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Volume 1, numéro 4, november 1974

URI : https://id.erudit.org/iderudit/geocan1_4art05

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Éditeur(s)

The Geological Association of Canada

ISSN

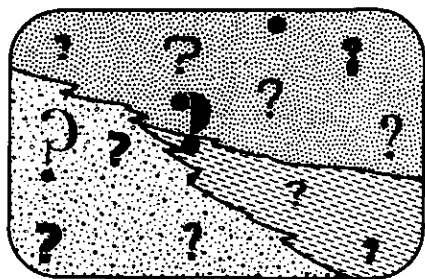
0315-0941 (imprimé)

1911-4850 (numérique)

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Citer cet article

Neale, E. R. (1974). The Geoscientist and Canadian Science Policy (With Gleanings from a SCITEC Forum). *Geoscience Canada*, 1(4), 35–38.



The Geoscientist and Canadian Science Policy (With Gleanings from a SCITEC Forum)

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Who Cares?

Most geoscientists who I work with or talk with profess very little interest in the subject of this article. Superficially this is a good sign and the common attitude "Let's get on with the job and to hell with the geopolitics" may suggest a healthy interest in science and a wholesome disregard for the manipulation and intrigue supposedly associated with top management.

However, there is another side to the coin which has been succinctly expressed by Dr. Virginia Douglas who has just completed her term as president of SCITEC (The Association of the Scientific, Engineering and Technological Community of Canada): "Science policy is far too important to be left in the hands of the politicians". When we think a little about the possible outcome of recent recommendations, maybe we'll be inclined to agree with her; for example: (1) the shift of the University granting function in aid of basic research from NRC (National Research Council) to a Government Department; (2) the rumoured shift of the Mines Branch from its longtime association with the Geological

Survey of Canada to the Department of Industry, Trade and Commerce; (3) the proposal that a single government department will henceforth review and assess the complete Federal Government science budget. Some of these decisions when implemented may have serious consequences within our own little niches in the earth sciences and maybe even upon us as individual workers.

An increased awareness of the importance of science policy decisions has come about in the past few years with publication of three volumes of the Report of the Senate Special Committee on Science Policy chaired by the Hon. Maurice Lamontagne. Again to quote Virginia Douglas "... the Senate Committee deserves a good deal of credit for helping Canadians focus on some fundamental issues in science policy. Certainly the scientific, engineering and technological associations have been challenged to re-examine their own goals and to give serious thought to their responsibility for helping define a science policy for Canada." The reports of the Senate Committee spurred scientists to form several groupings of scientific societies including the super umbrella organization, SCITEC. These umbrella organizations, some individual scientific societies and some individual scientists have submitted briefs commenting on various aspects of the Committee's recommendations. So far they have contented themselves only with reactions but the hope is that this newly awakened interest in science policy will eventually result in some positive initiatives from scientists. Our own Canadian Geoscience Council has set a good example in this regard by recently negotiating an advisory role with the Department of Energy, Mines and Resources.

The purpose of this paper is to provide a brief review of some of the background behind the Lamontagne Committee recommendations and to comment on a couple of these recommendations that appear to cause concern among geoscientists. My review is based only on a recent reading of the Lamontagne Report, on

participation in a SCITEC Forum held in Ottawa, May 2-3, 1974, and on my recent association with the Canadian Geoscience Council. I hope it will provoke comment and discussion and possibly stimulate other papers by some of you who are better qualified to write them both by your experience and by your more direct involvement with the subject.

Present Canadian Science Policy

Volume 1 of the Lamontagne Report offers a critical review of Canadian science that leaves little doubt that Canada has never come close to having an integrated science policy. Scientific activities grew up independently within various government departments subject only to control of Treasury Board - this was a so-called *Pluralistic Model*. When the National Research Council came into being in 1917 to coordinate and promote scientific and industrial research in Canada, it faced at least two problems: (1) there was abysmally little research underway in the country; and (2) the pockets of research already established in government didn't particularly want to be coordinated.

