

Presidential Address

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[Aller au sommaire du numéro](#)

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Presidential Address

Presidential Address to the Geological Association of Canada, St. John's, Newfoundland

Le Défi Canadien

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Introduction

Le Défi is the challenge and today I wish to present to you the combined challenges currently facing our profession, because we seem to have been slow to recognize and/or acknowledge some of them. Ladies and Gentlemen, a few months ago I wrote that "geology is not in a backwater but is a rapidly developing science that is exciting, relevant, and well-poised to respond to present and future needs in the world." Today I wish to expand on this topic. The new challenges and the new frontiers will require the same breed of people but a different outlook. Geologists (e.g., King Hubbert) have seen the energy crisis gradually develop but it took political action to aggravate the situation so that the public took notice. The greatest danger now could be a public which believes the developing crisis is purely political. Today we are concerned with energy; tomorrow it could be a certain mineral commodity. But we are also concerned about environment so that there be proper land mass management. I wish to show what is being done and how your Association is displaying leadership in these areas.

The Challenges

The challenges facing the geoscience community today are many and varied. I will dwell briefly on a number of the more important and highlight certain problem areas where action could be taken. Many of the challenges are interrelated. Today I wish to show how this interrelationship tends to focus on one area in which our Association could perhaps play a greater role, namely: communication.

We are representative of the geoscience community. For a term of reference I would place us at the centre of a triangle whose apices represent the end points of the challenges:

As in many geological problems we find we are not dealing with pure end



members but with a mixture (or solid solution series). Within these mixtures we can identify specific problems and I feel we should regard them as challenges.

Needs of Society

Resource Policies. Long before the political threat of shortage of petroleum fuels in North America late last year, we had been reading statements by learned scientists such as King Hubbert, in the U.S., and F. K. North and J. T. Wilson in Canada, on the long-term developing problem of the finite nature of fossil fuels. Current estimates suggest that within our life-time we will possibly not have sufficient oil and gas to satisfy our needs in Canada. But the realization of the finite nature of fossil fuels has caused society to ask very basic questions – how much do we have? How easily can more be found? How much do you think we *might* have? Should we export some if we have too much or should we save some for later?

Canada and its provinces are not alone in considering this matter. Many nations have suddenly become more keenly aware of not only their fossil fuels but all their earth resources – and the same questions are being asked.

The result has been that industry, government and university scientists have been forced to study and evaluate resource potential on a long-term basis. A number of different estimates may result because of uncertainties due to lack of data combined with inherent variability of certain geological factors. These may cause some confusion to laymen so I think it is vital that the nature of the geological factors be properly explained and that the magnitude of the extrapolation be emphasized. Only in this way may we prevent a credibility gap developing between scientists and politicians or planners.

Land Use. The need for greater use of geological data in land use planning has been frequently stressed in the past but geologists are now being asked to provide such information. However we now realize that there is difficulty in communicating this information appropriately. For example:

- a) Resource Potential. Again how best can it be displayed? In B.C. such data has been required in planning location of railroad.
- b) Terrain Sensitivity. How best can a rockslide or mudflow threat be evaluated and portrayed? or how can foundation stability and integrity be predicted and presented? Some examples of how these factors have been dealt with are contained in the scientific reports recently published for the Mackenzie Valley Pipeline.
- c) Scenic beauty or geological monument. In certain areas many of us can appreciate the scenic beauty of an area – but how can this be expressed geologically? In certain rare cases the geological features exposed are themselves justification for establishment of a park or monument such as recently done for the Mt. Edziza volcanic area in B.C.

Needs of Industry

With a society which desires to integrate development of earth resources with an overall policy of planning, our highly renowned and successful mineral industry would like to receive both assurance that it can continue to participate in development and be given, in consultation with the governments concerned, fair and reasonable guidelines. Care must be taken that such guidelines take into account the unique geological nature of problems industry faces. Much more effective statements on these points can be made by our sister organizations representing the petroleum and mining industries. Particularly competent reports are contained in the articles of John Kostuik and Louis Renzoni in the first issue of *Geoscience Canada*.

Certain facets of the problems to be faced are worth mentioning here.

High risk nature of mineral exploration. Somehow people do not fully appreciate the high risk nature of mineral exploration. Unlike other industries, a mining company for example, has first to find its product. The problem is a gamble akin to searching for the proverbial needle in the haystack *without* the assurance that it is there. Consequently we have seen in Canada some spectacular winners but many losers who either doggedly persist or quietly pass from the scene. Members of the public from time to time may sense the high risk nature through personal financial setbacks following a frivolous speculation on the stock market. Unfortunately they do not probe deeper into the geological nature of mineral deposits to appreciate why they present such a high risk for investors and why they are so frustratingly elusive even to modern day prospectors.

