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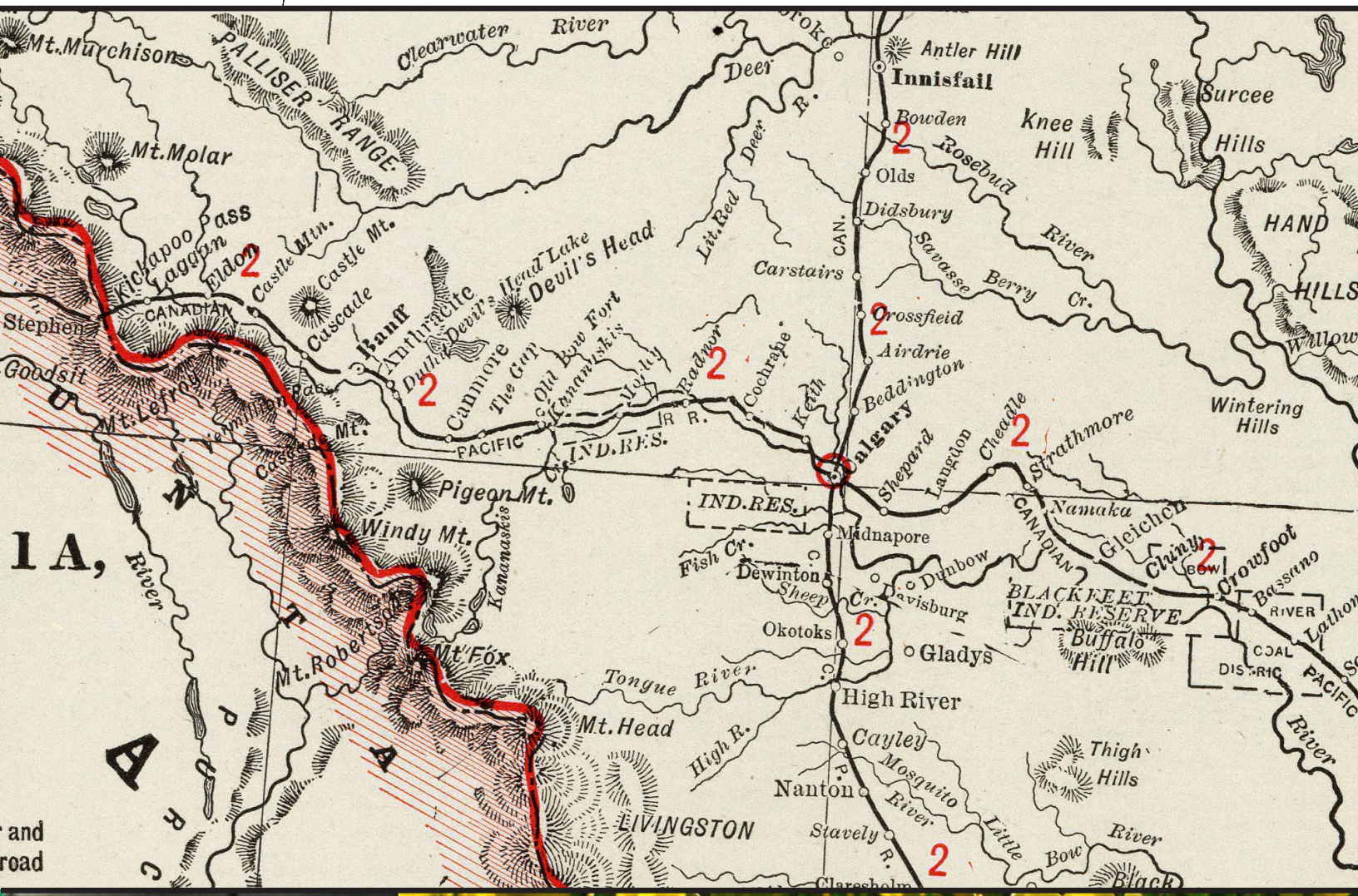

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Map of Southern Alberta, 1901

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Quarterly Newsletter of the
Canadian Cartographic Association/Association canadienne de cartographie
www.cca-acc.org

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Map (from the David Rumsey Map Collection): 1901 by George Cram showing the railways and commercial banks of the area that is now Alberta and Saskatchewan. Calgary is located at the intersection of 51N and 114W graticule lines; for scale, the distance is 100 km from Calgary to Banff. The towns with banks are circled in red, and the railways numbered (in this portion all are '2': Canadian Pacific). Along the railways, some towns have grown, while others have dissolved; those close to Calgary have been enveloped within the city limits, now covering over 5000 km2.

The Rocky Mountains are represented with hachures, and the divide marking the BC boundary. Devil's Head, north of Canmore was used as a navigation marker by early explorers from the Prairies. The 200 km of Rocky Mountain front on this map portion is approximately equivalent to the view from Nose Hill, the conference Friday evening field trip.

Submitted by Roger Wheate, CCA Representative on the Canadian National Committee.

A Word from the Editorial Team

End of school terms, floods and tornadoes, federal elections, royal wedding and writing reports – what a busy spring! All the interest group chairs must be very busy preparing papers and presentations for the upcoming conference. This Calgary event promises to be very stimulating. We are looking forward to seeing all the presentations!

Unfortunately only one interest chair article was submitted for this edition of Cartouche: chair for the Map Use and Design Group – an article reflecting on map use and the influence of modern technology. In addition to this article, this issue presents two Natural Resources Canada's projects: one introducing the development of customized multilingual topographic maps of the Arctic and the other reflects on a new approach to geological map production. We hope you enjoy these articles.

Have a good conference everyone!

