

# LEGEND

Organic	
Alluvium	
Colluvium	
Eolian	

Glaciolacustrine - offshore (clay) Glaciofluvial - ice contact Glaciolacustrine - offshore (silt) Glaciolacustrine - nearshore Glaciolacustrine - shore

Glaciofluvial - outwash Glacial - till (yougest to oldest) Bedrock

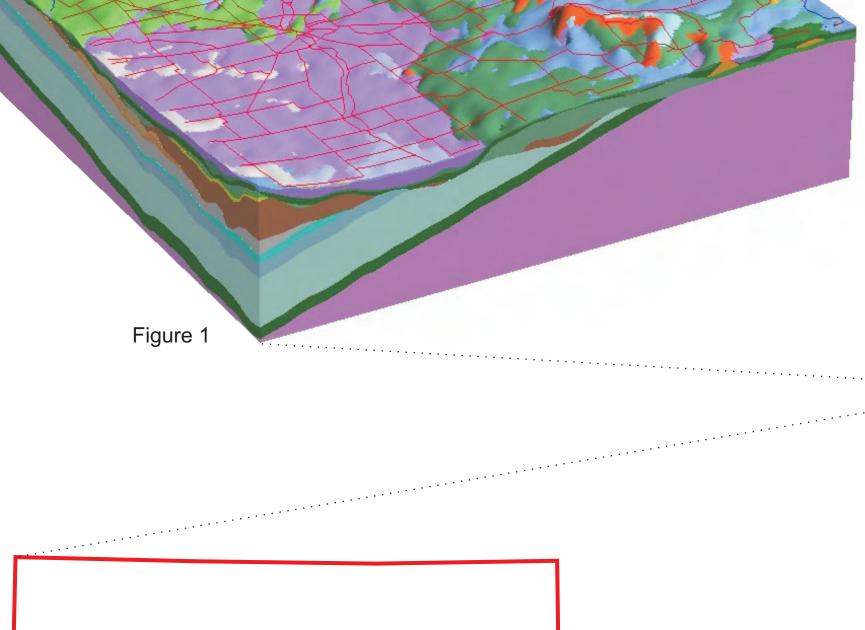


# **Contributions to international initiatives:** Red River Valley 3-D model, North American Soil geochemical Landscapes and One Geology

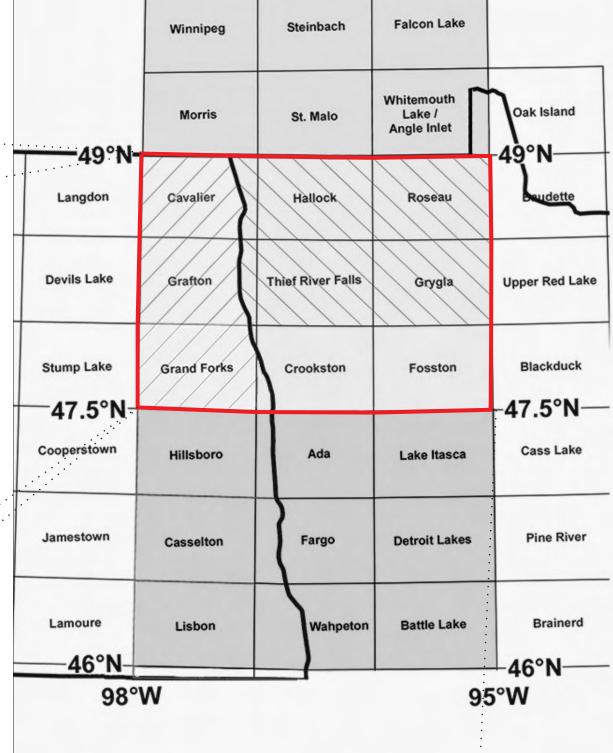
G.L.D. Matile, G.R. Keller and H.D. Groom

