

Geoscience in the Dot-Com World - Changing with the Times. **GAC Presidential Address Annual Meeting St. John's,** **Newfoundland 28 May 2001**

Scott Swinden

Volume 28, numéro 3, september 2001

URI : https://id.erudit.org/iderudit/geocan28_3gac01

[Aller au sommaire du numéro](#)

Éditeur(s)

The Geological Association of Canada

ISSN

0315-0941 (imprimé)

1911-4850 (numérique)

[Découvrir la revue](#)

Citer cet article

Swinden, S. (2001). Geoscience in the Dot-Com World - Changing with the Times. GAC Presidential Address Annual Meeting St. John's, Newfoundland 28 May 2001. *Geoscience Canada*, 28(3), 105–111.

PRESIDENTIAL ADDRESS

Geoscience in the Dot-Com World – Changing with the Times

GAC Presidential Address
Annual Meeting
St. John's, Newfoundland
28 May 2001

Scott Swinden
Department of Natural Resources
PO Box 698
Halifax, Nova Scotia B3J 2T9
hsswinda@gov.ns.ca

It is a very great pleasure to be here today to deliver the GAC presidential address for 2001. It is an honour to have had the opportunity to serve as your president and I am very grateful to the Association's members for the vote of confidence accompanying that honour.

As many of you may be aware, I am not exactly a stranger to this particular stage. However, in times past when I have found myself here in front of an audience, I was merely expected to play the mandolin and sing. It is a rather more daunting task to stand here and be expected to pass words of wisdom and erudition, in the face of experience that required only that I remember the words to the songs and sing them on key. I trust that by the end of the address, you will not be wishing that I had elected to play and sing instead.

Many presidents in past years have taken the opportunity offered by this address to unburden themselves on some matter of concern, and I intend to follow that tradition this morning. I originally envisaged this address as a rather broad consideration of the future of geoscience in our changing world. But as I began to put it together, I realized that the topic could easily supply material for several

addresses. And so I have chosen a slightly narrower path, focussing on my own particular corner of the geoscience world, that of the provincial and territorial geological surveys. In retrospect, perhaps the address would have been better titled "Geological Surveys in the Dot-Com World." Nonetheless, I believe that many of the things that I have to say are broadly relevant and will be of interest to the geoscience community as a whole.

CHANGE: EFFECTS AND IMPLICATIONS

It is often said that "the only constant in the world is the certainty of change." I believe this is true. But I believe it is also true that the rate of change is not constant, that there are times when change proceeds more rapidly, and times when change produces a more profound result. Periodically, we are introduced to a new social paradigm, a new political order, or a new technology that, in a very short time of rapid change, revolutionizes our environment.

Looking at the changes going on around us today, I suspect that future historians may well look back on the present time as one of those periods of intense change, when the world embraced digital systems and transformed itself into a global, highly connected web of information and communications, what I refer to euphemistically in the title of my address as "the dot-com world." The effects of this transition are felt in all corners of our society, no less among the geoscience community than others.

It looks to me like the dot-com world will be rather different for Canada's provincial and territorial geological surveys than the world of the immediate past. Many significant changes are upon us and coping successfully with these changes is a challenge that all of us face,

individually and collectively. And although the galloping progress of technology that has revolutionized all aspects of our work, from the most remote field locations to the most advanced analytical laboratories, is clearly one of the prime change agents in today's scientific world, it is not the only one. Other changes are coming to our landscape from other directions, and we need to identify and be ready to deal with them.

Mineral Development Agreements

In thinking about where we might be going, it is useful to consider for a moment where we have been and how we got here. Most of today's provincial and territorial geological surveys are, to a large degree, the product of one of the times of rapid change that I spoke of earlier. A new political paradigm, the Mineral Development Agreements (or MDAs) in which federal and provincial or territorial governments agreed to jointly invest significant new resources in support of mineral development, was the catalyst for rapid growth and development of provincial/territorial geological surveys in the 1970s and 1980s. This resulted in profound changes to the nature and function of the country's geological survey network far beyond the simple infusion of cash into the system.