The Council helped solve the first problem by establishing its own laboratories in 1932, but in so doing it at least temporarily relinquished interest in the coordination role. During the Second World War, NRC expanded its staff and budget by seven times and began building up an international reputation under the leadership of first, Dr. C. J. MacKenzie and later (1952-62) under Dr. E. W. R. Steacie. This period saw a considerable broadening of NRC's activities and very large increases in its grants towards university research. Dr. Steacie summarized the five-fold function of NRC as follows: (1) A government laboratory with specific duties; (2) A foundation similar to the Canada Council; (3) An industrial research laboratory; (4) A research institute more like a university laboratory than a government department; (5) A national academy with functions similar to the Royal Society of London or the US National Academy of Sciences. If there was any national science policy message

of the time that we clearly remember, it was Dr. Steacie's words: "... A university professor and a few students ... in my mind is the ideal team".

The Royal Commission on Government Organization published its findings in 1963 and noted that science policy was virtually inoperative. Their recommendations and a report on them by Dr. C. J. MacKenzie led to the establishment in 1964 of a Science Secretariat within the Privy Council Office which acted as a service agency to assist government departments and other agencies in getting their proposals before Cabinet, and the Science Council of Canada in 1966, an independent advisory body which was asked to assess in a comprehensive manner Canada's scientific and technological resources, requirements and potentialities. However, as 11 of the 29 members and associates of the Council were senior government officials the objectivity of the Council's decisions and its freedom of discussion were questioned from the start. Also, care was taken that it did not infringe on existing agencies so that it really had no role to play in the direct dealings of NRC and other government departments with Treasury Board. However, for better or worse, a change took place in the 1960s and government science moved from a pluralistic to a *coordinated model*.

Policy in Canadian Geoscience

Most of the research in Canadian geoscience had been carried out by the Geological Survey of Canada and other federal and provincial government agencies until the 1960s. Coordination of research was handled by a National Advisory Committee on Research in the Geological Sciences established in 1949 which consisted of 21 members representing universities, industry and government who were appointed at the invitation of the Minister of Energy, Mines and Resources. A short, informative review of the work of the NACRGS has recently been presented by Y. O. Fortier as a foreword to the 20th (and final) report of this Committee. Involving senior government

scientists, as it did, the Advisory Committee's objectivity in its advice to the Minister was, of course, open to the same criticism as that of the Science Council of Canada. This Committee published an annual review of research in the geosciences and also distributed grants to support research in the universities. The enormous growth of university geoscience faculties in the mid 1960s and the belated but generous support of their work by NRC widened the distribution of geoscience research centres across the country and also eliminated the need for NACRGS grants to universities. The Blais Report, "Earth Sciences Serving the Nation", commissioned by the Science Council, recommended that the Department of Energy, Mines and Resources should transfer responsibility for coordination of discipline-oriented research to appropriate professional societies. A step has already been taken in this direction with the Department recently contracting out preparation of an annual review of the geosciences to the newly formed Canadian Geoscience Council.

The Proposals of the Lamontagne Committee

The Senate Special Committee on Science Policy set up in November, 1967, has completed the most exhaustive review of Canadian Science ever undertaken. Its major recommendation is for a *concerted action model* to replace the coordinated model of the 1960s. According to the Senators, coordination without authority is an empty role. The Ministry of State for Science and Technology (MOSST) is the designated authority to implement this new model which involves coordination of activities under effective control and leadership. This major recommendation and some of its attendant details were approved in the Throne Speech of February, 1974, and at time of writing await only approval of Parliament to be translated into action.