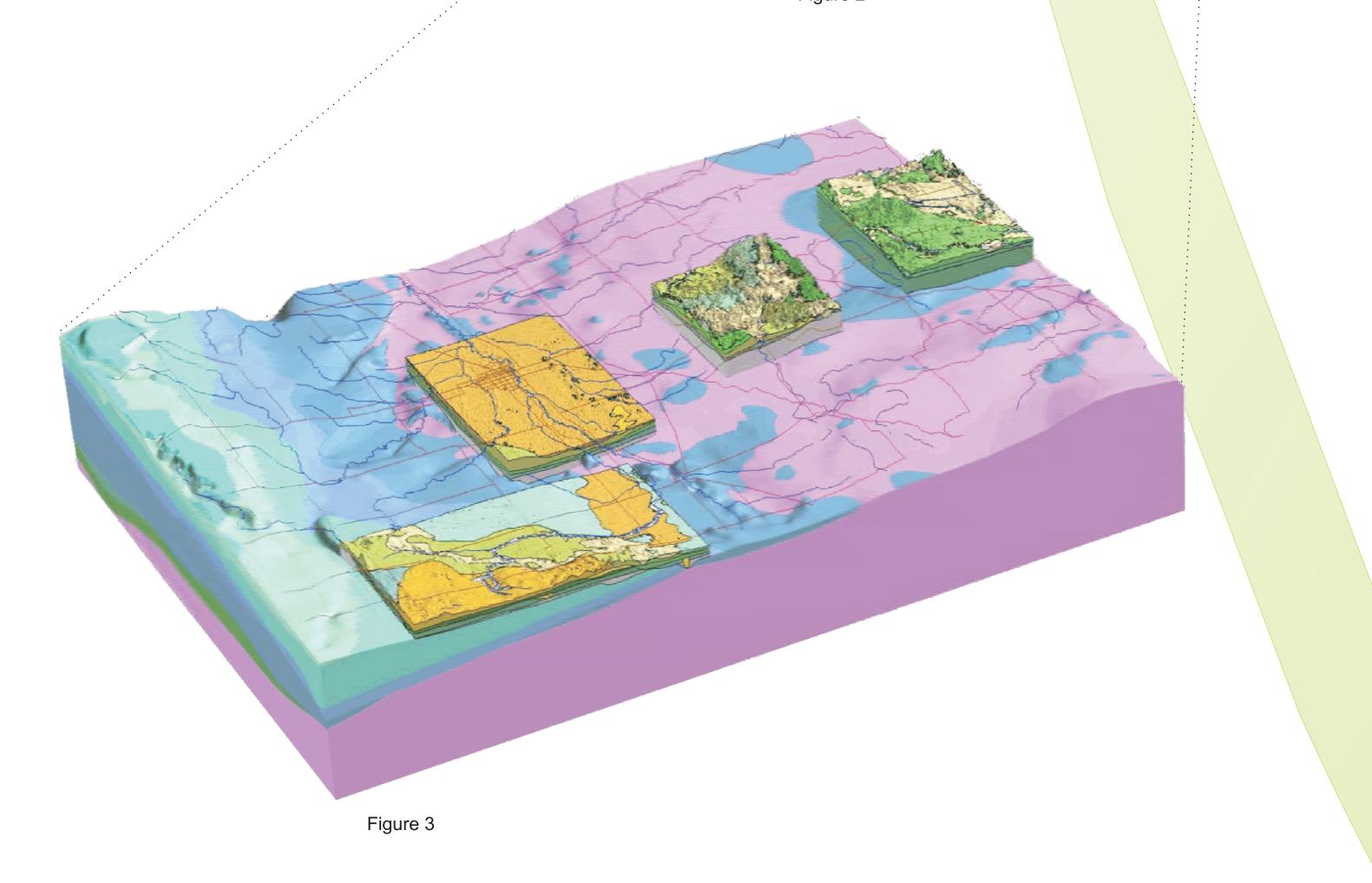
### Introduction

The Manitoba Geological Survey (MGS) has played a significant role in advancing a number of international projects over the past year. This poster summarizes Manitoba's involvement in three ongoing projects ranging in scale from global (OneGeology) to North American (Tri-National Soil Sampling) to province/state cooperation (Red River Valley 3-D model). These projects directly impact groundwater, health and geohazards as well as international data