The Team

PRESIDENT
Donna Williams

Thoughts to Start Conversation

In this pre-conference article I have chosen to review the meeting minutes from the executive meetings and the annual general meetings over the past 4 to 5 years. During this review I came across the report from an Ad hoc committee on Structural Change. These documents provide an understanding of the challenges the Canadian Cartographic Association has faced the last several years and through these there is some good information that, I feel, can help us find our way forward.

I have identified two linked and ongoing themes from this review. First, we have been concerned with diminishing membership and how to improve these numbers, and, secondly, the Association has been thinking of its future. These two themes are linked and could be considered one. Discussions have been held by the executive and the membership on a number of occasions. Many good ideas have been brought forward and a few have been followed up.

My goal through this short article is to provide some background on the SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis that was carried out in 2008. Then I add some current thinking related to change in understanding since 2008. The last part of this article presents some options in moving forward for possible action and decisions on the future of the Canadian Cartographic Association.

First, however, I want to present an overview of the strengths and weaknesses of the organization as identified from the original analysis submitted in 2008.

Strengths

- The Canadian Cartographic Association (CCA), founded in 1975, is the only organization in Canada that is specifically dedicated to matters cartographic (although there are other organizations that have cartography as a focus).
- There is a strong contingent of knowledgeable, amicable members.
- Conferences move around the country, thus having a regional focus each year.
- We receive money from government to assist us in annual conferences.
- We have a past, and it's a good one.

Weaknesses:

- The CCA has a strong academic representation and, unfortunately, many practicing cartographers feel a sense of exclusion and have little in common with the academic side of the discipline.
- The CCA membership has declined in numbers steadily over the last several years from an all-time high of 408 in the late 1980s. There are likely several contributing factors, such as the rise of Geographic Information Science (GIS) and its mapping capabilities that have drastically improved over time. Many new groups have come about which deal directly with GIS. The CCA has not responded significantly to this change and this might have resulted in lower membership numbers.
- We have had several years where promo was not undertaken to a very great extent in spite of warnings that membership was declining. Lots of good intentions, but not much tangible action.
- There have been some attempts to attract student members, but what is required is a sustained and on-going effort to recruit students. This has resulted in too few younger members.
- Fewer papers – our annual conference is not a draw for presenters; instead they go to the CAG or AAG where there are subgroups in visualization, GIS, cartography.
- Existing members not stepping up to the plate to take on the VP role (headed to president role) -- so we have had to arm twist people to do so who were already heavily committed.
- Running the CCA is a lot of work for a low level of membership, and long standing members are having to be recycled when they have already contributed their energy and ideas, rather than younger people having a chance to show their zeal and take the association in directions they like.

The report goes further to talk about opportunities, the main one being holding conferences with other organizations. The CCA has frequently met with other organizations with positive results. The question in my mind and one I have heard from other members is simply, "is this enough?"

The fact remains that it is challenging to recruit people for the executive and membership continues to fall. We have had trouble reaching quorum at several successive annual meetings. The Association needs to address the issues and act one way or another. I'd like to put forward two possible roads that we might follow to open the discussion.

We can chose one or the other, or decide to look at both. Perhaps by the end of the Calgary conference we will have found a completely different road, but I offer these suggestions to seed the conversations we will have.

Firstly, as has been suggested many times before, we need to make a concerted effort to boost membership. Many ideas have been put forward over time to increase numbers,

- Increase activity throughout the year with mail outs, blogs, notices and personal contact.
- Solicit funds for more competitions and student funding.
- Posters and other promotional materials should get out to universities and colleges.
- Seek out practitioners in private industry and government and encourage their attendance with technical sessions.

There is no question in my mind that the CCA could find more members and create a larger base of support. All of this takes time and effort. Although these discussions have taken place over years and some investment has been made, the overall results have not been seen.

The second road that I would like to suggest is the possibility of joining with another organization. There are many options and opportunities that could be investigated over the coming year. Dan Cole has begun discussion with NACIS and CaGIS about joint conferences. From all reports the meetings are highly successful and directly related to the interests of the CCA. Is there an opportunity to link with either or both of these groups?

Another possible idea along the same direction would be to investigate the opportunity to join with other Canadian organizations. Through discussion with the Canadian Institute of Geomatics president, there is the possibility of staying a distinct association under their umbrella. Perhaps the CIG would be willing to do much of the administrative work and conference organization, leaving CCA members to focus on our distinct business.

Finally, there may be opportunity to join with an organization such as the ACMLA or the CAG with whom we have often met in the past. Could we join executives to reduce the load on each individual organization? Imagine being part of an organization where the CCA is like a specialty group with our own budget, our own newsletter and our own special session, but only having one representative on the executive of the larger organization.

As I mentioned earlier, these are thoughts to start conversation. Through meetings at the Calgary conference and emails, I hope to work with the executive and the membership to outline some actions for the coming year. I encourage you to have interesting conversations around this subject and let me know what you think. Look for an article by the soon to be past president in the coming issues of Cartouche on this subject.

Author Donna Williams is the President of the Canadian Cartographic Association and the Program Manager of the Atlas of Canada Program, Data Dissemination Division, Natural Resources Canada.

PAST PRESIDENT,
Daniel G. Cole

New CCA Executive and our New Vice-President

As Past President and Chair of the Nominations Committee, I would like to thank members of the Committee William Crumplin, Glenn Brauen, and Byron Moldofsky for their work on it.

As of the 2nd Executive meeting of the CCA in Calgary, the new members or continuing members of the Executive will be:

- President - Gerald Stark
- Vice President - Anna Jasiak
- Past President – Donna Williams
- Secretary - Elise Pietroniro
- Map Use & Design - Julia Siemer
- History of Cartography - Ken Favrholdt
- Treasurer - Paul Heersink
- Analytical Cart & GIS - Fiona Ryle
- Education - Dawn Mooney
- Map Production - Paul Wozniak

Thank you to these members for volunteering and contributing to the important task of running the Canadian Cartographic Association. Unfortunately, there were no nominations for the Awards of Distinction this year.