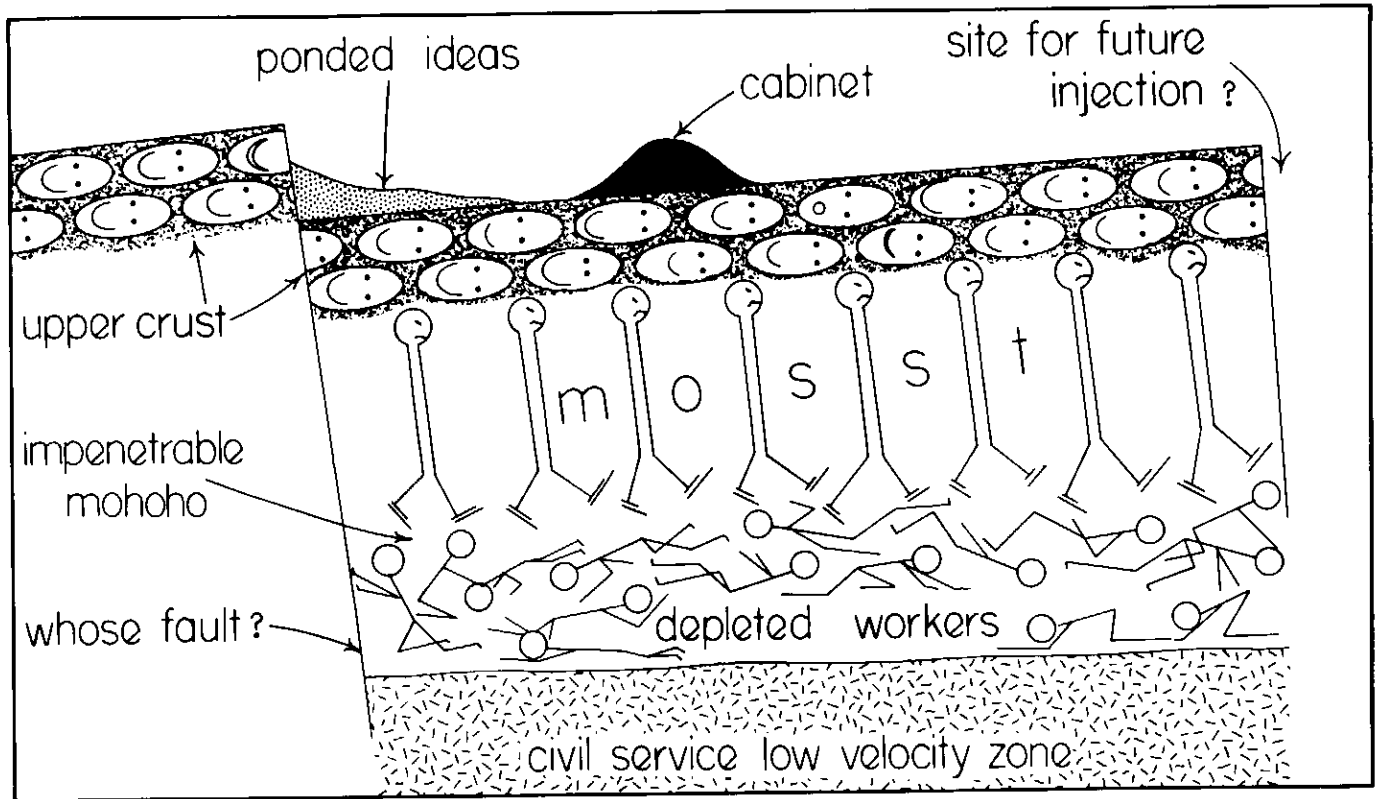
Recommendations of Volume 3 that seem to particularly concern both individual geoscientists and member societies of the Geoscience Council

are: 1) MOSST will undertake a special review and assessment of the complete governmental science budget which will then be submitted as a package to Treasury Board; 2) NRC will be divested of its granting function and new foundations would be created in its place which would report to MOSST; 3) Establishment of a Canadian Industrial Laboratories Corporation, with strong industrial representation on its board, which would bring government's applied research laboratories (e.g., the E.M.R. Mines Branch) together and separate them from the basic research groups with whom many of them have been associated; 4) A recommended special status for the Royal Society of Canada and for SCITEC as the two national organizations the government would use as its main channels of communication to the scientific community. In return for this service, the Royal Society and SCITEC should receive adequate annual unconditional grants.

