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Groundwater Resources Studies

The *Groundwater Resources Study* (GRS) series seeks to better the understanding of Ontario's groundwater resources through the collection, evaluation and distribution of geoscience data. The main objective of the series is to provide accurate information on a range of groundwater-related themes, including local- to watershed-scale aquifer characterization and delineation; geologic controls and influences on groundwater quantity and quality; and methods development. Products of the groundwater program include geoscience reports, data sets and protocols for information collection and handling. Geoscience information generated through the series will find application in the protection and sustainable management of the province's groundwater resources.

The publication can be downloaded from
http://www.geologyontario.mndm.gov.on.ca/mndmaccess/mndm_dir.asp?type=pub&id=GRS005

Groundwater Resources Study 5
Karst of Southern Ontario and Manitoulin Island; by F.R. Brunton and J.E.P. Dodge. This digital data release contains reconnaissance-level field data and polygons depicting the nature and regional distributions of karstification of Paleozoic bedrock units within thin drift and exposed bedrock regions of southern Ontario and Manitoulin Island. Field photos of key karst features such as caves, sinkholes, disappearing streams and springs, and solution-enhanced joint sets are highlighted for selected regions on the digital map. The relative response of the various sedimentary rock units to karstification is placed within a stratigraphic and geographic context. The data is organized into a series of folders of varying type and format. These include: 1) main Karst report to accompany map; 2) an ArcGIS® map; and 3) a second report prepared by Golder Associates and OGS staff describing 3D data in the form of field site descriptions and joint measurements, digital core logs, and geophysics from select regions to further delineate/investigate the vertical extent of particular surficial karst features. The data are available on 1 DVD. $25.00.

Users of OGS products are encouraged to contact those Aboriginal communities whose traditional territories may be located in the mineral exploration area to discuss their project.

Karst Study for Southern Ontario

Getting Started Guide

Contents:

Introduction:

This digital map data product of the Ontario Geological Survey comprises one DVD-ROM disk containing Karst and Paleozoic geology map data for southern Ontario, Canada. It is a geographic information system (GIS) based map of the Paleozoic bedrock influenced by or susceptible to karstification. The data are useful for many purposes, including groundwater and surface water studies, other environmental studies, geotechnical investigations, land-use planning and mineral exploration.

This “getting started” document is intended to help clients begin to use the data. The DVD also contains a more comprehensive “report” in the documentation folder. Most of the documentation is in “pdf” format, which may be read using Adobe ® Reader ® software available for download from Adobe’s site at http://www.adobe.com/products/acrobat/readermain.html.

Using the data with ArcGIS ® software:

The data may be accessed with ESRI ® ArcGIS ® 8.x, 9.x software, including ArcView ® 8.x, 9.x as follows.

- Copy the contents of the DVD to a new directory on your hard drive. The data will occupy about 1.5 GIG of space. The folder structure must be maintained.

- For each newly copied folder right-click and uncheck the Read-only option check box.

- The 'Fonts' folder provided on the DVD contains font files required by ArcGIS for symbolizing point features on the map. The fonts must be installed as follows, prior to viewing the data sets in ArcMap. In Windows ® 2000 ®, open the 'fonts' subdirectory in your 'winnt' directory, or click start, select Settings, then select 'Control Panel'. In the 'Control Panel' open the 'Fonts' folder, under 'File', click 'Install New Font' and map to the ‘fonts’ folder copied from the DVD or simply copy the ‘QUAT.TTF’, ‘OGScontacts.TTF’ and ‘OGSFaults.TTF’ files located

in the ‘fonts’ folder and paste it into the 'fonts' subdirectory in your 'winnt' directory. For Windows ® XP ®, the font folder is located in c:\WINDOWS\Fonts. Click start, select Settings then select 'Control Panel'. In the 'Control Panel' open the 'Fonts' folder, under 'File' click 'Install New Font' and map to the ‘fonts’ folder copied from the DVD.

- Use ArcGIS to open the project file “map.mxd”, found in the new directory. Open ArcMap and under file click ‘open’ and select map.mxd. The user can simply click on or off whatever layers he/she chooses. The legends for each layer can be viewed by clicking the plus sign next to each layer. Please note that at full map extent, regeneration time for some layers may be slow.

The data can also be opened directly from the DVD without copying it to the hard disk. To do this, use ArcGIS to open the project file “map.mxd”. The project files are found in the top or root folder of the DVD.

Using the data without ArcGIS ® software:

In the “map_pdf” folder on the DVD there is a layered “pdf” file (karst.pdf), which is the digital equivalent of a conventional printed geology map. This digital map may be viewed using Adobe ® Reader ® software. The visual quality of the pdf map is blocky when zoomed in close, and cannot equal the visual quality that may be obtained with GIS software.

Contents of the DVD-ROMs, map projections, scale and base map information:

There is one DVD-ROM disk in the Karst Study for southern Ontario data release. This disk contains a complete set of data in geographic projection (decimal degrees, NAD 83 datum).

Tables 1 and 2 detail the contents of the DVD.