Serving on the CCA Executive Committee for the last two years has been both an enlightening and rewarding experience for me. Attending and participating in the conferences and board meetings in Wolfville, NS and Regina, SK were very enjoyable; and chairing committees to select our new editor of Cartographica, Nigel Waters, and in-coming vice-president of the CCA, Anna Jasiak, proved to be a bit of a challenge that in the end appear to fit the saying "good things come to those who wait."

As a final note, I am still trying to get the other cartographic organizations (CaGIS and NACIS) to seriously consider having a joint two or three way conference together during the coming decade. Stay tuned.

>> Continue on to the next page and read about our new Vice-President

Welcome Anna!

Anna Jasiak
Geography Activity Leader
Atlas of Canada Program
Mapping Information Branch, Natural Resources Canada

An early interest in fine arts steered Anna towards cartography and Carleton University where she completed a B.A. Honours in Geography in 1985. During her studies she completed three summer terms working for the Canada Centre for Remote Sensing in Ottawa. Her career started with Kenting Earth Sciences which focused on her cartographic expertise, soon to be followed by cartographic work for the 1987 Federal Electoral Mapping Project with the Department of Energy, Mines and Resources. She then completed ten years of service as a project manager working with the Census of Population at Statistics Canada. It was there that her love of maps and realization of mapping as powerful tools for communicating information steered her towards her present career at Natural Resources Canada working with the Atlas of Canada team.

She had the pleasure of participating in the development of the 6th edition of the Atlas, watching it evolve as one of the first Internet based atlases in the world, officially launched in 1999. With her census experience she was able to develop thematic mapping modules depicting census data for 1996, 2001 and 2006, as part of the national map collections online. A strong underlying interest has lead Anna towards expanding her pursuit of the promotion of geographic education through her outreach efforts.

Anna has been involved with the CCA and the CAG for over 10 years. She is presently a co-editor of Cartouche.

Daniel G. Cole is Past President of the Association. He is the GIS Coordinator, Smithsonian Institution, Washington, DC.

VICE-PRESIDENT
Gerald Stark

Message from the Vice-President

As the first warm days of spring come our way, it is time once again to gear up for the CCA's annual general meeting and conference. This year's gathering carries two significant similarities to our meeting of 2010 at the University of Regina.

Firstly, we shall again be partnering with our good friends from the Canadian Association of Geographers (CAG). Geography and cartography always go hand-in-hand with spatial analysis and data presentation and such a 'team effort' should produce some interesting and valuable discussions.

Secondly, our meeting venue is once again, located in western Canada. As an Albertan, I feel this signifies yet another opportunity to not only enjoy western Canadian hospitality but to experience first-hand the tremendous growth this part of the country has seen in past few years. The scope and rapidity of change in this part of western Canada beckons the skill of the cartographer to rise up and provide much-needed mapping expertise to help government and private interests to properly plan for extreme growth scenarios.

The Calgary conference also brings to our attention a sometimes overlooked aspect of what is important to Alberta and that is – water. Although the province's oil and gas industry commands much attention from mapping agencies to help with proper planning decisions of such a resource, it is the availability of water that is the key to the future long term sustainability of Alberta's development in the areas of fossil fuel extraction, agriculture, urban expansion and recreation. Our gathering in Calgary will see several sessions devoted to water issues and I am pleased the conference has recognized this subject area as one that both the geographer and cartographer can contribute.

I look forward to seeing you in Calgary this year, and I also want to thank the CCA for giving me the opportunity to serve as your Vice-President. I should also let you know that my tenure as VP will end very soon, but I shall return in another role. Stay tuned!!!

Gerald Stark is the Vice President of the Association. Gerald is a cartographer at Alberta Agriculture and Rural Development in Edmonton, Alberta.

MAP USE AND DESIGN
SPECIAL INTEREST GROUP
Julia Siemer

Map Use and the Influence of Modern Technology

When I was teaching an introductory class on map reading and analysis last fall we had a lively discussion on how maps are oriented correctly in map design and for map use. Although it seemed obvious to me that printed maps are nowadays typically oriented to the north, my students didn't necessarily expect this to be the case. Oh well… one might think, but maybe this is simply an indication of a different approach to map use rather than a sign of poor knowledge.

In elementary school, I was taught to always keep a map, in particular a town map, oriented to the north and adjust my mental map depending on the path I was walking. This was considered the proper way of using a town map. Personally, I often found this approach more confusing than helpful. Of course, as an eager student, I officially followed my teacher's advice, when in fact I rotated the paper map most of the time.

Numerous cartographic research papers have been published on the influence of gender on map reading and spatial skills. Probably better known are books such as "Why Men Don't Listen and Women Can't Read Maps" (Pease & Pease 2001) where the authors, among other areas, look into differences in spatial skills of men and women. This and similar publications typically judge the rotating-the-mental-map approach as superior and consider rotating the paper map inefficient map use. Although there are statistical differences in spatial strategies in men and women observable, on an individual basis men and women may be quite similar in their approach when solving spatial tasks (Quaiser-Pohl & Jordan 2004).

Nowadays, most maps are designed with north on top. This is often done automatically (e.g., maps in GIS, Google maps) and most of the time there is no need to change this, especially with many users expecting it. Although this is true for many maps, modern technology has changed map use options dramatically. Not only are we exposed to maps and visualized spatial information almost everywhere and at all times, but technology has also taken over some map use tasks.