At the start of the 1970s, most provincial mines departments had a relatively limited geoscience capability. Most had a few geologists, who kept tabs on the local mining industry, did summaries and reviews of provincial mining activities, compiled geological maps at regional scale, carried out resource inventories, and supplied the knowledge and advice required by public policy makers. The vast majority of geological mapping in Canada was carried out by the Geological Survey of Canada (GSC), generally

with little direct co-ordination or guidance from the provinces.

This was changed dramatically by the MDAs. One of the first of the geological surveys to benefit from a Mineral Development type of agreement was Newfoundland in the early 1970s. Newfoundland was one of the first provinces to successfully argue for federal funding of provincial geoscience as an economic development tool. Geoscience funding agreements were first reached with the Department of Regional Economic Expansion in the early- and mid-1970s. Within a very few years, these led to dramatic growth in the Newfoundland Survey's size, scientific capability, and breadth of programming.

Through the late 1970s and early 1980s, this experience was repeated in most provinces and territories. The political will to accept geoscience as an economic development tool led to substantial incremental federal and provincial funding delivered through the MDAs, and these in turn resulted in dramatic increases in the overall funding, level of staffing, and scope of geoscience work in provincial and territorial surveys. Even the surveys in Ontario and Quebec, which already had substantial geoscience capacity, experienced growth through the MDAs. By the late 1980s, the transformation of government geoscience in Canada was more or less complete. Provincial and territorial geological surveys throughout the country had become highly competent, active, applied geoscience organizations, firmly in control of the geological mapping, resource evaluation and management, land use, and other societal geoservice functions within their jurisdictions.

It is, of course, one thing to take on a new responsibility in times of ample resources, and quite another to continue to deliver it in times of shrinking resources. By the early 1990s, the winds of change were starting to blow for geological surveys in Canada. The Federal Government clearly signalled that it no longer considered mineral development in the provinces to be a federal priority, that economic development money would no longer be invested in minerals at anything like the scale of the previous decades, and that the days of the MDAs were numbered. The demise of the

MDAs was, in itself, a significant fiscal blow to government geoscience in Canada, not only to the GSC, which had delivered the lion's share of the federal contributions, but also to the provinces, where incremental funding assigned to the MDAs was not always rolled into the A-base budgets at the end of the last MDA. In hindsight, it would appear that, in many jurisdictions, the political will at the provincial level to support geoscience programming as an economic development tool had more to do with the leveraged federal funding than with either a philosophical commitment to the science, or an acknowledgment of the responsibility to provide an adequate level of geoscience programming.

The federal program review that decimated the GSC in the mid 1990s, and similar exercises in most provincial jurisdictions, heralded a fundamental change in direction for government geoscience in Canada. This is having long-term effects that are equally significant to those of the late 1970s, but opposite in sign.

I believe that Canada's provincial and territorial geological surveys face significant challenges in continuing to deliver an adequate level of expert and relevant geoscience to the societies of the dot-com world. Successfully addressing these challenges is critical if Canada's geoscience survey network is to continue to provide the level of service that the country needs. Two of these challenges — approaching crises in funding, and demographics — are critical issues that

are fundamental to our capacity to do this, and warrant a closer look.

Funding

Let's look at the funding issue first. Figure 1 is a graph that will be familiar to many of you. It shows total government geological survey funding since the late 1980s. The message is clear. Funding steadily decreased from about \$178 million in 1987-88 to about \$79 million in 1998-99. This is a dramatic drop in support and it occurred at both provincial and federal levels.

It is true that in the past year or so, we have seen some reversal of the trend. The federal government has announced \$15 million in geoscience funding over three years in the Targeted Geoscience Initiative. Some provinces, notably Ontario, Manitoba, Alberta, and British Columbia, have announced new money for geoscience programs. However, a recent industry-government task force investigation into the state of geological mapping in Canada identified the need for an incremental expenditure of more than \$360 million over the next 10 years just to fill priority gaps in surface geological map coverage (Task Force Report, 1999). In this context, the response to date is minimal. The dramatic drop in overall funding for geoscience by Canadian governments has, in my view, seriously compromised our ability as a nation to meet our own needs for up-to-date geoscience. But the money is not likely to come back and we are going to have to find ways to deal with that.