Grand Forks model in progress





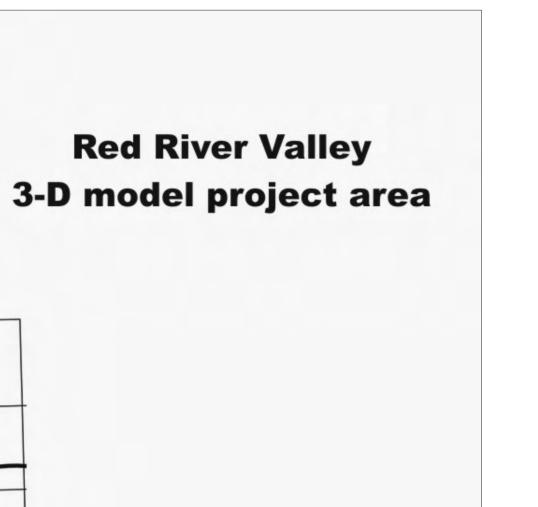
# Red River Valley 3-D model

The geological surveys in Manitoba, Minnesota and North Dakota are working together to expand the knowledge of the Quaternary lithostratigraphy in the Red River Valley (across the Canada – U.S.A. border). The project area is approximately 130 000 km<sup>2</sup> extending from 95°W to 98°W and from 46°N to 51°N. The project area is based on existing 3-D geologic and hydrostratigraphic models for the northern portion of the area (Winnipeg model from 95°W to 98°W, and from 49°N to the 51°N) and southern portion of the area (Fargo model  $\dot{f}$ rom -95°W to -98°W, and from 46°N to the 47.5°N).

This collaborative project has four main objectives: 1) generate a new seamless cross-border surficial geology map, 2) correlate U.S.A. and Canadian Quaternary stratigraphy, 3) integrate drillhole databases into the new 3-D model, and 4) develop a Grand Forks 3-D geologic and hydrostratigraphic model to be combined with the existing Fargo (Thorleifson et al. 2005) and Winnipeg (Matile et al. 2001) 3-D models (Fig. 1 & 3). The new Red River Valley 3-D model will prove invaluable with regards to cross-border groundwater issues.

In the central Grand Forks area, regional surficial and bedrock mapping, as well as regional quaternary stratigraphy has been completed for nine metric quadrangles (Fig. 2). Three of these (from North Dakota), however, require compilation and four (from Minnesota) are in need of new, updated surficial geological mapping. Figure 6 shows progress on the regional surficial map to date (eg. central portion of map is clearly less detailed and requires updated mapping)

The medium being used for stratigraphic correlation in the project area is glacial till, which may be derived from up to six different source areas (Fig. 4). Till samples from drillholes (Fig. 5) throughout the project area have been analyzed for matrix texture (sand, silt and clay) and coarse sand lithology. In order to develop cross-border till correlations, 1900 samples have been analyzed to date, and a network of cross-border cross-sections have been developed.