Some Reactions to the Lamontagne Reports

The Lamontagne Committee's findings have appeared as: Volume 1 (1970) – A Critical Review: Past and Present; Volume 2 (1972) – Targets and Strategies for the Seventies; Volume 3 (1973) – A Government Organization for the Seventies. These volumes have been sufficiently spaced in time to permit significant input from the scientific community and succeeding reports are liberally sprinkled with quotations from briefs and comments concerning the earlier one. Volume 3, which contains strong recommendations for action is probably eliciting the strongest responses. Most of the briefs I've seen concentrate on the recommendations listed above. Strangely enough the one that seems to have received most attention, at least from geoscientists, is the recommendation that the Royal Society and SCITEC should be sources of information and advice to government. We'll return to this below.

The immense new powers proposed for MOSST as assessor and financial scrutineer of Canadian science have raised many suspicions. This ministry



has not impressed with its performance since its creation in 1971 – but possibly, as Senator Lamontagne suggests, this is because it hasn't had the power to do so. MOSST has no scientific function of its own, only a control function and the fears of many were expressed at the SCITEC forum by a well-known agricultural scientist. He stated that the scientists attracted to MOSST will form an additional layer of bureaucracy – and the more efficient and capable they are the more troublesome and dangerous this bureaucratic layer will be in exchanges between the toiling masses and the uppermost crust. The answer to that could be that MOSST itself will now represent the uppermost crust. Another fear expressed in briefs and conversations concerns MOSST's mandate to review the entire science budget and this can probably be telescoped into the remarks of a former prominent Treasury Board official who mentioned that a good deal of first rate basic research was carried out in the most unlikely crannies in the government, e.g., basic cancer research under a poultryman's assistance program. If all these little pockets of activity are brought into

public view with dollar signs attached to them, the thrifty tax-payer might be tempted to foreclose on a good deal of creative science!

The proposed shifting of the granting function from the NRC Awards Office to a new Natural Sciences Research Council which will report to MOSST has stimulated a good deal of comment, chiefly because the NRC grants committees seemed to work so satisfactorily. We've all had our complaints about NRC practices and decisions but, astoundingly, we always receive prompt replies and sometimes we get action. For example, the Blais Committee recommendation that scientists from industry be included on the grant committees was speedily implemented. Requests that the committee members visit university departments and obtain first hand impressions were also effected with dispatch. If it's functioning so well why change it? The reasons given are that it will allow NRC to devote more time to its laboratory functions and that because of the disciplinary approach of NRC interdisciplinary research had not been sufficiently coordinated and encouraged.

Probably the correct approach to

constructive comment and criticism of science policy is not to knock proposed restructuring and reorganization of government, after all that is Government's prerogative, but to concentrate on the philosophy and basic thinking that supposedly justifies the changes. This is what SCITEC addressed itself to at a recent forum held in Ottawa with 145 participants from 27 societies and over 100 interested observers. It chose three basic themes touched upon by Lamontagne and used to varying degrees to justify his recommendations and it chose two or more articulate adversaries to lead off the discussion of each theme – thus airing the diverse opinions of the attending scientists but also allowing them to identify common grounds. The forum also permitted spokesmen for those suspect organizations, SCITEC and the Royal Society of Canada to publicly reveal their aspirations.