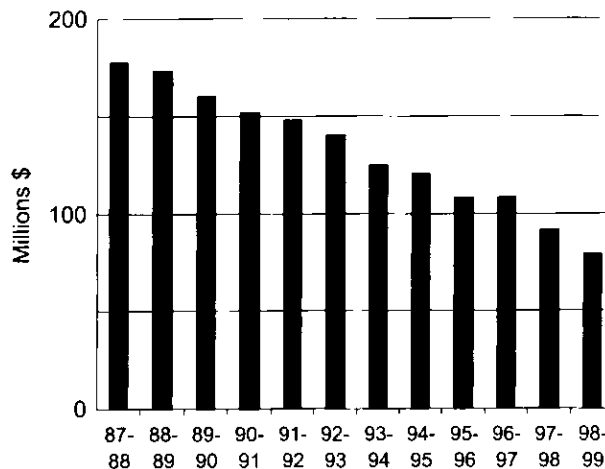


Figure 1 Combined budgets of Canada's provincial and federal geological surveys for the years 1987-1988 to 1998-1999 (Task Force Report, 1998).

Demographics

The demographics problem is no less severe. It relates to the fact that, as I noted earlier, most provincial surveys grew to their present size during the MDA era. A significant number of the geoscientists who work for these organizations was hired at that time, and these individuals are more or less the same age. The geoscientists who made their careers in the provincial and territorial surveys during the 1970s and 1980s have made an enormous contribution to the geoscientific knowledge of the Canadian landmass. They have mapped and interpreted the bedrock and surficial deposits of large parts of the country, documented and interpreted its mineral resources, acted as a catalyst for economic development and investment and, not to put too fine a point on it, aged — more or less gracefully — together.

But as we move into the dot-com world, the demographics that allowed the country's geological surveys to be extraordinarily productive in the latter quarter of the 20th century are, in many cases, now starting to work against them. The problem can be illustrated by looking at hiring patterns over the past three decades. If we consider the provincial and territorial surveys in terms of their hiring demographics, we see that there are three groups, as follows.

I'll start with the group that I know best. Figure 2 shows the demo-

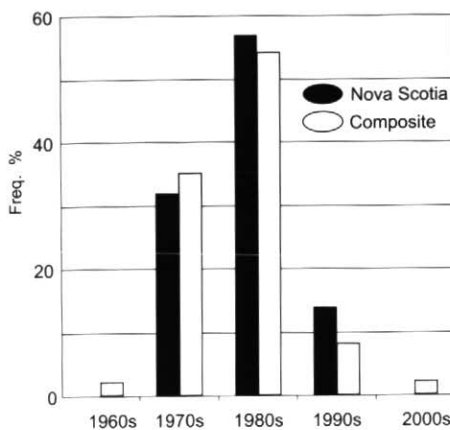


Figure 2 Hiring dates of survey geoscientists in Nova Scotia and aggregated totals for British Columbia, Manitoba, New Brunswick, Newfoundland, and Nova Scotia. The graph represents a total of 133 geoscientists. Source: Committee of Provincial Geologists data, unpublished.

graphic profile for geoscientists in the Nova Scotia survey. About 30% represent the pre-MDA complement, almost 60% were hired in the early- to mid-1980s to gear up for the MDAs, and a very few have been hired since the 1980s.

This turns out to be characteristic of about half of the provincial geological surveys. This group as a whole contains a little more than 40% of the provincial/territorial survey geologists in Canada. Almost 90% were hired in the 1970s and 1980s. These surveys have a demographic profile that is essentially inherited from the MDAs, and have not been granted significant opportunities to refresh their numbers through post-MDA hiring. Most of us who are managing in this environment pay very careful attention to the bar on the right side of this diagram: that is our future.

Ontario and Quebec comprise the second group (Fig. 3). Both are very large, mature surveys that had a significant pre-MDA capacity, and together they include almost 40% of Canada's provincial/territorial geologists. These surveys both contain a significant complement of pre- and syn-MDA staff, but they also are blessed with a significant component of post-MDA hiring.

