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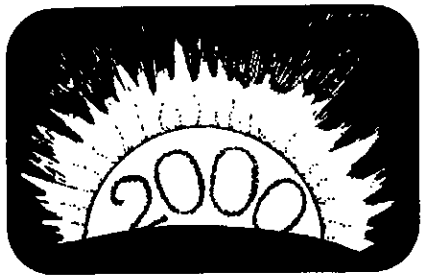
Article abstract

A vigorous, high-quality earth science research community in Canada brings two rewards: great new concepts and tools for Canadians working in the resource and environmental sectors; and bright, energetic recruits to the profession that, in many disciplines, will be desperately needed when many of our present community retire in the next 15years. It is time for a new era of collaboration; it is time to respond constructively to the damaging cutbacks of NSERC Research Grants support of the earth sciences; and it is time to propound new large scale collaborative projects that catch the imagination of Canadians. In this article, we describe actions that are being taken now towards these goals, and we invite your participation in this venture, not least during the multi-society festival of the GeoCanada 2000 meeting.



Earth Science Research for the 21st Century: A Theme for the GeoCanada 2000 Meeting. Actions on Collaboration, NSERC Reallocation and New Megaprojects

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SUMMARY
A vigorous, high-quality earth science research community in Canada brings two rewards: great new concepts and tools for Canadians working in the resource and environmental sectors; and bright, energetic recruits to the profession that, in many disciplines, will be desperately needed when many of our present community retire in the next 15 years. It is time for a new era of collaboration; it is time to respond constructively to the damaging cutbacks of NSERC Research Grants support of the earth sciences; and it is time to propound new large scale collaborative projects that catch the imagination of Canadians. In this article, we describe actions that are being taken now towards these goals, and we invite your participation in this venture, not least during the multi-society festival of the GeoCanada 2000 meeting.

RÉSUMÉ
Une communauté géoscientique canadienne saine et active comporte deux types de retombées : la découverte de nouveaux concepts et l'élaboration d'outils nouveaux pour les travailleurs canadiens des secteurs des ressources minérales et de l'environnement et, la formation d'une relève jeune et brillante dont plusieurs disciplines auront grand besoin dans 15 ans alors que ceux d'aujourd'hui prendront leur retraite. C'est maintenant l'heure de se serrer les coudes; il faut reconstruire après l'ère des douloureuses coupures des subventions du CRSNG dans les sciences de la Terre; il faut mettre de l'avant de nouveaux projets rassembleurs à grande échelle et qui en appelle à l'imaginaire des Canadiens. Dans le présent article, nous présentons les efforts en cours pour atteindre ces objectifs et nous vous invitons à vous y joindre, en particulier lors de la réunion GéoCanada 2000 qui rassemblera plusieurs sociétés.

GEOCANADA 2000

During 29 May-2 June 2000, several of Canada's earth science societies will be gathering in Calgary to celebrate GeoCanada 2000. The Canadian Geoscience Council and the Royal Society of Canada are co-sponsoring sessions on one of the special themes that will be threaded through the meeting. The subject will be "Earth Science Research for the 21st Century," chosen to encourage the community to define some common goals, and to raise wider and deeper awareness of the "hot" issues.

We will be preparing for these sessions over the next few months by, among other things, soliciting your views and ideas. Information collated and visions created from these efforts will be published on the web prior to the meeting. We will put together a program that includes the presentation and discussion of visions for the various earth science disciplines and their interactions. These will lead to a "townhall" forum at GeoCanada 2000 on future directions of research, and on possible future earth science "megaprojects."

A report will then be published summarizing the formal presentations, the resulting discussions, and the specific recommendations that are derived from the sessions at GeoCanada 2000. This report may be published in *Geoscience Canada*, in early fall of that year.

WHY NOW?

We believe this to be an auspicious and, indeed, critical time to take stock of what we have achieved, and in what directions we should be striding. The beginning of a new millennium brings with it the desire in many quarters to look ahead, but in addition there have recently been a number of events and/or developments that have significantly affected the earth sciences community in Canada, and that need to be vigorously debated.