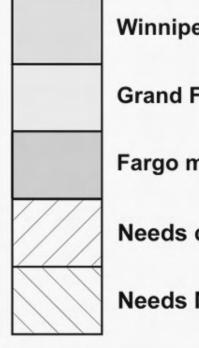


Figure 4

Winnipeg model **Grand Forks model** 

Fargo model

**Needs compiling** 

**Needs Mapping** 



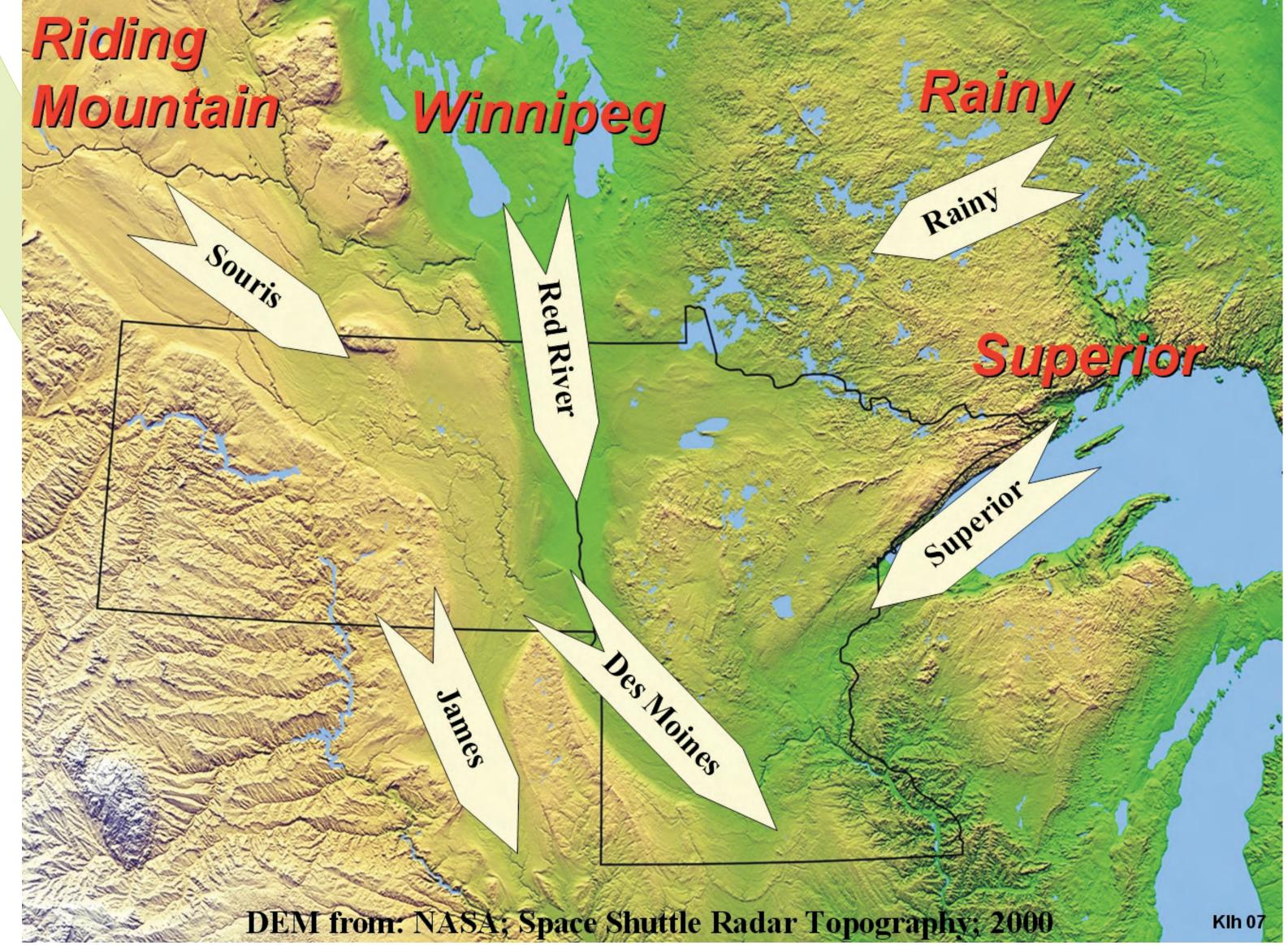
# North American Soil Geochemical Landscapes Project

The seemingly overwhelming task of mapping the soil geochemistry of all of North America has been undertaken by the North American Soil Geochemical Landscapes Project (Tri-national soil sampling project). This multi-national cooperative project (Canada, United States and Mexico) is designed to systematically characterize regional variations in soil (bio)geochemical characteristics. The project began with a series of pilot studies in 2004 in the U.S.A. and Canada. Sampling protocols were further refined in the Maritimes and U.S.A. from 2005 to 2007. The project results will contribute to a variety of applications, issues and disciplines such as assessing and managing natural resources and environmental hazards.