The third group, the territorial surveys and Alberta, have a hiring profile dominated by hiring in the 1990s and 2000s (Fig. 4). These are young surveys, both corporately and individually. Collectively, they represent about 20% of provincial/territorial survey geoscientists.

The hiring data help to explain how the demographics of today's geological surveys evolved but unfortunately, they paint a rosier picture than actually

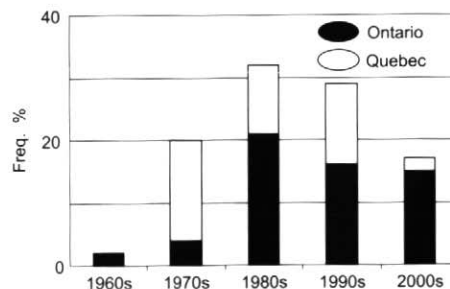


Figure 3 Hiring dates of survey geoscientists in Ontario and Quebec. The graph represents a total of 123 geoscientists. Source: Committee of Provincial Geologists data, unpublished.

exists. Date of hiring does not take into account the fact that some geologists are hired, not for their young legs, modern education and boundless enthusiasm, but for their experience and acquired wisdom. Many of the new hires in the 1990s were, in fact, contemporaries of those geologists already there, and they will reach retirement at about the same time as the MDA complement. And if we look at age rather than year of hire and think about how much time we actually have to deal with the approaching problem, we find that the surveys break down neatly along provincial *versus* territorial lines. Almost all provincial surveys (Fig. 5) have a demographic profile that is heavily weighted towards higher ages. In all cases, more than 60% of the staff are older than 40; in two of them, more than 50% are over 50.

The territorial surveys, by contrast, are dominated by younger geologists (Fig. 6) and have an age profile that probably would have been characteristic of most provincial surveys in about the mid-1980s. Their demographic crunch is still a long way off and they have lots of time to learn from the lessons that will soon trouble their provincial counterparts.

As a whole, provincial/territorial surveys in Canada exhibit an age profile in which more than 70% of the geologists are over 40 and more than 30% are over 50 (Fig. 7). Less than 25% are in their 30s, and if you take out the territories and Ontario which has increased its size by 15% in the new millennium alone, that number slips to about 10%.

This analysis is rather striking and

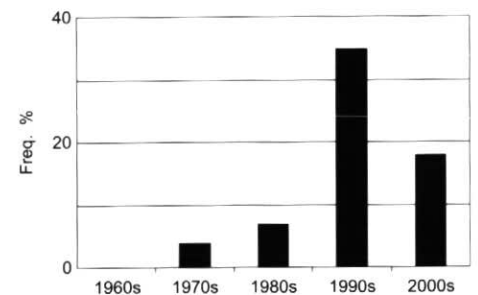


Figure 4 Hiring dates of survey geoscientists in Alberta, Nunavut, Northwest Territories and Yukon. The graph represents a total of 64 geoscientists. Source: Committee of Provincial Geologists data, unpublished.

sobering for those of us who are paid, at least in part, to provide for the continuance of the provincial geological survey programs. The reality is that within a little more than a decade, something like 70% of our staff will be either eligible for or very close to retirement. At that time, or shortly thereafter, they will head out the door, and with them will go priceless intellectual and corporate knowledge that many organizations will, frankly, be unable to replace. We will lose a priceless volume of intellectual property that has been gained over thousands of person field seasons and hundreds of thousands of traverse kilometres of fighting through the bush and the flies to study remote outcrops, of hundreds of person years of fly camps, of tonnes of moss peeled back to get at the fresh surfaces beneath, of interpretations arrived at through long hours of debate and discussion with colleagues in camp and in the office. And although the geology has been described and written about in notes and articles, put on maps, and confided to colleagues and clients over the years, there is still a very large body of scientific knowledge in our heads that clients can access now but which will not be available for love or money 10 or 15 years from now.