The scale of the geology data is nominally 1:50,000. Most of the individual maps assembled for the Paleozoic geology of southern Ontario are of this scale, but some smaller-scale data was also used.

The base map, which was used in assembling the data, is the Ministry of Natural Resources’ Land Information Ontario/ Natural Resource Values Information System base map.

Data layers and attributes:

As can be seen in the ArcMap legend, there are many layers in the Karst study GIS map. Also, individual layers may have many attribute columns which can be used for visualizing or querying the data. The layers and attributes are described in Table 3 for convenience. The “layers” are ArcInfo “coverages” which can be imported to clients’ existing Geodatabase(s).

Table 1: Contents of DVD-ROM

Top Folder	Folder	Sub-Folder, File names	Contents
	coverages		All ArcInfo coverages.
	Documentation		
		Karst-GRS5-FRB-JEPD-10-08.pdf	Project Summary and Technical Document
		Metadata.pdf, .html	Detailed metadata
		Legend.pdf	Map legend
		Final-Golder-OGS-Karst-BH-3D-FRB-04-02-08.pdf	Golder Associates report - 3D-borehole study
	fonts		Font files required for point symbology. Must be loaded by user.
	Google Earth	Resources	Karst datasets in Google Earth format
		Doc.kml	Final kml for viewing the karst data in Google Earth.
	layerfiles		Layer files used to display proper symbology in creating the mxd.
	Map_pdf	Karst.pdf	Karst study poster in pdf format.
	photos	**Devonian, Silurian, Ordovician**	Karst photos - Hyperlinked to karst_photo coverage.
		Carden, Guelph, Napanee, Ottawa, Wiarton	Geophysical boreholes - Hyperlinked to karst_bholes coverage.
		joint_orientations	Joint orientations (rose diagrams) - Hyperlinked to karst_joints coverage.
map_8.3.mxd			ArcMap project file (mxd) found at the root directory of the cd. (version 8.3)
map_9.0.mxd			ArcMap project file (mxd) found at the root directory of the cd. (version 9.0)
map_9.2.mxd			ArcMap project file (mxd) found at the root directory of the cd. (version 9.2)
dd.prj			Projection file.
Readme.doc			Getting Started Guide: how to use the data, and basic metadata

Table 2: Map layers and attributes (ArcGIS)

Layer	Attribute	Description
KARST_POLY poly (unit polygons)		Karst and Paleozoic geology unit polygons, which classify the distribution of Paleozoic bedrock formations and those units susceptible to karstification.
	ORIG_UNIT	The geological unit number captured from the original map legend (source_map), for example 1, 2, 5, 5a, 5b.
	ORIG_FORMATION	Provides information regarding the formal geological formation from the original map legend, for example "Bobcaygeon Formation".
	ORIG_LITHOLOGY	A lithologic description of each map unit captured from the original map legend (source_map).
	AGE	Geologic age of the rock unit, for example “Ordovician”
	SOURCE_MAP	The original map number used for this compilation.
	UNIT_NUMBER	The geological unit number assigned to the polygon from the project legend, for example 1, 2, 5. Units are stratigraphic formations or in some cases groups as indicated in the legend.
	SUBUNIT	Sub_units are subdivisions of units based on original maps. These may be members within formations, formations within a group, or facies or beds as indicated in original maps. Sub_units may extend across a number of map sheets or may only exist on a single map sheet.
	UNIT_NAME	The stratigraphic unit name assigned to the polygon from the project legend, for example “Queenston Formation” or “Hamilton Group”. Units are stratigraphic formations or in some cases groups as indicated in the legend.
	GROUP	The lithostratigraphic unit next in rank above formation.
	FORMATION	Rock unit identified by lithic characteristics and stratigraphic position.
	MEMBER	A lithostratigraphic unit comprising some specially developed part of a formation.
	PRIMARY_LITHO	A lithologic description of each map unit from the project legend.