The national geological surveys of each of the participating countries are coordinating the collaborative work with provincial and state geological surveys. In Canada, agencies such as Health Canada and the National Forest Inventory provide funding and/or expertise in exchange for specific sampling intervals or analysis requirements. Sampling sites are selected based on a grid system with one randomly selected sample site per 40 km grid cell, totaling approximately 6100 locations over all of Canada. All participating countries follow core sampling protocols. Protocols for additional samples, however, vary between jurisdictions largely because of differences in funding levels. Protocols for sampling in areas of permafrost and organic soils are currently beir

In June of 2008, the MGS participated in a cross-Canada transect proposed by the Geological Survey of Canada (GSC) that straddled the Trans-Canada Highway. Using the protocols set out in the Maritimes, five depth intervals were sampled. These were classified as the public health interval (0-5 cm), the National Forest Inventory sample (0-15 cm) and the A, B and C soil horizons. An additional 0-5 cm sample was collected to measure natural Anthrax levels in the soil. Radon gas measurements were also taken at each site. Samples from twenty-one sites were collected by a four person crew (H. Groom and G. Matile – MGS, H. Byker and C. Streiber – GSC summer students). This covered ile <u>V</u>iew F<u>a</u>vorites <u>G</u>roups <u>T</u>ools <u>H</u>elp - 🔾 🗳 🥝 🗢 | 🏠 🖉 - 🏯 💢 🗂 🌽 i 🔽 🗸 area of approximately 335 km, from the Saskatchewan border to just east of Winniped and approximately 65 km south of the Trans-Canada Highway. Sample sites further east will be sampled when organic soil protocols are established. Dominant soil types collected in Manitoba were black chernozems (Fig. 7) with a parent material ranging from QQ @ ? n a 2 i clay till in the west to sand in the Assiniboine delta and finally to heavy clays of the Lake

Analytical data will be available from the GSC website free of charge (http://ess.nrcan.gc.ca/eh-esh/trinat/index\_e.php), however specific dates for data availability are not currently known. It is also not known if data sponsored by outside agencies will be served on the GSC webpage.



Agassiz plain in the Winnipeg area.

#### OneGeology

OneGeology is an ambitious global initiative, concatenating digital geological map data from geological surveys around the world and serving it in a dynamic map format via the web. OneGeology is currently supported by seven international organizations, and is the flagship project of the 'International Year of Planet Earth'. The vision of the OneGeology web portal is to facilitate and increase the accessibility of geological map data worldwide. Currently, there are 84 nations participating in the program; a number which is steadily increasing. Each nation is represented by its national geological survey.

The Geological Survey of Canada currently provides data to the project at a scale of 1: 5 million. The OneGeology target scale is 1: 1 million. This shortcoming, specific to geological surveys of large countries, prompted the MGS to assemble four map sets, some with multiple layers, for the OneGeology portal. These four map sets utilize previously compiled bedrock and surficial geology maps.