In the normal course of events, we would expect a significant portion of that knowledge to be passed on through a mentoring process with junior staff. However, in most provincial surveys, new hiring is not happening at anything like a rate that can provide for the sustainability of the knowledge base. What this means

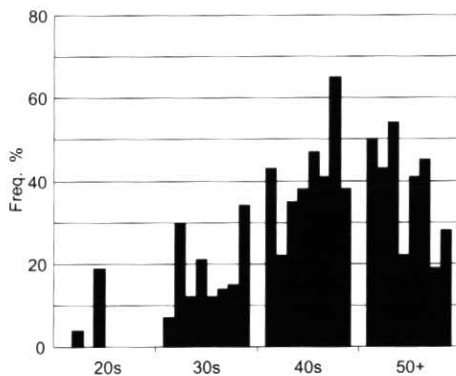


Figure 5 Age of geoscientists in provincial surveys. Each bar represents the total number of geoscientists in an individual provincial survey for a particular age range. Source: Committee of Provincial Geologists data, unpublished.

is that arguably the surveys' principal stock in trade, their wide, expert and personal knowledge of the geoscience of their jurisdiction, that hands-on, down-and-dirty, I've-been-there-and-seen-that expertise to which clients have become accustomed, will be lost.

WHAT TO DO?

This is a fairly apocalyptic view of the near future: no money, no people, and no corporate knowledge. What are we going to do?

It is my view that times of change are also times of opportunity. It is my belief that dealing with change successfully requires the ability and foresight to both pick things up and let things go. I do not believe that the geological surveys are going to wither and die. But I do believe that in order to thrive in the dot-com world, they are going to have to change, they are going to have to pick some things up and let some things go, and with that change will come growth, refocussing of efforts, and ultimately a renewed mandate and a set of skills that can deliver that mandate. Now is the time to start planning for the next generation of geological surveys in the image of the post-MDA era. I suspect that while they will retain some of the characteristics of the present surveys, there will be some differences as well.

CRITICAL FACTORS FOR FUTURE SUCCESS

What are the critical factors for success that will provide for the survival and

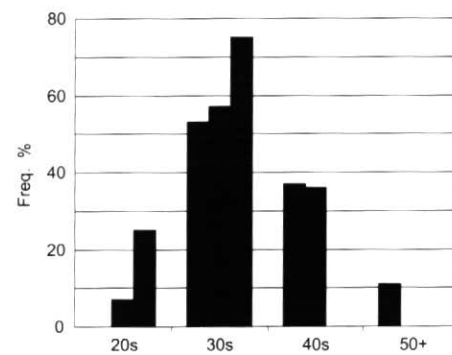


Figure 6 Age of geoscientists in territorial surveys. Each bar represents the total number of geoscientists in an individual territorial survey for a particular age range. Source: Committee of Provincial Geologists data, unpublished.

relevance of the provincial and territorial geological surveys in the dot-com world? I would like to focus on seven factors that I think will be key as our geological surveys evolve: vision, relevance, skills, partnerships, communication, technology, and a little help from our friends.

Vision

First and foremost, we must develop a clear vision of what we expect our geological surveys to be and to do. What will be their mandate and how will they have to be structured to deliver that mandate? What are they going to pick up and what are they going to let go?

As I have already said, I believe that our current vision of provincial geological surveys is very much rooted in the vision of the MDAs. Provincial and territorial geologists have been, in the last decades of the 20th century, principally geological mappers and resource specialists, focussed on providing the basic geoscience knowledge that their jurisdiction requires, studying and interpreting its mineral resource endowment, and using this to further its economic aspirations. We must ask ourselves: "Is this still our vision for geological surveys in the post-MDA era? Is this all we expect of them?" My answer to these questions would be "no."

It is important that provincial and territorial surveys continue to recognize and accept their responsibility for provision of basic geoscience and retain their practical bent and clear client focus. I think one of the things we will have to let

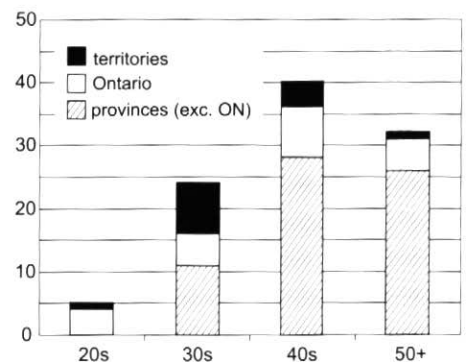


Figure 7 Summary of age demographics for provincial and territorial survey geologists. More than 70% are over 40; more than half of those under 40 are in the northern territories and Ontario. Source: Committee of Provincial Geologists data, unpublished.