	DESCRIPT_FULL	A detailed description of each map unit from the project legend.
	DESCRIPT_BRIEF	A summary of the detailed description of each map unit from the project legend.
	KARST	Selected Paleozoic bedrock units susceptible to karstification. Attributed as **"known"** - observed, measured field data or data from Published reports, **"inferred"** - regions of Carbonate bedrock units highlighted as most vulnerable or susceptible to karstification, where direct field observations have not been made by OGS staff or other sources. A natural extrapolation of the known karst areas for given rock units and **"potential"** - areas of carbonate rock units identified as most susceptible to karst processes.
	EVIDENCE	Observed karst features found in areas identified as **"known"** karst. Features include caves, sinkholes, karren and disappearing streams.
	DESCRIPTION	All areas attributed as "known" karst are described in detail in the Karst report associated with this publication.
	DRIFT	An attribute describing the relative thickness of overburden. This information was taken from MRD-128 – Surficial Geology of Southern Ontario.
KARST_POLY arc (contacts)		Paleozoic geology unit contacts. Contact lines between unit polygons. Level of confidence indicated as per original map. Faulted contacts are indicated by different line types.
	FEATURE_CODE	A character field containing a feature code such as "geolap-0" or "fltmd-0".
	DESCRIPTION	A character field containing each feature's description. For example, the feature code "geolap-O" represents contacts which are approximate.
	SOURCE_MAP	The original map number used for this compilation.
	COMMENTS	A character field reserved for any additional information about the feature.
KARST_FAULT		Captures fault lines with level of confidence indicated as per original map. May be boundary of unit polygon (i.e., coincident with a karst_poly arc line) or may cross-cut unit polygons.
	FEATURE_CODE	A character field containing a feature code such as "fltmd-0".
	DESCRIPTION	A character field containing each feature's description. For example, the feature code "fltmd-0" represents a fault-contact, ball on downthrown side.
	SOURCE_MAP	The original map number used for this compilation.
	COMMENTS	A character field reserved for any additional information about the feature.
KARST_POINT		Karst point features observed or compiled from existing publications.
	FEATURE_CODE	A character field containing a feature code (karst).
	FEATURE	Observed karst features, features include caves, sinkholes, and disappearing streams.
	DESCRIPTION	A character field containing each feature's description. ie – Sea cave relict
	SOURCE	Source of information, ie Parks Canada
KARST_PHOTO	 HYPERLINK	Contains information and representative photographs of various observed karst features located across southern Ontario. Point dataset containing hyperlinks which display the representative photo. User activates HYPERLINK button located on the TOOLS toolbar.
	KARST_PHOTO	Unique number used as an identifier for OGS geologist.
	NAME	General name of the photograph.
	STATION	Field station number used as an identifier for OGS geologist.
	EASTING	Easting
	NORTHING	Northing
	ZONE	UTM grid zone. (17 or 18)
	FEATURES	Description of the features observed in the photograph.
	FOLDER	Hyperlink to the photos.
KARST_JOINTS	 HYPERLINK	Contains information and representative images of joint orientations measured in areas of exposed bedrock across southern Ontario. Point dataset containing hyperlinks which display the representative image. User activates HYPERLINK button located on the TOOLS toolbar.
	STUDY_AREA	Study area.
	STUDY_LOCA	Study location.
	ZONE	UTM grid zone. (17 or 18).
	BOREHOLE	Borehole ID.

	EASTING	Easting
	NORTHING	Northing
	JOINTS	Hyperlink to the joint orientation (rose diagrams) images.
KARST_BHOLES	 HYPERLINK	Contains information and representative images of borehole information including photos, geophysical logs and descriptions. Point dataset containing hyperlinks which display the representative image. User activates HYPERLINK button located on the TOOLS toolbar.
	STUDY_AREA	Study area.
	STUDY_LOCA	Study location.
	ZONE	UTM grid zone. (17 or 18).
	BOREHOLE	Borehole ID.
	EASTING	Easting
	NORTHING	Northing
	BOREHOLES	Hyperlink to the geophysical borehole images.
rocksurface		Shaded relief for bedrock surface. Taken from Miscellaneous Release Data—207 Bedrock Topography and Overburden Thickness Mapping, Southern Ontario C. Gao, J. Shirota, R.I. Kelly, F.R. Brunton and S. van Haaften
BASE MAP LAYERS (water, roads)	From Land Information Ontario.	

Layers in the ArcMap ® project (mxd file):

The ArcMap project file (mxd) provided for this dataset was created so that the user can simply double click and open a completed map displaying all the layers and information captured in this dataset. Table 3 lists the layers found in the ArcMap legend, the GIS layers or coverages used to create that ArcMap layer, the attribute displayed and the layerfile used.

Table 3: Layers in ArcMap project (mxd).

Group Layer	ArcMap Layer	coverage	Displayed attribute	Layerfile
	neatline arc	neatline		
Golders_study_Report2	karst_joints point	karst_joints		karst_joints.lyr
	karst_bholes point	karst_bholes		karst_boreholes.lyr
Karst	karst_point point	karst _point		karst _point point.lyr
	karst _photos point	karst _photos		karst _photos point.lyr
	karst _fault arc	karst _fault	FEATURE_CODE	karst _fault arc.lyr
	lakes polygon	lakes	IW	lakes polygon.lyr
	roads arc	roads		roads arc.lyr
	karst _poly arc	karst _poly.aat	FEATURE_CODE	karst _poly arc.lyr
	karst _poly polygon	karst _poly.pat	KARST	karst _poly polygon.lyr
Paleozoic_geology	karst_fault arc	karst _fault	FEATURE_CODE	karst _fault arc.lyr
	lakes polygon	lakes	IW	lakes polygon.lyr
	roads arc	roads		roads arc.lyr
	karst _poly arc	karst _poly.aat	FEATURE_CODE	karst _poly arc.lyr
	karst _poly polygon	karst _poly.pat	UNIT_NUMBER	karst_poly_geology polygon.lyr
	rocksurface	rocksurface		

Google Earth

This folder contains a Google™ Earth file for the Karst dataset. Google™ Earth is a free earth visualization tool available at http://earth.google.com/. To use Google™ Earth, at least 128 MB of RAM is required (256 MB or higher recommended). Simply double-click the file doc.kml to view the data in Google™ Earth.