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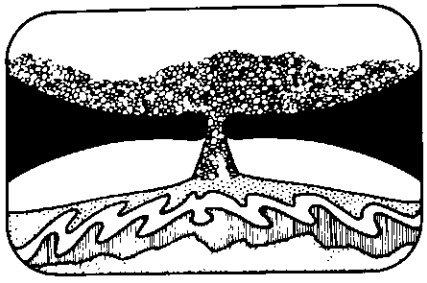

Geological Education

On Supporting Your Local Earth Science Teacher

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Next year more than 2,500,000 students will be enrolled in grades 7 through 12 in Canada. Will these students receive a proper instruction to the earth sciences? The Usher report (1972) presents a sobering picture of the status of earth science education in Canada, especially at the junior high level. Earth science is presented under that title in junior secondary schools (grades 7-9) in only two provinces, Saskatchewan and Alberta. Six provinces present very limited introductions to earth science within a general science course. These provinces are Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba and British Columbia. It is even more difficult to evaluate the effect of earth science teaching at the senior high level (10-12). The importance of the contribution of teachers of physical geography cannot be underestimated for these grades but it is important to realize that most of these courses lack a science oriented laboratory approach. The present trend in earth science education in the United States is away from didacticism to a managerial approach. The rigid schedules originally used to take a student step by step through a preconceived "orderly" approach to the subject have given way to seeking ways of stimulating a truly intrinsic motivation in students. Research has shown that we cannot expect students to find our materials intrinsically interesting if teachers impose a rigid structure in their classrooms, especially in the intermediate grades where students are first introduced to geology, astronomy, physical geography and geophysics.

Of the 1,300,000 students enrolled in grades 7, 8 and 9 only about 143,000 receive the kind of introduction to earth science that other "traditional" sciences receive as a matter of course. The Usher report went on to emphasize that the primary problem in the teaching of earth science in Canada was the dearth of well trained science teachers. He suggested that teachers of earth science should receive a B.Sc. degree. There is no question that these students would be better teachers of the earth sciences at the senior high levels but if we are to wait for this to happen we can expect to see little change from the current situation over the next ten years. I do not believe that a teacher of earth science in the junior secondary grades requires a B.Sc. degree. Students within our Faculties of Education can be trained to teach earth science in grades 7-9 without a B.Sc. degree. This is a much more reasonable approach to solving our earth science teacher dilemma. Any student in a Faculty of Education that has taken the first year university courses in the basic sciences plus introductory geology, physical geography, astronomy and geophysics can do a reasonably good job with a grade 8 earth science course. One thing is absolutely necessary to make this scheme workable. These teachers must receive a great deal more help from the geoscience profession than they are presently receiving. Except for a few isolated areas in Canada earth science professionals have literally turned their back on the teaching profession. Granted, a few of you have tried to help but your first attempts may have been discouraging. Do not harbour the illusion that widespread change in the system is possible even within the next five years. There are some bright spots here and there but in some areas the candle is about to be extinguished.

I do not know what it will take to get our geoscience professionals involved in the problems of the typical earth science teacher. Can we find a common ground to bring the dedicated professional earth scientist together with his or her high school counterpart? I believe your association with a high school science teacher and his class is absolutely essential. Too many times we find our professional groups trying to help but working in a vacuum without input from local science teachers. No, these teachers may not ask for our help but they need it. The earth science teacher is not in dire need for another high school geology book, good or otherwise, Canadian content or not. The rigid schedules and matter-of-fact methods of presentation of geologic principles, for example, are neither realistic nor pedagogically sound for grade 8 students. Teachers are now being trained to allow individual students to make significant decisions about what is to be studied and to be less concerned about maintaining artificial constraints and more concerned about their students as human beings. What does this mean to the earth science professional interested in helping his teacher colleague? The emphasis today is on projects involving hands-on activities. Individual instruction is paramount. Local projects come to the fore. Local help by trained professionals is more essential than ever because students want to study their immediate surroundings. Our typical grade 8 teacher does not know his way through the geologic literature, for example. Neither is he capable of running a geology field trip with much meat in it. These teachers need our help.

I believe that the combination of earth science and ecology can be one of the most attractive disciplines to our students. This is so especially if it contains the essence of humanitarian principles. Earth science has one aspect that is nearly universally appealing to the non-science oriented student. It can be taught as an outdoor activity and enjoyed years afterwards on every camping trip or outing. For this reason alone it deserves to be a part of every high school curriculum. Once our biology, chemistry, and physics teachers realize how enriching the earth science experience becomes they will be more than willing to include it as part of their science program even though they may feel uncomfortable working with a science in which they did not specialize in college. Somehow we must first motivate these teachers. Remember that relatively few science teachers have any background in geology, for instance. What are the ways that we can whet their appetites and encourage them to go back for a summer institute in geology or one of the other earth sciences? At the same time a slow but perceptible dribble of trained

earth science teachers will constantly enter from the wings.

