evident that exercises in field procedure such as pace and compass, stratigraphic measuring and identification of rock features in the field are desirable.

The three major field trips were led by members of faculty at Western. A trip to Sudbury over the first weekend is used to demonstrate in the field igneous and sedimentary rock types, the stratigraphic succession, the synform structure of the Sudbury basin, the occurrence and geological control of ore, the evidence for the impact theory, and the character of the Grenville front. A trip is also made underground, and through the Inco smelter. Excellent accommodation is used at Laurentian University.

The trip on the Paleozoic of Southern Ontario examines rock exposures from Niagara Falls to Lake Huron to demonstrate the succession of formations and fossil occurrences. Stops are made at one oil field and also the famous Nelson Crushed Stone quarry at Burlington. This quarry is a classic locality illustrating continuous quarry rehabilitation with its screen of trees, nursery areas, soil filling of the quarry face with subsequent grass cover, and a fish pond. The long range program for this quarry is a lake with an adjacent recreational park.

A trip to examine the Pleistocene glacial deposits emphasizes deposition and the stratigraphic interpretation. Some comments by participants suggested more time should be devoted to geomorphic features but this probably reflects the presence of geographers.

A visit is also made to the local chip sample library of the Ontario Division of Mines, Petroleum Resources Section to examine the preparation and storage of drill samples for local oil and gas exploration. A voluntary trip is made to Toronto to visit the Royal Ontario Museum, the Ontario Science Centre and other locations.

Visiting Speakers

The program includes three special speakers. It is evident from comments from the participants that the first criterion is that the person be an outstanding speaker. Experience has shown that the reception of ideas is strongly controlled by this factor. The subject matter must be understandable and relevant.

In 1974 the speakers were Dr. Robert Legget who spoke on Geology and Urban Development in Canada, Edward Freeman of the Ontario Division of Mines whose subject was high school curricula in Ontario, and pertinent literature available from provincial and other organizations, and Dr. R. W. Hutchinson who spoke on plate tectonics and sea floor spreading.

In the discussion subsequent to the talk by Ed Freeman it is evident that there is an abundance of literature, much of it free. The GAC committee on education would provide a real service if lists can be prepared and

distributed to teachers across the country.

Social Program

The social program is most important because it heightens communication. On the evening of arrival, all faculty and participants gather in the lounge at the University residence. Light liquid refreshments and snacks break down barriers and encourage conversation. Name badges are distributed indiscriminately and each individual must then find the person whose badge he holds and subsequently introduce him to the whole group. One fellow made a most complete and exceptional introduction except that he could not remember the name of the individual he was introducing!!

Other events include a picnic, an evening at the Stratford festival and a final banquet without speeches but with appropriate presentations designed to emphasize contributions by the recipient.

Conclusions

The workshop at Western is designed to assist secondary school teachers in the area of methodology of earth science teaching. The success of the program hinges in large part upon the direction provided by two experienced secondary school teachers. Members of the faculty at Western provide coordination, and conduct the field trips. The teachers who have attended agree that the workshop is of particular benefit toward the development of their own course with comments indicating that the program provides an experience varying from a refresher session to a completely new approach to the teaching of earth science.

However, it is evident that this program does not provide the long range requirements for the proficient teaching of earth science in the secondary schools. As expressed by one participant in 1974 – "a full credit course should be taught by a person with several courses in geology". The long range solution will be provided by the universities which will foster a university curriculum designed for earth science teaching in the secondary schools. Such a program should be advertised in calendars. Up until now, many teachers of earth science in high schools have come from industry and government but as the number of courses increase – and this seems definitely the trend – the need will only be filled by graduates from university who have completed a satisfactory course.

The Science Council study of 1970 pointed out that the present graduate of a secondary school in Canada probably lacks the ability to appreciate fully their physical environment and to enjoy, through knowledge, the spectacular variety of Canadian terrain. Stated another way the student who graduates from high school at present knows something about the birds and bees, and about the flowers and trees. But in a country like Canada he should know something about the rocks and the minerals, too!

MS received, October 3, 1974.

Archean Petrography Seminar/ Workshop

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A conference on the petrography of Archean rocks was held at the Donald Gordon Centre for Continuing Education, Queen's University, on October 4th and 5th, 1974. The conference was organized by the writer under the auspicies of the Department of Geological Sciences, Queen's University, and was well attended by 40 geologists from both universities and industry. The format of the meeting stressed informality and actual work by the participants on thin sections provided by each speaker. The participants were allotted 10 minutes to give background information on their rocks and a further 20 minutes (sometimes more) were spent by all participants examining the thin sections which had been provided.

After opening words of welcome by R. A. Price, the conference got down to business with a presentation by W. B. Bryan of the Woods Hole Oceanographic Institute, on "Textures of Modern Abyssal Basalts". Textures similar to these have been showing up in well preserved Archean rocks and this work was well received. Gaston Gélinas and his group from Ecole Polytechnique presented several seminars highlighted by samples of remarkably well preserved quench texture rocks from their traverse area