Modern car navigation technology – or GPS as it is often simply called – for instance is an example of digital mapping and typically uses default settings where the map is oriented to the north at the start of the trip (Figure 1). The map is subsequently rotated according to individual driving direction (Figure 2), where technology interprets and orientates the map for the user. Therefore, the map user doesn't need to choose whether to rotate his/her mental map or the paper or digital map. Interestingly, this technology driven approach is seen as consequential and there seems to be no discussion on whether this is a superior or inferior use of maps.

When discussing this shift in map use, students in my class considered GPS technology helpful and expected the map display to correspond with individual driving directions rather than having a fixed orientation. I have often used GPS navigation technology myself and until this discussion in class I had never actually realized how technology changed this particular map use task and how much it influences our expectations of some cartographic products.

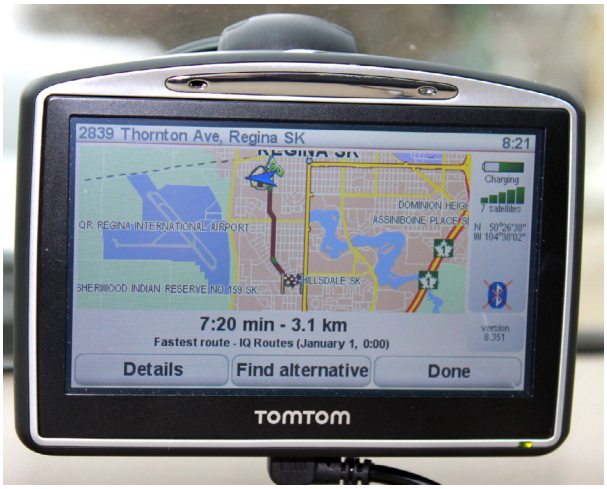


Figure 1: Start display of a map for GPS driving directions, oriented to the north

Figure 2: Subsequent map display, following driving direction (south bound)

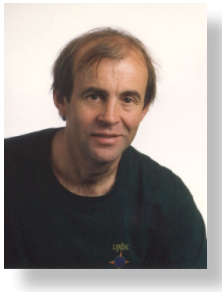
References

Pease, A. and B. Pease, 2001: Why Men Don't Listen and Women Can't Read Maps. Orion, London

Quaiser-Pohl, C. and K. Jordan, 2004: Warum Frauen glauben, sie könnten nicht einparken – und Männer ihnen Recht geben. Über Schwächen, die gar keine sind. Eine Antwort auf A. & B. Pease. C.H. Beck. München

Julia Siemer is Chair of this Interest Group. Julia is an Assistant Professor of Geography (Cartography and GIS) at the University of Regina.

CCA REPRESENTATIVE ON THE CANADIAN NATIONAL COMMITTEE
Roger Wheate



Useful Information for the CCA Annual Conference

Annual Conference, University of Calgary (with CAG), May 31 to June 4

Conference Program:
The program for the Calgary Canadian Cartographic Association (CCA), Canadian Association of Geographers (CAG) and Association of Canadian University Planning Programs (ACUPP) conference includes seven sessions on GIScience, modelling and spatial analysis, mapping / cartography, and two special sessions on "Putting Metis on the Map"; CCA members are chairing four of these and other sessions. There are eight presentations by CCA members:

- Preliminary GIS Analyses of Selected Archaeological Sites in Western Mongolia, by Daniel Cole
- 'Stomp': The Ecological Footprint of Travel for a Competitive Girls Sports Team, by William Crumplin
- Atlas of Canada: Responding to the Needs of Today's Geography and Social Sciences Teachers, by Anna Jasiak
- Canada's Community Map Program, by Paul Heersink
- Atlas of Canada Moving Forward, by Donna Williams
- Mapping Patterns from the 1911 Canadian Century Research Infrastructure Microdate: Households and Languages in 1911, by Byron Moldofsky
- The Dasymetric Method for Mapping Population, by Julia Siemer
- Mapping Glacier Retreat in the Western Cordillera, by Roger Wheate

Conference program details are also available at: ***http://geog.ucalgary.ca/cag2011/***

Getting to the Conference Venue
A taxi from the airport costs $40-50 (~ 30 minutes). If you are not in a rush, City transit costs $2.75 and may take 1-1.5 hours – Bus #100 to McKnight-Westwinds LRT station (Light Rapid Transit). Take the train downtown and transfer on 7th Ave (anywhere between 1st and 8th Street) to the Crowfoot Line – alight at University Station for residences/conference or Banff Trail for Motel Village.
Map: *http://www.calgary.ca/docgallery/bu/engineering_services/emaps/transit_map.pdf*

CCA Events

Tuesday May 31, 13:00 to 17:00: Executive meeting

Wednesday June 1, 12:30 to 13:30: Cartographica editorial meeting (all welcome)

Wednesday June 1, 17:30: Orienteering event (~ 1 hour, not including the pub)

Thursday June 2, 12:30 to 13:30: AGM (all members) **

Friday June 3, 12:30 to 13:00: Executive meeting

Friday June 3, 18:00 to Sunset: Nose Hill Park field trip (pub afterwards)

** **Please** email Roger Wheate ***wheate@unbc.ca*** to indicate attendance for our planning, and for further information or details.

View west to Rocky Mountains from Nose Hill

View south to downtown Calgary from Nose Hill

FEATURE ARTICLE
by: Eva Siekierska

Development of Customized Multilingual Topographic Maps of the Canadian Arctic

New types of topographic maps are being developed by the federal government for the northern territories of Canada. These maps are focusing on the needs of the Arctic community where climate change and even more social and economic change are increasingly noticeable. A project has been initiated to develop customized topographic maps at the scale of 1: 50 000. At the present time the project is situated to help the community engagement needs of the Geological Survey of Canada. The Geo-mapping for Energy and Minerals (GEM) Program was announced in 2008 to provide the geo-science knowledge necessary for private sector exploration companies to guide investment decisions, as well as for government to inform land-use decisions such as the creation of parks and other protected areas. GEM's focus is mainly on mapping the Arctic using modern geological methods and standards to identify the potential for energy and mineral resources.