1. Visit your local high school and meet the science and social studies teachers. *You* must take the initiative. They are not likely to come to you or even phone you for help.

2. Offer your services on weekends or perhaps during the week for guest lectures, field trips, etc. Make yourself available to individual students working on earth science projects much as an examiner or scouter would in the Boy Scouts of Canada.

3. Prepare a field trip guide to the geology around the nearest large high school. Lead the first two or three trips yourself.

4. Prepare a rock or mineral collection and donate it to your nearest science teacher. Use local materials if possible. Prepare a brief description of the collection and go over it with the teacher. Include a detailed large scale map with all collecting localities carefully shown.

5. Prepare a fossil collection, from local rocks if possible, and present it to your nearest science teacher. A biology teacher may be interested in using the collection as a teaching aid even if you find that earth science is not being taught in the school. Go over the types of preservation, fossil groups and write up a short description of how *these* fossils have been useful in working out local geologic history. Better yet, take a science class on a fossil hunting expedition.

6. Offer to take your science teacher's class on a trip to the nearest geology museum and spend an hour with them looking at displays and specimens.

7. Perhaps you can arrange to borrow a teaching set of rocks and minerals from a local university or college. Offer to show a science class the basics of rock and mineral identification.

8. Translate a technical report on the geology of your home town area into a jargon free introduction to the natural history of the area. Then lead a field trip through the region and pass out free copies of your translation.

9. If you are more ambitious, write a brief introduction to the geology of your home town, illustrate it with your own black and white photographs and send it to me. I can probably find money somewhere for a relatively cheap reproduction of it in quantities of from 250 to 1000 for free distribution in your school district.

10. Visit your local school board headquarters and find out where the natural areas visited by school groups are located. Sometimes these areas are visited by thousands of students each year. Commonly such areas are used to acquaint the students with the flora and fauna. Prepare an interesting short summary of the geologic highlights of the region. Use lots of line drawings and photographs. Visit the camp while it's in session and offer to go over your material with the camp director and his staff.

11. Prepare a list of all publications on the geology and natural history of your local area and make sure that sufficient quantities get into all the school districts of your city. Perhaps a local industry will provide funds for the development of a good teaching library in earth science for the young students of the community.

12. If that fails, make a donation of several books on geology or earth science to your school library. Write one yourself but key it to the landmarks and scenic areas of your province.

13. If you are an exploration geologist offer to take a group of students on a prospecting trip. Introduce compass and simple mapping techniques. Perhaps you have enough influence to get the students into a mine or to have the local school sent a complete set of all important minerals and rocks from the mining district of your interest.

14. Write up a description of the economic minerals of your province and arrange to have mining companies provide representative samples to your neighbourhood school.

15. Go through your slide collection and pick out 50 representative slides of geologic phenomena. Make up a key and write a brief description of each slide. Contribute a duplicate set to the school resources library or to your nearest science department. Perhaps the provincial teacher's association will make duplicate sets for sale as a lesson aid in geology.

16. Organize a camping trip for the local science class. Get them above timberline, onto a glacier or into a cave. Make it as interesting and exciting as possible but introduce the basic concepts of geology that relate to the excursion. Provide a brief writeup and list of stops so that the trip can be run again. They'll never forget it.

17. Stand up at your next school board meeting and ask about earth science instruction in your school. Is it being taught? If not, why not? Then do something about it.

18. Show a group of science teachers how to use a polarizing microscope. Provide a few free thin sections for the class. They may be able to construct their own microscope with your help.

19. Do the same with a binocular microscope. Collect a representative sample of coarse grained rock or sediment (a beach sand or marine sand with micro-fossils would be interesting). Get them into the wonderful world of microfossils. Show them where local materials are easily accessible. Give them the name of a geologist that might be able to help them out with their collection or provide free fossils.

20. If you are a laboratory oriented scientist working for a university, government or private company arrange to take a group of science students through your research facility. Invite another class later.

21. Get to know your high school teachers on a personal basis. Show them the teaching and professional resources available to them. Let them browse through your personal library or loan them copies of important publications dealing with the local scene.

22. Show the local science class how to stake a claim. This can be done without leaving the school ground. They'll find this a very interesting experience.