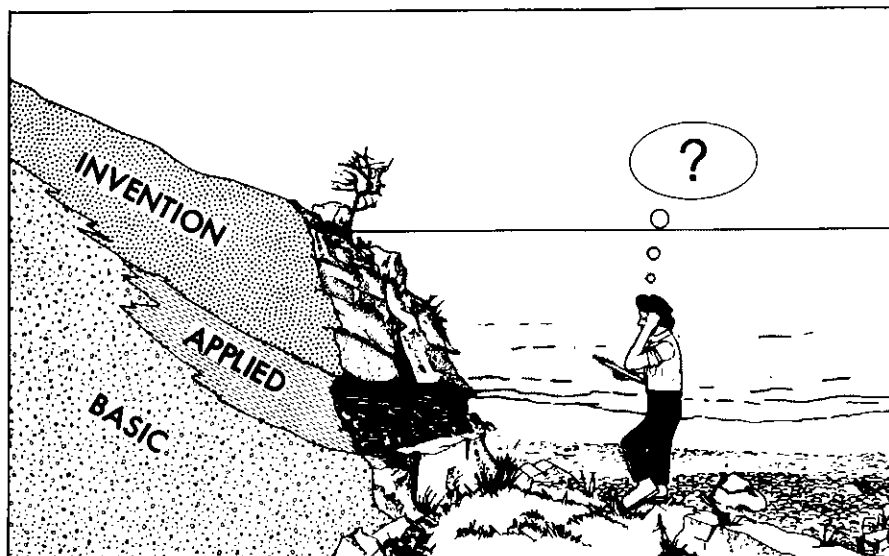
An Angular Unconformity(?)

The Lamontagne Committee's proposal for the reorganization of government departments and agencies was partly based on their disagreement with a common

hypothesis that there is an unbroken spectrum from basic research through to innovation. They state that this concept of a conformable sequence from basic to applied research to technological innovation is "wrong in most cases in the real world". An almost overwhelming amount of evidence is cited from the history of science and from empirical studies of the technological innovation process to support their view. Practical examples are cited such as that of the Bell Labs which have produced Nobel prize winners and engineering breakthroughs and who purposely erect management and/or spatial barriers between basic, applied and development groups. The Lamontagne conclusions have been challenged by many Canadian societies and by a distinguished Canadian scientist, Nobel Laureate Gerard Herzberg, who has cited many examples to show that all technology is based at one stage or the other on discoveries in basic science made without any thought of their possible usefulness.

Senator Lamontagne and Dr. Herzberg confronted each other for the first time on a public platform at the SCITEC Forum and they were equally convincing. However, the invited discussants and the contributors from the floor were almost all in support of the continuum theory. Dr. A. Naimark, Dean of Medicine at University of Manitoba, made a good point when he suggested that the Senate Committee had concentrated almost wholly on industrial innovation where time lags might be greater and links with basic research more tenuous than in other fields of endeavour. His own examples from biomedical science offered convincing evidence of a continuum.

In our field, it's rather difficult to subscribe to the Senator's recognition of unconformities or even disconformities in the sequence. Eight or nine years ago many of us had difficulty accepting ocean floor spreading, transform faults and plate tectonic theory and we looked upon the theorists working with these concepts as rather undisciplined. Today, if we can judge by the large attendance of mining company geologists at a recent NATO



symposium in St. John's on Plate Tectonics and Metallogeny the wild theory has been transformed into a pragmatic guideline to mineral exploration within a few years. Some of those scientists who made fundamental contributions to the original theory have now emerged as leaders in its practical applications.

We can all think of many other examples: the economic mineral finds made during curiosity-motivated research projects of the Geological Survey of Canada; the trilobite expert who suddenly switches successfully to a managerial role in mineral exploration; the young scientist who gets his kicks from Precambrian life and its kinky sedimentation patterns and suddenly finds himself being courted by uranium exploration companies who have realized that their own applied studies have been too restrictive and that their programs should be tied to broad evolutionary models of Proterozoic basins.

There are those who raise semantic arguments and maintain that almost all biomedical and geoscience research is applied and hence that examples from these fields cannot be used to support the continuous spectrum theory. If we accept this we must then ask what is the justification for removing applied labs (e.g., the Mines Branch) from their traditional association with the (equally applied?) labs of the Geological Survey.

A conclusion from the SCITEC Forum is that the repeated

Lamontagne attempts to explode the "myth" of a continuum between basic research and innovation have generated stimulating and informed debate but have been rejected by the scientific community. Denial of the continuum is, hence, a shaky basis for the reorganization of departments and agencies.