go will be the wide, personal, outcrop-scale knowledge of our jurisdictions' geology that is the legacy of years of MDA-funded mapping. I do not see how, in most jurisdictions, we can replace that knowledge, or carry on systematic geological mapping at anything like the pace of the last quarter century. Something else we will have to let go will be our vision of completing the systematic geological mapping of our jurisdictions in any reasonable timeframe. This work increasingly will have to be strategic and focussed on expressed societal objectives as we carefully choose the areas in which to invest our geological mapping resources.

Jurisdictions will probably vary in what they decide to pick up. During the past half dozen years, many geological surveys conducted an in-depth needs analysis as part of their commitment to the Intergovernmental Geoscience Accord. Most heard from their stakeholders and clients that geological maps are and will continue to be their most prized product. However, many also heard an expressed societal need for a wide variety of geoscience products beyond geological maps, ranging from land use planning to resource management, water resource inventory and protection, identification and remediation of geohazards (both natural and man-made), environmental assessment, protection and remediation, and many other things. Needs vary across jurisdictions, of course. The challenge in each jurisdiction is to ensure that we understand what our society needs from us, develop a vision of a geological survey that can meet those needs, and start planning to implement that vision.

Relevance

As the vision is developed, it will be necessary to ensure that survey activities are, and are seen to be, relevant to society's current needs. Provincial and territorial geological surveys in Canada have, until now, defined themselves very much in the context of their jurisdiction's mineral development needs, particularly the needs of the grass roots explorationists. But fundamental changes have occurred in our minerals industry in recent years. Levels of mineral exploration typically are very low, major companies

are, by and large, not players in grass roots mineral exploration in this country, and junior companies are finding it increasingly difficult to raise capital.

I see both a challenge and an opportunity here. The challenge is that the generally scarce resources and lower levels of exploration may be a long term problem, and it may, therefore, become increasingly difficult for geological surveys to justify putting all their eggs in the service-to-mineral-exploration basket. The opportunity is that junior companies now dominate the grass roots exploration business. Junior companies, by their nature, possess less geological capacity than the majors, and rely on provincial geological surveys for information and expertise that they are unable to provide for themselves. Jurisdictions will have a choice to make. What is the balance between the level of mineral deposits expertise they can afford, and the needs of the exploration sector? It will be necessary for each jurisdiction to carefully judge the need for geoscience support by their junior sector clients, and weigh the economic returns of supporting this sector against the impact of decreased competitiveness for exploration investment dollars if they choose not to conduct geoscience in support of the junior sector.

In this context, another thing we will probably have to let go is the in-depth and personal knowledge at a deposit level of the province's mineral resources, gained by years of MDA-funded detailed mineral deposits studies. I expect that many will decide to operate their mineral deposits programs at a more general level, concentrating on inventory, compilation and metallogeny, and less on detailed deposit-scale work.

Skills

Geological surveys in the dot-com world will continue to require the broad, field-based skill sets of competent geological mappers. The approaching demographic problem, of course, presents opportunities for young geologists and I would hope that today's teachers will recognize this and encourage students with aptitude and interest in field-based studies. Future opportunities for this type of work may be brighter than those experienced by graduates in recent past years. Surveys

must continue to offer summer employment to students, if we are to ensure that bright young geologists with appropriate field skills and training are available when they are needed.

In addition, there will be a need for some other skill sets. As we look around, we see many areas where geoscience can contribute to the well-being of the public. We also see many examples of situations where the application of geoscience could have alleviated or prevented human or fiscal loss. There are opportunities for geological surveys to get involved with their societies in imaginative and innovative ways. To do this, they will require scientists with skill sets outside of those of a classical survey mapper. In this, the approaching demographic crisis may provide opportunities. Surveys that are unable to expand to address new needs may, by careful planning, be able to use some of the vacancies created by retirements. It will be critical for survey managers to look at the mix of skills that are being lost, and decide what must be replaced and what can be let go. Will new expertise be needed, for example, in hydrogeology, low-temperature geochemistry, soil mechanics, paleontology, geological engineering, and land use planning? If the emphasis of the client base and our skill sets is to be shifted, what existing expertise need not be replaced? How much expertise is required in petroleum geology, structure and tectonics, granite petrology, sedimentology, metallogeny? This planning must be done now, if organizations are to be created that can successfully compete and thrive in the dot-com world.

