CHAPTER 6 PRINCIPAL CANADIAN GEOSCIENCE RESEARCH INITIATIVES

In the three preceding chapters (Chapters 3 to 5), the current state and future developments and trends in the geosciences have been predicted in terms of the basic science, technology, and industrial application. Given the state of the economy it is unlikely that the geoscience community can expect a significant influx of new public expenditures, despite a strong justification for it and the long-term benefits that would accrue such an investment. The Committee considers that cost-savings and efficiencies can be gained by more effective collaboration (see Chapter 7 and others) and that the geoscience community must decide as necessary, where to allocate its resources, particularly if large programs/megaprojects are to be undertaken (*e.g.*, Lithoprobe, Ocean Drilling Program, Continental Scientific Drilling, Canadian Ocean Frontiers Research Initiative). The community does not have a good mechanism for assessing, evaluating, and deciding upon the competing demands of the megaproject proposals. This problem also faces other areas of science (*cf.* KAON, SNO projects; National Advisory Board on Science and Technology, 1989). Note elsewhere (Chapter 8, section c) the potential role of CGC in arranging national forums both to spawn new initiatives and discuss priorities for geoscience funding.

The committee has reviewed the Canadian geosciences and has attempted an initial priorization for future investment in most subdisciplines. The results should not be used or cited as a specific recommendation but rather as a first step of a more intensive review of priorities in future research. Table 6.1 is a matrix summarizing suggestions for relative priority or future status of many areas of Canadian geoscience. Research subject is divided into four broad themes: Core, Mantle, and Crustal Dynamics; Fluids in and on the Crust; Water, Mineral and Energy Resources; and Environmental Change; each contains several subdisciplines. The latter are ranked low (L), medium (M), or high (H) in terms of Economic Competitiveness; Sustainable Development; Health and Safety; Scientific Advantage; and Public Interest. They are each evaluated as to whether the research is predominantly of short, medium, or long term. Some subdisciplines are identified as having a strong geographic/geologic advantage conveyed by the particular nature of the Canadian landmass. No attempt was made is evaluate relative cost, or which sectors are dominant participants in, or have responsibilities for, the research areas.

Table 6.1 illustrates the complexity of geoscience research but does not show well the inter relationships between subdisciplines. The subdisciplines are not ordered or

Table 6.1 MATRIX KEY

L, M, H in columns 1-5 represent low, medium, and high ranking.

1 **Economic Competitiveness** - The degree to which research activities are expected to have an impact on Canada's global economic competitiveness. This criterion refers both to the actual research activity and to anticipated technological developments.

2 **Sustainable Development** - The degree to which the research activities, and associated technological developments, will contribute to sustained development of Canada's resources. This includes international need for information related to environmental constraints to development and human impact on the environment.

3 **Health and Safety** - The degree to which the research activity is expected to contribute to the improved health and safety of Canadians.

4 **Scientific Advantage** - The degree to which Canada has already developed a significant capability upon which an enhanced position internationally can be built.

5 **Public Interest** - The degree to which the general Canadian public has developed an interest in, or concerns regarding, the particular or related research field.

6 **Research Timeframe**

S Short Term - Research projects that could be completed over a period of 0 to 5 years and the results made available to contribute to other activities of socio-economic relevance.

M Medium Term - Research projects that would require 5 to 10 years in order to generate sufficient results to be meaningfully applied to other activities of socio-economic relevance.

L Long Term - Research projects that would require long-term observations or investigations (time periods greater than 10 years) in order to produce results which could be meaningfully applied to other activities of socio-economic relevance.

* **Geographic Advantage** - The asterisk denotes research activities that are favoured because of particular or unique attributes of the Canadian landmass or Canada's geographic situation.

Table 6.1 Matrix of principal Canadian research initiatives

RESEARCH SUBJECT		1	2	3	4	5	6
THEME: Core, Mantle & Crustal Dynamics							S M L
Surface Processes & Crustal Dynamics		M	M	M	M	L	
Earthquake Processes, Prediction, Paleoseismology		M	M	H	M	H	
Sedimentary Basins	*	M	M	L	M	L	
Real-time Plate Movements		M	L	L	H	M	
Neotectonics	*	M	L	M	L	L	
Mountain-building Processes		M	L	L	H	M	
Core/Mantle Processes		L	L	L	M	L	
Mantle/Crust Interactions	*	L	L	L	M	L	
Plate Boundaries		L	L	M	H	M	
Crustal Structure	*	M	L	L	H	L	
THEME: Fluids in and on the Crust							S M L
Analysis of Drainage Basins		H	H	M	H	M	
Water Quality and Contamination		H	H	H	H	H	
Mineral-water Interface Chemistry		M	M	L	M	L	
Modelling Water Flow		M	L	M	H	L	
Fluids in the Continental Lithosphere		M	L	L	M	L	
Glaciology	*	L	H	M	H	M	
Fluids in Oceanic Spreading Centres	*	M	L	L	M	M	
Fluids in Convergent Margins	*	L	L	M	M	L	
THEME: Water, Mineral, & Energy Resources							S M L
Water Resources		H	H	M	H	H	
Aggregates		M	M	L	M	L	
Production Techniques		H	M	L	L	L	
Mantle Processes & Mineral Resources	*	H	L	L	M	M	
Ore Deposit Modelling	*	H	M	L	H	L	
Geophysical Exploration Technology		H	L	L	H	L	
Geothermal Energy - Low & High Enthalpy		M	H	L	M	M	
Concealed Ore Deposits	*	H	L	L	H	M	
Sedimentary Basin Analysis	*	H	M	L	M	M	
THEME: Environmental Change							S M L
Environmental Geochemistry		M	M	H	M	H	
Health and the Geosciences		M	M	H	L	L	
Geohazards		H	H	H	H	H	
Storage/Isolation of Radwaste	*	H	H	H	H	H	
Environmental Degradation (*e.g.*, Mining)	*	H	H	H	M	M	
Greenhouse Gases	*	M	H	M	M	H	
Climate Modelling		H	H	M	H	H	
Ocean Mapping (incl. Technology)		H	M	H	H	M	
Soil Development and Degradation		L	H	H	H	M	
Geosciences in Ecosystem Analysis		M	H	M	M	L	
Recent Global Changes	*	L	H	M	M	H	
Quaternary Geology	*	L	M	M	H	H	
Catastrophic Change		M	H	H	M	M	
Paleobiology		L	M	L	M	M	
Paleoceanography & Climate Model Validation	*	L	M	L	M	M	

ranked except for a coarse clustering on the basis of their short-, medium-, or long term nature. The listing of research subdisciplines is not exhaustive but does capture many of those discussed in Chapters 3 to 5.

For comparison, Table 3.2 (Chapter 3) is taken from the US NRC Report (National Research Council, 1993; Table 7.5) showing those research themes considered as top priority for the future solid-earth sciences in the U.S. Both figures should help engender debate in the Canadian geoscience community on research priorities and responsibilities.