The development of customized topographic maps, in support of GEM programs, is facilitated by the availability of the detailed topographic maps at the scale of 1:50 000, referred to as the CanTopo series, which are being produced within the Topographic Mapping Initiatives program of Natural Resources Canada. This series of maps will be completed for the whole northern region of Canada by April 2012. Moreover, the territorial governments are accelerating the publication of aboriginal place names, which have been collected by the numerous research projects carried out in the Arctic. The aboriginal names are delineated following rigorous methodologies. The delineations for place names of Nunavut are published online by the non-government organizations Inuit Heritage Trust (IHT) and the Kitikmeot Heritage Society.
http://www.ihti.ca/eng/iht-proj-plac.html
http://www.kitikmeotheritage.ca/research.htm#atlas

Many of these names have been submitted for approval by their respective Territorial naming authorities and some have been supplied to the Geographical Names Board of Canada Secretariat for inclusion in the national data base (http://geonames.nrcan.gc.ca). Many place names gathered in the territories were collected and delineated on 1:250 000 scale maps, the most detailed topographic map available which provided coverage of the whole Arctic region of Canada. However, this scale may not be sufficient to depict the toponyms in the regions with a high density of names; in such a situation an inset map is used. Figure 1 shows an inset at the scale 1:120 000 scale with the IHT delineation of place names in the Pangnirtung region of Baffin Island. The delineation for official names in the Canadian Geographical Names Database are recorded at the 1:50 000 scale.

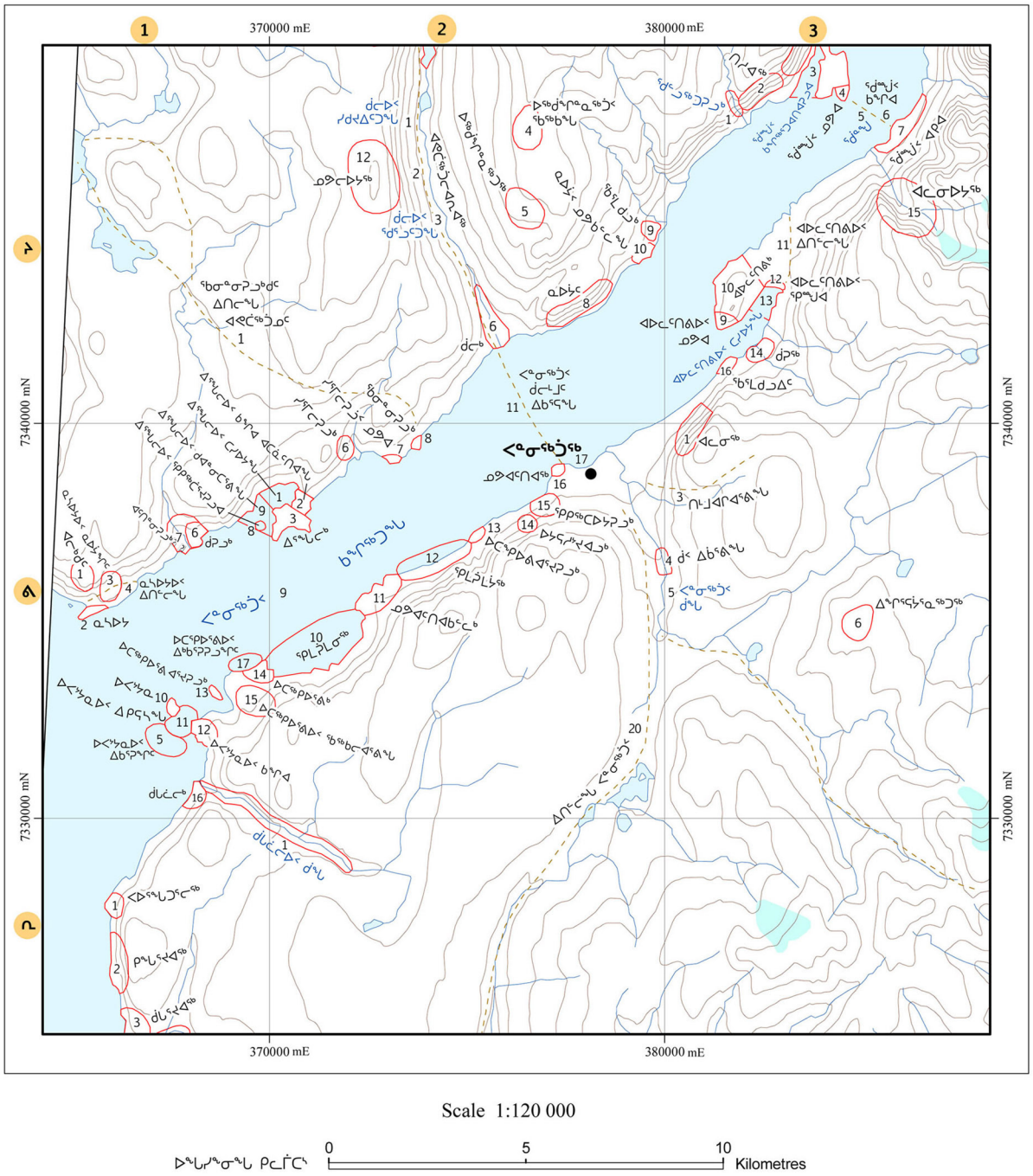


Figure 1: Inuit Heritage Trust Delineation of Place Names of the Pangnirtung Region.