C.B.A. is Good for General Motors – How About You?

A wholly visible government science budget which will be subject to annual scrutiny and public hearings naturally raises the question of evaluation of the research output. One session of the SCITEC Forum was devoted to the applicability of cost benefit analysis techniques to research output. Somewhat differing viewpoints were offered by Dr. Frank Eadie of Bell Northern Research and Prof. Douglas Hartle of Toronto but there was a measure of agreement. Dr. Eadie felt that c.b.a. was most desirable in applied or mission-oriented research and that the first questions asked should be: why do this at all, why do it now and why do it this way? For applied programs the benefits can be identified because they are inherent in the objectives. However, he felt that the benefits of basic research could not be quantified and, therefore, c.b.a. could not be applied. The benefit of pure research is first of all the satisfaction of the individual and only secondarily that of others.

Professor Hartle who was formerly

an advocate of c.b.a. when with the Treasury Board in Ottawa now believes it has no place in government science, basic or applied. He stated that it was only applicable in industry where time and money were the important factors and effects on society were not an important part of the calculation. This view was supported by Dr. F. Bachelor of the University of Calgary who cited the difficulty of measuring the benefits of the increasing amount of applied research on environmental problems. In discussion, Hartle later agreed that c.b.a. was applicable to some applied research, e.g., health care systems where you could count cures, mortalities, etc.

There was one point that probably everyone agreed on: a visible budget for government science will have disadvantages and it could become a political football.

The Elitist Society

Volume 3 of the Lamontagne Report suggests that it would be impossible for MOSST to maintain direct contact with all 119 Canadian Technical and Scientific societies and recommends that this contact be developed through the Royal Society of Canada and SCITEC. The Royal Society was singled out for scientific and technological studies dealing with Canadian issues and also as the non-governmental organization (NGO) which would maintain international relationships with similar bodies abroad and with the International Council of Scientific Unions (ICSU). This has not been a popular recommendation.

The Royal Society of Canada, founded in 1882, has about 750 fellows who are elected by peers on the basis of scholarship. It consists of three sections of which the Science Section (recently re-named "The Academy of Science" of the Royal Society) has increased greatly in size and is now by far the largest with 500 fellows. At one time ownership of a Ph.D. was virtually sufficient for election but as researchers have increased so have entry standards and probably only one per cent of Canadian research scientists are in the Society. The Science Section has

attempted to be representative and it is surprisingly so geographically but less so in terms of discipline where it is possibly rather over-endowed with geoscientists – but their relative size has been cut back in recent years, and under-represented in engineering and medicine – who are expanding fairly rapidly. The Science Section is elitist but much less so than other national academies.

Dr. John Chapman outlined the aspiration of the Royal Society in international affairs. He noted that Canada was the only western country (possibly the only country) where government departments were the adhering bodies to the international NGO's, e.g., NRC was the adhering body to ICSU and NACRGS through the Geological Survey of Canada was the adhering body to the International Union of Geological Sciences. All other countries worked through their national academies, e.g., the UK through the Royal Society of London. Canadian practice is a source of concern and embarrassment to some of those concerned with international science. The Royal Society is representative of all or almost all scientific disciplines in Canada and feels that it is qualified to act as a Canadian academy and interact with other national academies. The present panels and committees include scientists other than fellows and its international committees would be chosen in cooperation with specialist associations such as the Canadian Geoscience Council instead of being appointed by a government department.

Most of those present seemed impressed with the modest aspirations of the Royal Society and several delegates privately confessed that despite their complaints they were previously unaware of how international relations were handled by our own and by other countries.

It probably behooves the Royal Society to advertise itself and its modest aspirations as an academy more widely!

Whither SCITEC (or Wither SCITEC?)