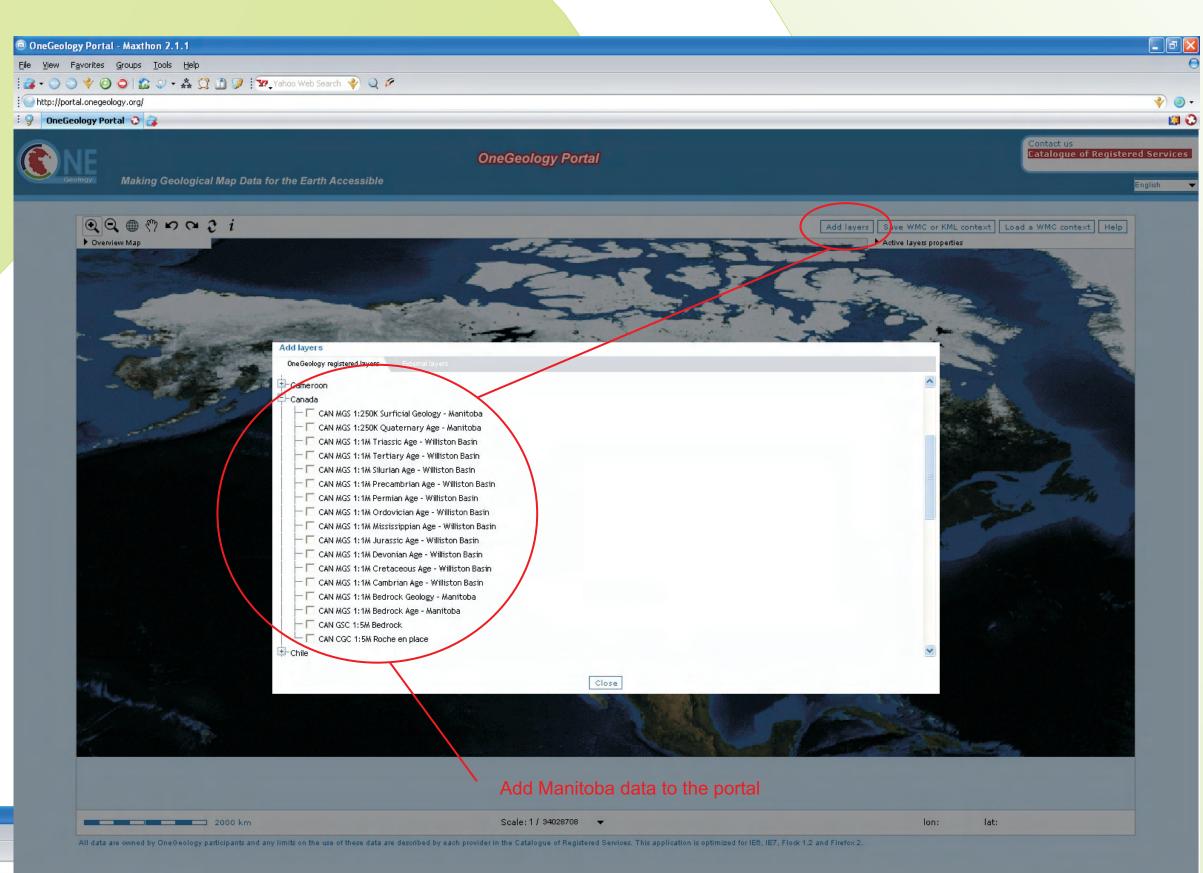
#### The four map sets are:

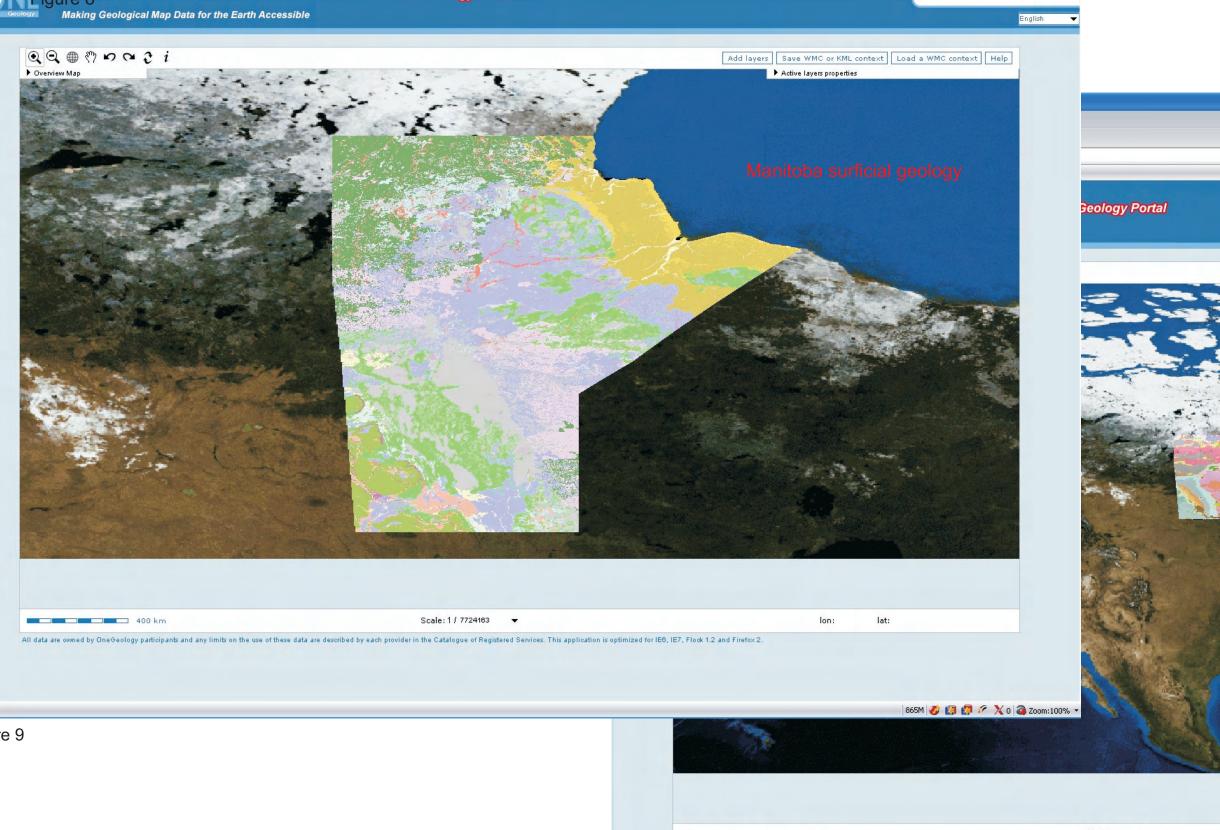
- a surficial geology layer representing the compilation of the most detailed surficial geology maps available in Manitoba (Matile and Keller, 2007) (Fig.9),
- 2) a bedrock geology layer representing a fusion of 1:1 million bedrock geology polygons from the Geological Map of Manitoba (Manitoba Department of Mines, Resources and Environmental Management 1979), and the Phanerozoic bedrock polygons cropped to Manitoba from the recently completed 'Williston Basin Architecture and Hydrocarbon Potential in Eastern Saskatchewan and Western Manitoba project' (see Nicolas, 2008, this volume; www.willistontgi.com) (Fig. 10),
- 3) a Manitoba chronostratigraphy in 2 layers which uses the same base data as the bedrock geology, but with polygons categorized by age rather than lithostratigraphy as well as a separate Quaternary layer (Matile and Keller, 2007) that covers about 90% of Manitoba,
- 4) the Williston Basin chronostratigraphy which is represented by a series of 11 layers utilizing map data derived from the Williston Basin Architecture project, which extends significantly into Saskatchewan, and is unique in that each time period is represented by a separate layer allowing the user to remove, or 'peel' off individual time periods (see display on table below).

A fifth map set representing Manitoba topography is available, but has yet to be uploaded to the OneGeology portal. The Manitoba topography layer has been created for the OneGeology portal to allow the user to utilize the portal's transparency option and provide shaded relief for the Manitoba map sets. It can be manually added to the OneGeology portal by going to "Add Layers"/"External Layers" and copying in the following link:

http://geoapp2.gov.mb.ca/wmsconnector/com.esri.wms.Esrimap?Servicename=CAN\_MGS\_SRTM\_ DEM\_WMS&.

The MGS is presently the only province/state to provide data to this global project. The MGS is currently serving the data as WMS layers though an ArcIMS. The OneGeology portal can be accessed by visiting www.onegeology.org and clicking on 'Portal' (Fig. 8-10).





2000

#### **Economic Considerations**

Manitoba's active role as a contributor to major national and international projects has resulted in a significant contribution to the existing knowledge base relevant to modern geoscientific and social advances including: (Red River 3-D) groundwater management, (Tri-National Soils) health and environment hazards, and (OneGeology) geological education and data accessibility. Cross-border 3-D geological mapping unites disparate datasets and puts them into a single standardized nomenclature assisting in groundwater management on both sides of the Canada-U.S.A. border at an international level. The North American Soil Geochemical Landscapes Project provides continent-wide data on background soil geochemical levels relevant to a variety of applications, issues and disciplines such as assessing and managing natural resources and environmental hazards. The outcomes of these studies will provide further insight into the relationships between soil geochemistry, environment and health as well as provide a framework and protocols for wide-scale geoscientific surveying of soils for health and environmental purposes. OneGeology will provide greater accessibility of geological map data on the world stage. This is enhanced by the fact that the MGS is the first non-national geological survey to have data available on the portal, and at a more detailed scale than is currently available for Canada.



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