A NEW ERA OF COLLABORATION

First, during the last decade, there have been major changes, probably not to be reversed in the near future, in both the way earth science research is carried out in Canada, and the way that researchers are funded. Major cuts in public spending have seriously eroded the abilities of the academic and government sectors to carry out independent research. The inevitable cycles of the resource industries have resulted in downsizing of major companies and the increased contracting out of research services, as and when needed. As a counter-balance to these reductions, there has been significant growth in environmental earth science, both in the private sector and as a proportion of all earth science in the academic and government sectors. During the same period, there have been dramatic realizations of the benefits that accrue from interdisciplinary research. It would be facile to ascribe all these to the recognition of the importance of "earth system science" for the understanding of earth processes. However, this notion, of the need to consider a holistic earth and learn about the interactions among

the various earth spheres, is driving some of the most spectacular discoveries in modern earth science, for example, the influence of tectonics on long-term climate change.

One clear result from these pressures has been the far greater extent of collaboration, across disciplines and across the sectors of government, industry and academe. Yet, we sense this is only the beginning of the potential returns. The increasing complexity of the tools we use makes research ever more expensive: a further reason for collaboration to maximize the return from investment in research infrastructure.

RESPONDING TO THE CUTBACKS IN EARTH SCIENCES RESULTING FROM NSERC REALLOCATION EXERCISES

The Natural Sciences and Engineering Research Council of Canada (NSERC) funds science and engineering research in Canadian universities. Current access to NSERC funds by earth scientists is summarized by Hall (*Geoscience Canada*, v. 26, p. 141). Some 40% of NSERC funding of Earth scientists is distributed through the Research Grants program, which supports fundamental research of individuals and groups. Six years ago, NSERC established a mechanism for the redistribution of a percentage of the overall Research Grants budget among the many disciplinary Grant Selection Committees (GSCs) in response to emerging opportunities and evolving trends. The process (the Reallocation Exercise) takes a proportion of each GSCs budget and places it in a reallocation fund that is then redistributed among the GSCs based on the competitive review of submissions made by committees representing the constituency of each GSC. There have now been two reallocation exercises, and in each case the earth science community did very poorly, resulting in a significant decline in the overall funding available for research grants in the earth sciences relative to the other GSCs.

The first Reallocation Exercise, in 1994, redistributed 8.5% of the total fund. GSC 08 (solid earth science) and GSC 09 (environmental earth science) made separate submissions, resulting in budget reductions of 3.8% and 4.8%, respectively. The general comments for GSC 08 recognized solid earth sciences as being of great importance to Canada, but it was not clear how the current areas of strength would be maintained, and employment opportunities were seen to be low. For GSC 09, the potential for longer-term growth and significant contributions was recognized, but the work in Canada was judged as lacking in impact and in strong leaders in the field.

The most recent Reallocation Exercise was completed in 1998: 10% of the funding was redistributed (refer to http://www.nserc.ca/programs/realloc/report.htm). The two earth sciences committees made a combined submission which, upon NSERC assessment, resulted in a contribution of $1,675,200 to the reallocation fund. Only $961,695.00 of this contribution was returned to the earth sciences, and that was specifically earmarked for field studies. The review committee was pleased with the demonstration of the strengths of the Canadian earth science community, but very disappointed in the lack of a coherent vision for the future of earth sciences in Canada.

We should recall that about 40% of funding of earth sciences from NSERC comes from the Research Grants "pot" distributed to individual researchers: the community does generally somewhat better in competing for other "pots," especially those involving collaborative and targeted research. However, if we, as a community, feel that the reallocation results are less than we should expect, we must look to the future and begin to prepare for the next Reallocation Exercise, now.

PREPARING FOR THE NEXT REALLOCATION EXERCISE

The New NSERC Liaison Committee for Earth Sciences and Its Contribution to GeoCanada 2000

To deal with this issue, NSERC has encouraged university-based researchers in the earth sciences community to form a Liaison Committee for Earth Sciences. Similar committees in other disciplines that had also fared poorly have been effective in turning their situations around. The Liaison Committee has just been formed. Its draft terms of reference (to be discussed at the first meeting of the committee in September 1999) are:

1. To collect, through questionnaires or other means, the information necessary to develop a coherent vision for the future of earth science research in Canada;
2. To keep the Canadian earth science community informed of the developing vision and seek their input through electronic and other means, national fora, and links to earth science societies and organizations;
3. To seek the input of an international review team in evaluating the developing vision statement;
4. To provide a forum for discussion of earth science issues of interest to the research community and NSERC;
5. To suggest candidates and possible structures for the Earth Science Reallocation Steering Committee(s). Members of the Liaison Committee will be eligible to serve on the Steering Committee(s);
6. Should the timing of the vision development process deem it necessary, the Liaison Committee may assume some of the early responsibilities of the Steering Committee(s).