Partnerships

In as much as the geoscience organizations of the future will look rather different than those of today, the fiscal regimes will also be different. Recall the downward trend of geoscience expenditures by governments over the past decade (Fig. 1). During this time, we have relied increasingly on diminishing field budgets to accomplish our goals. We have seen operational budgets diminish rather faster than salary budgets, with the inevitable result that the salary-to-operations ratio for many organizations has become very high, hampering the ability to deliver an

adequate level of field programs. Many surveys may continue to have difficulty finding the funds to do field work in the dot-com world, and will have to look elsewhere for fiscal support. In my view, the watchword will be partnering. We will have to seek opportunities to partner with those who have an interest in the outcome of our work. Partnering, by definition, means that both parties bring resources to the table. We have some history with this and by now should be getting quite good at it. In the past provincial/territorial surveys have partnered with the GSC, with mineral exploration companies, and often with other government departments. In the future, we will have to cast our net more broadly. We have some models to work from. Perhaps the best model for partnering in geoscience is provided by the NATMAP program. NATMAP projects brought in everyone from universities, to minerals companies, to water resources boards, to municipalities, and were almost all extraordinarily productive. We can learn much from the way this remarkable program was operated, and we should make the effort to do so because successful partnering will be critical to our future.

Communication

To maintain public support for our activities and to attract partners, we are going to have to convince people that we have something they need, and this leads me to the next challenge, communication. It has probably never been as important as now that we learn to communicate effectively with the society in which we live and work.

We as geoscientists must recognize that we have been remarkably unsuccessful as communicators with anyone except ourselves. With a few notable exceptions we have not been able to engage decision-makers or the public in meaningful discussion about what we do, why we do it, or how it is important to them. It is critical for all of us to develop this skill. The need is highlighted by the fact that even though we have certainly not completed even a significant portion of the geological mapping that Canada requires, and even though our industry colleagues consistently tell us that survey geological maps are critical to their

continued success, we have by and large failed to convince decision-makers and the public who pay our bills that this work needs to be done. Even with the benefit of more than 20 years of tremendous advancement in knowledge, with new discoveries directly attributable to our efforts, society's members do not generally identify up-to-date geological maps, mineral deposit models, or a highly competent, knowledgeable provincial geological survey with their own well-being. And recent experience has shown us with graphic clarity that when funding decisions have to be made, decision-makers are quite prepared to let significant chunks of our program go.

It is not good enough to talk just to each other, through our technical meetings and scientific journals. We need to learn to talk to non-technical people, to journalists and politicians, to businesspeople and homemakers, and to listen thoughtfully when they articulate their needs. This is a skill that most of us do not possess in great measure, and one that we desperately need. Some of our own wise men and women have been telling us this for years (hello Ward Neale); it's time we listened more closely. We have made some significant strides in recent years in this direction. The spectacular Geoscape poster series springs to mind, as does the successful bacon-and-eggheads breakfast meetings program on Parliament Hill that brings together scientists and politicians. We must do more of this if we are to survive and thrive.

Perhaps the best recent evidence that we *can* do this is last year's debate over the proposed renaming of Mount

Logan. This provided the first opportunity in my memory for geoscientists to take the lead in engaging Canadians in an issue of national political interest and GAC played a key role. We learned some valuable lessons from this experience. We *can* do it. But we need a lot more practice.

Technology

One of the places we can go for help with our communications needs is the world of information technology. IT has revolutionized the working environment, not only of geological surveys but of all of geoscience, and will continue to do so. This is the area where we see the closest interface between changes facing our geological surveys and the defining characteristics of the dot-com world. The importance of computers in science cannot be overestimated and the technology is constantly evolving, providing new opportunities for data accumulation, processing, analysis, visualization, publication, and archiving. I believe it is critically important that the geological surveys of the future maintain a very high standard of IT capability and that Canada's geological surveys co-operate to ensure that as a nation, our geoscience database is consistent (in both quality and accessibility), compatible, and useful to all of our clients. Most surveys already dedicate significant resources to IT; all will have to in the future.