SCITEC was born in 1970 partly as a response to Lamontagne Committee

hearing's where it became painfully obvious from their representations that the various discipline based societies had had very little communication with colleagues from other disciplines. The Senators pointed out that it was naive of Canada's scientists to leave it to politicians to compare and integrate the diverse views of the various scientists and that even though they didn't expect the scientific community to speak with one voice they did expect that an organization of scientists should be responsible for clarifying differences of opinion and stating the rationale behind them.

SCITEC initially drew its membership from societies and from individual members, the latter policy enabling it to draw on the support of distinguished and dedicated Canadian scientists. At the May 3rd meeting Dr. Peter Forsyth discussed changes in By-Laws that increase the responsibility of associations and umbrella groups so that it is now truly a society of societies. It has acted as a forum and parliament of science, its lively executive committee members have kept science policy discussions in the public eye through articles in the journal, "Science Forum" and elsewhere, and it has generated and developed the idea of a Canadian House of Science and Technology. However, it has had to face suspicions from the scientific community that have almost verged on hostility from some of the professional societies (particularly engineering and medicine), its Council is continually inundated with 'new boys', sent in as member society representatives, who are uninformed on past decisions and want to start back at square one, and it is continually strapped for funds to maintain its small secretariat and support its growing activities.

The Lamontagne Report recommends that the Royal Society and SCITEC be the two main channels of communication between government and the societies. This has alarmed some of the societies who fear that it may threaten their autonomy and interfere with their ability to deal directly with government even though it is obvious that

SCITEC's activities will always be restricted to the role delegated to it by its member associations and its executive pronouncements have always emphasized the rights of individual member societies Anyway, enough protests have filtered in to Senator Lamontagne that he decided to drop a bombshell at the SCITEC Forum on May 2nd. He said that he found SCITEC conservative, cumbersome and too slow to react, and lacking the confidence of the engineers and social sciences (even though its last two presidents have been an engineer and a social scientist!). He suggested that perhaps it would be more realistic to have communications channelled through several national organizations representing engineering, social sciences, humanities and natural sciences and these could operate through a super council (called SCITEC??) to pursue specific joint activities. This super council would operate as a confederation rather than a federation.

Lamontagne's remarks may have done a great service to SCITEC because it rallied the forces. The forum had shown that there were areas, such as the continuous spectrum from basic to applied research, where most scientists could agree or at least understand where they disagreed. Dr. T. H. G. Michael of the Chemical Institute of Canada said that SCITEC had made enormous progress over a short span and that much of the mutual animosity between disciplines that characterized the early years had seemed to disappear. Drs. Eugene Munro and Robin Stewart, microbiologists, and Dr. W. W. Hutchison, president of the GAC stated that there was a need for a voice, a mediator and a forum for Canadian scientists and engineers and that SCITEC could do this job and it must get on with it immediately. It must show the scientific community that it is not just another bureaucracy but that it can show initiative and gain political clout.

If it accepts this challenge the scientific (and engineering?) community will rally behind it.

Where Do We Go From Here?

There is only one place to go and that is into the political arena. The Senators have invited us to join in and, through our societies, to provide advice and leadership instead of relying on bureaucrats and government appointed committees to point the way for us. They have also invited us to join with them in a Canadian Association of Parliamentarians, Scientists and Engineers in which to continue discussions which should lead to further mutual understanding and support.

The average working scientist is probably happiest with the small team approach extolled by the late Dr. E. W. R. Steacie and many of us agree with Dr. Herzberg that size and bureaucratic procedures tend to inhibit the spontaneous creativity of the individual scientist. However, in order to preserve that atmosphere we are obviously going to have to do things the average scientist apparently abhors namely organize, find common grounds, and lobby.

Two organizations are already available through which we can work. One, the Royal Society is an elitist organization but much more widely representative than other national academies. It was already there, preparing itself over the past few years to assume a useful role. The other, SCITEC, is a grassroots organization that sprang into being to meet needs identified by the Senate investigation. The geosciences are probably over represented in both these organizations so there are no complaints on that score. We can't ignore them and try to do our own little thing oblivious to the needs of other disciplines, we must work through them and if we don't like them we must change them.

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