At this time some careful and patient explanations are required to present: (a) the factors which appear to control concentrations of minerals, (b) the difficulty in assessing these to establish appropriate target areas, (c) the common lack of critical data, and (d) the immensely complex processes of searching for a possible deposit concealed, commonly thousands of feet, underground.

Time lag – search to development. So much luck is involved in finding a deposit that this factor is highly variable. Nevertheless I think it is important that planners be aware, at least qualitatively, of this factor as it bears on the risk factor discussed above as well as the broader problem of economic planning.

This factor is particularly crucial in determining whether the rate of discovery can maintain our competitive position on the world market as well as satisfy domestic needs. Consequently the highly complex but successful science and technology of Canadian mineral exploration is challenged to evolve even further.

Needs of Geoscience Research

The needs of Geoscience Research in Canada are in themselves varied. There are however priorities.

1) **Short Term Multidisciplinary Research.** The challenge here is presented by society but it is only the geoscience community (or sections of it) which can clearly define the geological factors to be examined so that study and evaluation can commence. A good example would be the recently completed report on the Mackenzie Valley pipeline corridor.

2) **Basic Research Required to Support Industry and Government.** Canada has an enviable reputation for the calibre of its geoscientific research related to resource development. Many of the programs with immediate or short term goals have been conducted by industry itself or in conjunction with university and government. Thus we have seen the major contributions to the knowledge and understanding of oil and gas basins in Canada, and the development of the highly sophisticated but successful system of geophysical techniques used in search for base metals. Programs with long-term goals related to providing a fundamental geoscience data base on which all earth science endeavours must depend, are chiefly provided by government agencies at times in co-operation with industry and university. Recently there has been a rapidly growing awareness that we lack critical data for areas where evaluation must be made swiftly.

Accordingly we are being challenged to produce conceptual models along with their data bases in a fashion such that concepts may be modified or altered as new data are acquired.

Thus we have seen the application of computer techniques in Canada for the collection of field data by Quebec, Manitoba, and Federal agencies and the production by flat bed plotters of high quality colour geological maps in Britain and more recently in Canada, Spain and France. The proper harnessing of computer technology to serve geologists appropriately and to cope with rapidly accumulating data is a major challenge at this time.

3) **Unique Challenges of the Vast Geology of Canada.** We are fortunate in Canada in having five major contrasting geological provinces each with their own inherent attributes.

Systematic mapping and synthesis combined with detailed studies of key areas have contributed enormously to formulating major concepts concerning the evolution of Canada and our earth in general. Reciprocally, many concepts and theories can also best be tested by examination of Canadian exposures. In both the Cordilleran and Appalachian Systems theories of plate tectonics are being examined, tested and where necessary, modified. Whereas current theories of plate motions appear to reasonably explain evolution of parts of the Phanerozoic, it would seem major modification is required for them to apply to older Precambrian strata. This challenge is currently leading to formulation of alternate models.

Substantial thicknesses or packages of Canadian geological strata were formed or deposited deep in the ocean. This factor combined with vast areas of continental shelf surrounding Canada, make it essential that we have a clearer understanding of recent undersea geological activity. Study of areas far afield, such as the mid-Atlantic ridge, may come not simply from the point of view of pure research but to test theories of practical significance. For example ore deposition in greenstone belts through hydrothermal action of circulating sea waters near spreading ridges has been proposed by Dr. Fyfe at the University of Western Ontario. With our vast tracts of Precambrian greenstone, it is vital we test and evaluate such proposals.

4) *Training.* A critical part of the unique challenge of geology in Canada is the training and initiation to the science conducted by colleges and universities to maintain an adequate flow of appropriately trained personnel. This subject is a topic for extensive discussion and is not examined further at this point.

Culture and Drama

There is a wealth of culture and drama in geology. It is a rich culture shared by few. Whether we be listening to the drama surrounding the unravelling of events that lead to evolution of a mountain range or analyzing clues in search of a mineral deposit we can be

held as fascinated as we can by any other type of cultural performances.

We, the professionals, can share this experience, but I feel too it can be shared with others. It seems to require someone with the ability of a Koestler (Sleepwalkers) or a Maurois (The Life of Sir Alexander Fleming) to appreciate the complex intertwining of logic, irrationality and intuition that appears to be so commonly associated with major scientific discoveries. Nevertheless where appropriate we should attempt to communicate this vital element of our sciences.

Science Policy

More recently we have become aware of another challenge – Science Policy. This can become another parameter in the simple sketch presented earlier so that the geoscience community sits at the centre of a tetrahedron with end points – Needs of Society, Needs of Geoscience, Needs of Resource Industries, and now Science Policy.

Early this year, the Senate Special Committee on Science Policy, chaired by Senator Lamontagne, published its third report entitled "A government organization for the seventies". Scientists in Canada, including myself, have reacted critically to this report. However the time has come to use the report in a constructive manner.