A Little Help from our Friends

A final key factor for success is, I believe, looking for good advice and taking it. The change that I am anticipating is a well-trodden path that many geological

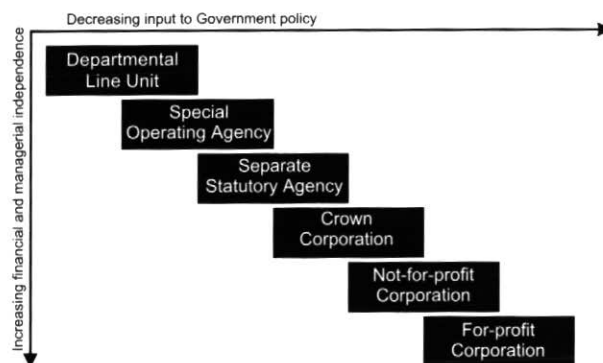


Figure 8 Alternative organizational and funding models for geological surveys (Task Force Report, 1998).

surveys, particularly those in many of the US states, have already followed. Many state geological surveys are already deeply involved with the quantity and quality of groundwater resources, with protection and enhancement of geological features critical to tourism such as beaches, with reclamation of lands disturbed by mining or by natural processes, with geochemical issues related to urban or industrial pollutants. Some states have maintained a significant presence in support of the minerals sector, but this is by no means universal. I think we have much to learn from their experience.

As we look for strategic models for the future, we need to remind ourselves that there are options beyond the paradigm of geological surveys in line government departments funded by public money. Recently, an industry-government task force, of which I was a part, investigated different funding models for geological surveys, at the request of Mines Ministers (Task Force Report, 1998). It identified a surprising diversity of possible models, with a range of public funding and public accountability (Fig. 8). Most of these are being piloted in different parts of the world as we speak. If decision-makers cannot be convinced that the public purse should continue to fund geological survey work, more and more geological surveys may choose to adopt entirely new ways of doing business in order to continue to deliver their programs.

CONCLUSION

As I said at the start of this address, the only real constant is the certainty of change. I think this euphemism is particularly appropriate today for geoscientists and I think it is aptly illustrated by the situation in which our provincial/territorial geological surveys find themselves. We have to adjust. We have to take a long-term view in our planning. And we have to look around and see where our geological surveys are needed; in many jurisdictions, it may no longer be dominantly in the resource development fields. We must accept this fact, and plan to position ourselves to provide the services that our societies require.

As to where our provincial and territorial geological surveys will eventu-

ally land in the dot-com world, I think the jury is still out. I don't have all the answers by any means. I'm not even sure I have most of the questions. But it is very clear to me that change is needed, that change will come, and that we must be prepared for it. Tomorrow will not be the same as today. Life in the dot-com world will be different for geoscientists, no less than for other members of society, and it is not only the geological surveys that have some adapting to do. There will certainly be challenges but there will also be opportunities, and it will be important that we make the right choices when we have to decide what to pick up and what to let go.

ACKNOWLEDGMENTS

I would like to thank the Committee of Provincial Geologists for providing the data that are used in the demographic analysis, Wayne Burt for producing the graphics, Mike Cherry for critically reading the draft manuscript, several members of the Atlantic Geoscience Society, who provided me with valuable feedback following presentation of an early version of this address at their annual meeting, and Roger Macqueen for editorial suggestions that improved the readability of the manuscript.

REFERENCES

- Task Force Report, 1998, Alternative funding arrangements for government geological surveys: A report to the mines ministers by a task force appointed by the Intergovernmental Working Group on the Mineral Industry: Provincial Geologists Journal, v.16, p. 71-118.
- Task Force Report, 1999, Funding government geological surveys: How much is enough?: A report to the mines ministers by a task force appointed by the Intergovernmental Working Group on the Mineral Industry: Provincial Geologists Journal, v.17, p. 79-99.