The customized topographic maps for community engagement will have the aboriginal names portrayed in the aboriginal language and script. Inuktitut names, which are written in syllabics are transliterated into Roman characters. This will facilitate communication with people who do not read syllabics. The multilingual legend will show only the topographic map elements found in the Arctic. The maps will have additional features, which are necessary for navigation in the Arctic regions, such as snowmobile trails and emergency cabins, as well as important ice features, such as polynia, which are needed to ensure the safety of activities carried out on the ice. An agreement has been signed with the Canadian Hydrographic Service to include bathymetry data.

There is more water than land area in the northern regions. Experiments are being conducted to enhance the representation of the terrain on land and in the sea by adapting hill shading. The inclusion of particular features is based on the availability of information and on the importance of the features, which is being defined in the consultation process.

The approach taken for development of customized multilingual topographic maps of the northern regions is based on an in-depth consultation with the northern communities. Consultations were conducted in the three culturally distinct regions of the Arctic, the eastern and western region of Nunavut, called Baffin and Kitikmeot region, as well as in the arctic region of the Northwest Territories inhabited by the Inuit, called Inuvialuit. The Inuit living in the southern Kivallin regions of Nunavut and in Nunavik regions of northern Quebec and Labrador have not yet been consulted.

Figure 2: Customized topographic map for community engagement

The consultations included interviews with elders of the communities, government officials, search and rescue officers and others. Additionally the project team gave presentations at community outreach events and at schools and colleges. The purpose of these presentations was to increase the awareness in communities of the availability of the maps on the GeoGratis website (*http://geogratis.gc.ca*) as well as to consult with the younger generation to understand their knowledge of the land and find out their specific needs for the customized maps. In summer 2010, the prototype maps, developed thus far, have been further tested by a research geologist during the field season. The feedback received has been more

than encouraging. The communities provided valuable comments, which have been documented and are currently being analyzed for further recommendations and additional adjustment to proposed content and map design and for the establishment of a priority for the inclusion of arctic features. The requests for more customized maps have been received from the aboriginal communities as well as from the organizations and institutions working in northern Canada.

Figure 2 is an example of a customized multilingual map of the Pangnirtung, a community located on the southern Cumberland peninsula on Baffin Island. The characteristic feature of the customized map is an illustrative frame, which communicates the cultural uniqueness of the Eastern Nunavut region and which draws attention to the map itself. The multilingual legend is placed on both sides of the frame, reflecting four official languages spoken in these regions. Other than English and French, Inuktitut, written in syllabics, is spoken in the eastern part of Nunavut and Inuinnaqtun, written in the Roman alphabet, is used in the western part of this territory. The aboriginal names on the map itself are displayed with the language of the regions. However, to facilitate understanding by all users, a transliteration into the Roman alphabet is given for the names in Inuktitut. In the future we are also considering the inclusion of a phonetic guide on the map surround to assist in pronunciation for those who do not speak a particular language.

This map contains only three additional arctic topographic features which have been requested by the community, namely snowmobile trails, an emergency cabin and polynia. The map was tested in the field and one of the named trails has been corrected by the local people. To make any adjustment to the topographic map one needs to either add a disclaimer indicating that some of the features are in the category of "Volunteer Geographic Information" (VGI) or to initiate a process of verification of collection. The proposed corrections have already been submitted to the Department of Culture, Language, Elders and Youth (CLEY) in the Government of Nunavut, for advice and acceptance of the modifications. CLEY is responsible for the approval of names and their delineations in the territory.

The customized topographic maps are in very early stages of development. Therefore, the design of the maps has not been finalized and the production process not yet proposed or tested. The user-centric community engagement oriented approach taken is by its nature a long process. However, during this process new insights are being disclosed and the process itself is part of the community engagement strategy strongly supported by the federal as well as territorial and local governments.

Acknowledgements

The contributions of the following team members of the project are gratefully acknowledged: Ko Fung, strategic directions and production manager; Peter Williams, data sources, data integration and production coordinator; Ken Francis, CanTopo map series Art Director; Maryam Jamaati, names placement and map production support; Sarah Ellis, data integration and map production support and Del Carry, community engagement consultant and graphic designer. Last but not least the GKM (GEM Knowledge Management) Program Leader Andrew Moore and TMI (Topographic Mapping Initiatives) Program leaders, Yvan Désy and Sylvain Lemay are sincerely thanked for their support and collaboration.

Author, Dr. Eva Siekierska is Manager of Cartographic Research Projects for the Centre of Topographic Information, Mapping Information Branch, Natural Resources Canada.

FEATURE ARTICLE

by: Andrew Moore

The Geological Map Flow Process – A New Approach to Geological Map Production

Geological Mapping – A Reflection on the Past

The Geological Survey of Canada, Natural Resources Canada, has been producing geological maps since Sir William Logan was designated as the first Director of the Geological Survey of Canada (GSC) in April, 1842. As is still the case, the compilation of a geological map is not restricted to the cartographic work but is really a more involved process. Just as a topographic map compilation requires the surveying of the topographic features, a geological map requires the collection of remote and ground based data from which the geologists will compile the map. But this is not a simple compilation based completely on observational information, the geologist takes on the role of a detective who, using their vast knowledge and skills of interpretation, must piece together the most likely scenario of the geological history based on limited information that can be collected as most of the 'facts' are hidden by vegetation, water, sediment and other rocks. Add to this the fact that the last glaciation of our continent (about 20 000 years ago) smeared many of the clues all over the place and that in a geological context, this glaciation was a very recent event. You can get an idea of how difficult it is for these 'rock sleuths' to practise their trade.