The initial membership of the Liason Committee is:

- Garry Clarke, University of British Columbia, Chair GSC 09 (rotating position)
- Henry Schwarcz, McMaster University, Chair GSC 08 (rotating position)
- Larry Mayer, University of New Brunswick, Group Chair (rotating position)
- Dick Peltier, University of Toronto, GSC 08/09
- Jeremy Hall, Memorial University of Newfoundland, CGC-GSC 08
- David Eaton, University of Western Ontario, GSC 08
- Les Cwynar, University of New Brunswick, GSC 09
- Don Francis, McGill University, GSC 08
- Brian Greenwood, University of Toronto, GSC 09
- Anthony Williams-Jones, McGill University, CCCESD representative.

The committee is starting to prepare the case for our discipline for the next reallocation of funds, which will be implemented in 2003. One of the first tasks of the new Liaison Committee for Earth Sciences will be to quiz the earth scientists in the NSERC community about their visions of future research directions and priorities. The results of this enquiry, to be conducted *via* a short questionnaire, will be fed into the preparation of some of the visions that will be presented in our special session at GeoCanada 2000. The same set of questions will be distributed to the wider community through the various learned societies, so that the GeoCanada 2000

sessions should fairly reflect the views of the whole community. The NSERC Liaison Committee will use the results of the GeoCanada 2000 debate in its formulation of a strong and clear vision of future directions. These, in turn, will be used by the Steering Committees that will later be charged with drafting the next Reallocation Reports to be submitted in January 2002.

We appeal to other earth science sectors to become involved and to contribute suggestions for the agenda for the GeoCanada 2000 sessions, to ensure an inclusive and lively discussion of the widest possible range of relevant issues.

MEGAPROJECTS

Canadian earth scientists are presently engaged in several large-scale collaborative projects. Examples funded by NSERC include: LITHOPROBE (targeted on the evolution of Canada's lithosphere); the Canadian contribution to the international Ocean Drilling Program; Climate System History and Dynamics (CSHD); Global Ocean Ecosystem Dynamics (GLOBEC CANADA); Global Energy and Water Cycle Experiment (GEWEX); International Northern Water Polynya Study (NOW); and Geomatics for Informed Decisions (GEOID), the latter being one of 14 currently funded Networks of Centres of Excellence. The first five receive two-thirds of the total NSERC allocation to Research Networks. Its nearest predecessor, the Collaborative Special Projects program, had been tapped to support the Boreal Ecosystem-Atmosphere Study (BOREAS , Canadian university participation in the World Ocean Circulation Experiment (WOCE), and the Canadian contribution to the Joint Global Ocean Flux Study (CJGOFS). These projects are held in very high regard in international circles, but the successes are transient. For example, LITHOPROBE will end in 2003 and the future of the ODP and the Canadian contribution to it is uncertain beyond the same year. A forward-looking community should now be planning to replace those programs with others, not mimicking them, but finding exciting new science to mould into possibly different kinds of collaborative research projects. We would therefore like to see possible future "megaprojects" addressed at the GeoCanada 2000 meeting. The outcome of the discussions of future visions may well provide useful steppingstones to their formulation. After all, the best science usually arises from grass roots debate. We interpret our role here as facilitating the debate and communicating the outcome across the community for maximum potential input.

The GeoCanada 2000 sessions will allow opportunities for presentation and wider discussion of existing plans for future megaprojects by grass roots groups. We would be happy to provide a section of the preparatory web page for advertising and describing any such proposals, and to include presentations of them in the GeoCanada 2000 sessions.

HOW CAN YOU HELP?

The purpose of this article is to tell you what's happening, and how you might contribute. Please:

1. Complete and return the questionnaire that will be circulated in the fall of 1999 to all NSERC earth science grantees, and to others through their learned societies;
2. Consider responding to the call for papers for the GeoCanada special session;
3. Review, and contribute to the discussion of, the web site on which the pre-GeoCanada 2000 meeting visions will be posted, and linked to the CGC web page: http://www.science.uwaterloo.ca/earth/cgc/cgc.html.
4. Attend and contribute to the discussions of the sessions on "Earth Science Research for the 21st Century," at the GeoCanada 2000 meeting.

We regard this as a critical time for our discipline, and a welcome opportunity to work together more effectively. In this increasingly competitive world, we believe that it is crucial to grasp such opportunities to enhance our professional standing among Canadians and among our peers elsewhere. We therefore respectfully urge you to engage with us in this process, and that you persuade the professional and learned societies to which you belong to make this a topic of priority by providing input to us over the coming year.

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