The document, and its earlier predecessors, pointed to and examined problems which had not been recognized, or certainly not resolved, by scientists in general. Part of the reaction is the basic anathema of research scientists to any sort of organization which might imply constraint.

Science policy looks back with some perspective at the base of the tetrahedron – needs of society, needs of industry and the needs of the sciences themselves. It recognizes that most science is funded by the taxpayer and that there is only so much money available. At the same time it wishes to ensure that priority goes to science related to the needs of the community. The policy makers themselves cannot judge the relative priorities of long-term programs required in pure science so the

scientists must discuss and discriminate to offer the appropriate guidance.

In responding to statements on Science Policy, your Association has had to start to integrate itself with other scientific groups. At first, like many of you, I feared a loss of identity. Now I am convinced it is essential we integrate: (a) so that other scientists may better appreciate the nature and problems in geoscience, and (b) so that we may have a clear perspective of geoscience in relation to other sciences. Rather than stand on the sidelines to watch and pass criticism, I think the time has come to participate. In doing so, I see no real danger of our forfeiting our autonomy.

Canadian Character of the Challenge

Canada is unique. An integral part of its character is its geology. This, combined with climate have led to the concentration of 85 per cent of our population, with two major cultures, within a 100 mile wide belt adjacent to the most technologically advanced nation in this world. This means that a vast part of Canada, land commonly dominated by exposed rock, is unknown or poorly appreciated by the majority of our population. Accordingly the challenge or *défi* becomes uniquely Canadian.

Communication

A prime problem is one of communication. Poor communication can lead to misunderstanding and distrust.

In every relationship I've discussed today, there is a clear need for our scientists to become more sociable, to integrate with other sciences and further to shed their reticence and communicate more effectively. Whether it be industry scientists trying to explain some of their problems to planners and politicians or a scientist attempting to demonstrate the significance and importance of his own research work, there is a need for better communication.

The nature of this communication will be diverse but our Association can and is responding to the challenge. Traditionally the greater part of our efforts has gone towards

communicating to our peers. However, we can see quite clearly that we are becoming so specialized that even communication among us is becoming more difficult. Any copy of the *Canadian Journal of Earth Sciences* emphasizes this point. Consequently reviews, such as the highly successful themes chosen for this meeting or for example those selected for the Cordilleran Section meetings, underscore a response to a need. There is the necessity also to communicate to other professionals and I can see *Geoscience Canada* partly filling this function. The education in high schools has been constantly monitored by Jack Usher, chairman of our education committee who, along with the Canadian Geoscience Council, is ensuring adequate communication among the persons concerned in each province. We have however been woefully deficient with respect to the needs of the layman. Much more emphasis must be placed in presentation to him of geology and, in particular, local geological scenes as demonstrated so effectively in the booklet prepared for our Cordilleran Section by G. Eisbacher and D. Templeman-Kluit on Vancouver Geology; or on a completely different and broader plane, R. Legget's "Cities and Geology".

Perhaps the greatest challenge of all, is for us to accept and re-orient ourselves to communicate our science so that others may appreciate or make use of it. Accordingly quite different approaches are required for high school students, for analysis and appraisal by other professionals, for quick assessment by politician or planner, and for leisurely perusal by an interested public. Obviously only a few of us can (and should) be involved in this role but it is vital that the importance of this function be appreciated.

The Future

The development of the geological sciences in Canada has been an integral part of the history and frontier development in Canada. Many of the greatest Canadian geologists are living with us today and an examination of them, not as scientists,

but as people, reveals the richness of their character. Furthermore no other small group of professionals knows so much about the surface of Canada. Many of these do so through a love of the land. Their interest in geology stems from a love of the outdoors, a wish to work in the bush and in the wilds, apart from civilization. Each summer we see the same miracle re-enacted: small parties going out for many months to operate in isolation under dangerous conditions where experience of party chiefs and the current technology keep accidents to a minimum. Conditions under which these people work would be classified as intolerable by many so-called professionals. Certainly in many instances conditions are marginal at best. Yet a particular combination of determination, leadership, and humour are required to see the groups safely through each summer. It is these same people who are, in my opinion, the salt of Canada; they perpetuate the tradition of the prospector and frontiersman. But in today's age we still require the same calibre of people, only the frontiers have changed.

Ladies and Gentlemen, I have given you today some glimpses of why geological sciences play such a key role in the economy of Canada and why geology in its own right is a worthwhile end in itself with its culture and drama. Given these circumstances I cannot be pessimistic. We have some of the most exciting geology in the world and through unravelling its evolution we have uncovered some vast but not limitless natural resources. In addition we have some of the top-notch geologists in the world and through them and mineral exploration technology we should be able to provide for our own material needs and assist other nations in developing theirs. But to do all this effectively and to allow orderly development, we must become more sociable and drop our reticence and commence communicating more effectively. Above all it is our responsibility as a scientific organization to ensure that the main theme is the science itself.