Over time, the GSC developed an international reputation for the quality of its geoscience maps from both a scientific and technical point of view. Much of the supporting information used for the compilation of the maps were then discarded or lost as the maps were published. However, times have changed and the GSC has had to adapt to the demands of users and technology. With the advent of Geographic Information Systems (GIS) and digital cartography, many enhancements in the way geological maps are produced have been made, but this has mainly focussed on the cartographic component and less so on the scientific components. Although technology has been applied to many of the scientific areas, it has been often on an individual basis and/or in support of scientific analysis and not in the context of data management or as part of a standard, end-to-end methodology. Increasingly, the demand for not only the interpretation (published map), but also for the supporting data, has compelled a rethinking of how the data is managed and used. The inherent value of this information, for example, the cost of collecting that rock sample on Ellef Ringes Island in Nunavut, includes not just the potential geological knowledge but also the cost of acquiring that sample. The collected data, therefore, has a significant value and has become a government asset that needs to be properly managed and made available to Canadians.

New Requirements for Geological Mapping

Clearly, a more efficient and streamlined method to collect, manage, interpret and disseminate this data, information and knowledge was needed. A catalyst was necessary to effect this change. The Geo-mapping for Energy and Minerals (GEM) Program was announced in 2008 to provide the geoscience knowledge necessary for private sector exploration companies to guide investment decisions, as well as for local

government to make informed land-use decisions such as the creation of parks and other protected areas. GEM's focus is mainly on mapping the Arctic using modern geological methods and standards to identify the potential for energy and mineral resources. GEM has become the catalyst that was needed.

Additionally, GEM was mandated to deliver geoscience data and knowledge. The Geological Map Flow (GMF) project was initiated under GEM to address the need for a more consistent and efficient approach to geological mapping and managing the geological map data.

Approach

The approach taken by the GMF team was to define a complete process from project initiation to output delivery so that the data was controlled from the outset. It was also understood that this would be a significant cultural change for many geologists and without adequate preparation and training through a transitional period, this initiative would be painful.

In order to mitigate this 'culture shock', the team:

- identified and reviewed existing best practices and selected those methods that could be adapted to the GMF;
- developed new tools that mimicked 'traditional' methods where needed, so that the adoption of new technology followed conventional practices;
- defined roles and responsibilities so that the scientist can continue to focus on science;
- provided specific training for the different roles in a timely manner;
- consulted continuously with geological staff throughout to address challenges and to enhance the process when and where necessary.

The project was divided into four components each addressing a key area in the GMF process: field preparation and collection, information management and compilation, map information dissemination, and training and delivery.

Figure 1: Field geologists at a sample site (left) and digitally collecting information in the field (right).

1. Field Preparation and Collection

The field preparation and collection component defines sources of information (e.g. topographic data, geophysical information, etc.) for project planning/preparation and provides tools to extract this information from the sources where necessary. An enhanced version of GanFeld was developed from an existing field data collection system for geoscience data, by providing a seamless data flow into the project data management process while continuing to provide field projects with a level of scientific flexibility. By properly managing the data during the collection phase, we can also support and feed other corporate systems such as the Sample Management System which catalogues all samples collected in the field including key tombstone information such as location, sample method, etc.

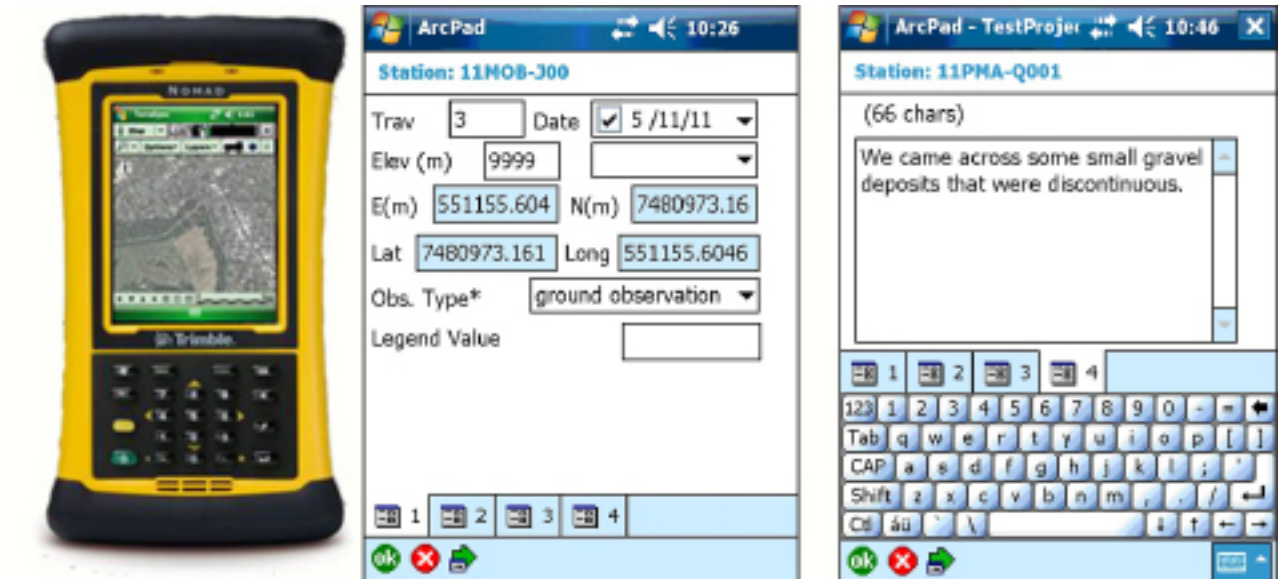


Figure 2: GPS/GIS enabled field device (left) and data collection interface (right).

2. Information Management and Compilation

This component supports the integration of data and information, both existing and new, and the interpreted geological map model within a structured project-level geodatabase. To support this the following were developed:

- standard bedrock and surficial geology geodatabases using consistent fields and consistent terminology while allowing for 'free text' descriptions at more detailed levels of the geologic model,
- tools and services to streamline the digital compilation of interpreted geologic map information (i.e. polygons, contacts, etc.),
- a legend compilation tool to facilitate the symbolization of preliminary/edit maps,
- an intuitive interface for the geologist to view multiple layers of collected field and other information, facilitating the digital compilation of interpretations,
- a service for the streamlined compilation of interpretations compiled on stereo-pair images.