23. Purchase a rock hammer and give it to your local science class. Then show them how to use it. Do the same with a hand lens and compass.

24. Find the nearest and most easily accessible rock outcrop or sediment sequence. Show the students how to collect samples and what to do with them afterwards.

25. Take a science class to the nearest stream. Show them how to measure discharge. Talk to them about stream activity and find evidence for each geologic process related to stream erosion and deposition.

26. Organize a class for prospectors and invite all of the local high school teachers to attend on a reduced fee basis. Schedule it on an annual basis.

27. Build a collection of geologic maps of the local area. Pick a good one out to show science and social studies

students how it can be used. Then let them make their own map or use a map of their choice in the field to work out local geologic relationships.

28. Visit the provincial Department of Education. Find out how many earth science teachers there are in your province and let them indicate to you those that have the ability to provide impetus for earth science education. Perhaps you can help them organize a workshop in which successful methods of teaching earth science can be introduced to 100 or 200 others. Maybe you can help them with the funding of such a workshop. Find out what aspects of earth science are being neglected in your province. Then do something about it.

29. If you are an engineering geologist or geotechnical scientist you have a ready made topic of great interest to every student. Discuss local geologic hazards with them. What role should the earth science professional play in community planning? Could you write up a local hazard that was remedied with expertise provided by geoscientists? What geologic principles were used to unravel the problem?

30. Visit your local Minister of Mines and Mineral Resources. Ask about their public service programme. Do they provide books on the geologic history of the province or on the areas in and around the major cities? If not, why not!

31. Visit your nearest university, college or regional school and find out if an earth science programme for teachers has been organized. Encourage the Head of the Department to work with the Faculty of Education and get an earth science major organized within the school.

32. Find out who is responsible for earth science education within the Faculty of Education. Work with him for he may not be a trained professional in earth science. He will welcome your interest.

33. The nearest school has a playground and a building. Write up a list of geologic exercises that can be accomplished outside but within the confines of the school ground. Discuss the process of weathering of the school building and introduce the concept of change and importance of geologic time.

34. Find out which members of the local geoscience fraternity are interested in helping their local science teachers. Organize a visiting scientist's programme.

35. You and your local colleagues could organize your own workshop and present a well illustrated summary of the geology of the province or of the local area. Make sure that you invite every school teacher interested in earth science. Show them the local geology and get them to organize their own field trips.

36. Get all the local scouters and cub pack leaders together for a field trip through the local countryside. The boys will enjoy it and so will you.

37. Write an article for *Geos* or *Geoscience Canada* that will be of interest to high school teachers and laymen.

38. Find out how you can get involved in the education programmes of the technical and professional societies to which you belong. Nearly all of them are actively involved in an effort to improve the quality of earth science instruction.

39. Visit your local public library and browse through the earth science reading materials. Perhaps you can advise the library of up-to-date texts or popularized versions of science topics in geology, geophysics, astronomy, and oceanography. Remember that high school students rely heavily upon the reading materials in public libraries as well as those in their school libraries. Donate a good book dealing with your discipline.

40. Join your local natural history society. Help them run field trips or at least make a contribution to their guides to natural history of the area. Perhaps they will invite you as a guest lecturer in geology or some other aspect of the earth sciences.

41. Find out who is active in outdoor education in your area. Commonly at least two or three teachers in each school are involved with this kind of work. They will welcome your contribution to the study of their special outdoor education areas. Commonly these people are heavily oriented toward biology and/or ecology but completely overlook the importance of geology or soil science.

42. Don't give up in your efforts to get earth science moving in your community. It is relatively easy for most of us to sit back and say "Let the educators handle the problem." We train qualified teachers each year but the rate at which they find their way into the system is nearly imperceptible.

43. Above all, if you find that there is a teacher in your local school that is interested in teaching earth science, encourage him in every way possible. He or she probably feels relatively lonely in their efforts and doesn't receive much acknowledgement or thanks for the effort. We all need that kind of help.

44. Once you have found a successful earth science teacher, write a letter to the local school board and to his principal. Let these people know that you appreciate the work the teacher is doing and perhaps you can put in a word for some of the equipment that he needs so badly, perhaps a dozen hand lenses or hammers. Make sure that his or her school board is aware of the importance of field trips and that the financial sacrifices that these may impose on the district are well worth the expenditure.

If you got this far you are probably *very* interested in earth science education. Let these teachers know that you are ready and willing to help them in any way that you can.

References

Usher, J. L., 1972, The teaching of earth sciences in the secondary schools of Canada: Report to the Canadian Geoscience Council, August 3, 1972, 48 p.

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