The use of consistent geodatabase design and science language enables the integration of published project-level geodatabases into a corporate geological map database. This in turn provides the foundation for the dissemination of geological map information.

3. Map Information Dissemination

This component has a product preparation process that streamlines the delivery of print-ready and geographic information system (GIS) ready products directly from the geological databases. This process includes providing geomatics (i.e. GIS-cartographic) support during the compilation steps and a more automated process for print-ready product preparation. The GIS-ready product is designed to facilitate immediate use in common GIS software and is released at the same time as the print-ready product. The GMF project team is working with GSC scientists and international agencies (United States Geological Survey, Federal Geographic Data Committee) to define a North American standard for the cartographic representation of geological information.

A key deliverable of GMF is a revised geoscience map output (print-ready and GIS-ready). The current Open File and A Series map publications will be replaced by the new Geoscience Map Series (GMS). The GMS is able to clearly show users that they are using a "preliminary map" and that a final version is pending. The final version will simply be a later edition of the same map and map series. In addition, the geoscience map outputs (print-ready and GIS-ready) are derived from the same project geodatabase through a semi-automated process (with defined procedures and tools) ensuring that both are delivered quickly and in a coordinated fashion.

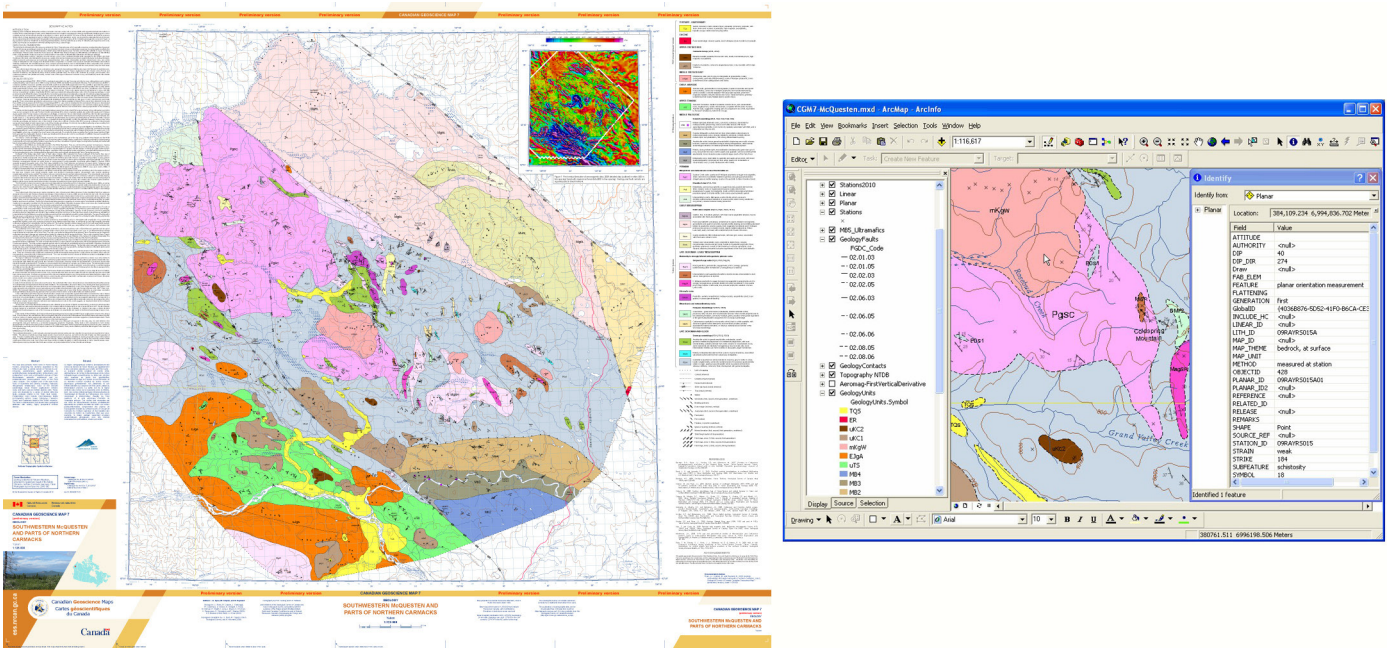


Figure 3: Geoscience Map Series (left) and corresponding GIS-ready data (right).

4. Delivery and Training

In order to support and coordinate a sustainable implementation of GMF, clear and consistent documentation, appropriate and timely training for field parties, and clearly defined the roles and responsibilities have been prepared. This component also provides support to key field geologists that will validate the work and direction of this project.

In summary, the Geological Map Flow process has gone from a purely cartographic and less standardized (not so GIS-ready) digital product, to a coordinated and consistent collection of geoscience information.

The former was characterized by non-standard inconsistent data collection, pen and ink compilation, and digital cartographic representation focused on a paper product model. The latter offers data that is now fully managed in a central project database from project initiation, through the scientific compilation, to the delivery of print-ready and GIS-ready products.

Results

As the GEM program nears completion and we look forward to GEM 2, the GMF system has evolved and has been adapted to overcome specific operational challenges and to mitigate the 'culture shock' effect associated with implementation of a new way of doing geological field work. To date, GEM has released new maps through this process and more are expected over the next two years. This process has shown that it can not only accelerate the delivery of geological map information by providing more efficient and effective data management processes and tools, but it has also shown GSC scientists and our key users alike the potential of this process in delivering supporting data in addition to the interpreted map.

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