

GIS in the OGS

Enhanced Mapping of Ontario's
Precambrian Geology with an
Integrated Approach to GIS

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Talk Outline

Integrating GIS Throughout the OGS !

- ▶ who is the Ontario Geological Survey (OGS) ?
- ▶ two Approaches to GIS in the Ministry (project and corporate)
- ▶ how has the OGS adopted project-based GIS into mapping projects ?
- ▶ making project GIS data discoverable and deliverable through Corporate GIS systems
- ▶ room to grow, bringing it all together

Who is the OGS?



Ministry of Northern Development and Mines (MNDM)

NORTHERN DEVELOPMENT DIVISION (NDD)

- ▶ economic development in Northern Ontario, investment, marketing

MINES AND MINERALS DIVISION (MMD)

- ▶ providing up to date framework geoscience data for Ontario
- ▶ regulatory function (mining act, claim staking, mine development, rehabilitation)

ONTARIO GEOLOGICAL SURVEY (OGS)

- ▶ Geoscience Program
- ▶ Resident Geologist Program

INFORMATION & MARKETING SECTION (IMS)

- ▶ Publications Services Section
- ▶ Digital Data Distribution
- ▶ Geoscience Library
- ▶ Investment and Marketing

GIS in the Mines and Minerals Division

2 levels of GI Systems work together to provide Ontario with Geoscience Data

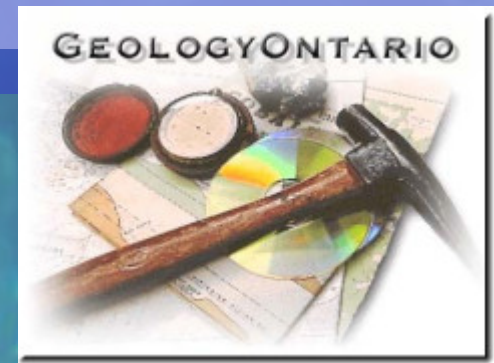
OGS – “PROJECT GIS”

- ▶ accessible by staff
- ▶ individual GIS databases
- ▶ housed on individual computers
- ▶ efforts to implement ‘standards’
- ▶ some customised systems



IMS – “CORPORATE GIS”

- ▶ accessible by public
- ▶ fed by project data
- ▶ web-based server systems
- ▶ ‘out of the box’ technology



Project GIS Within the OGS

- Geoscience Program -



Project GIS Within the OGS



OGS mission

Build, further develop, maintain and communicate geological, geochemical and geophysical information about Ontario to attract and retain investment in the mineral industry

Resident Geologist Program

Resident Geoscience Program (RGP)

- ▶ providing geoscience information & publications
- ▶ library and advisory services to the public
- ▶ network of offices throughout the province.

Geoscience Program

Precambrian Geoscience Section (PGS)

- ▶ improve the understanding of Precambrian geology and mineral deposits of Ontario
- ▶ convey this knowledge to clients
- ▶ multi-disciplinary mapping studies to address geological problems in key areas

Sedimentary Geoscience Section (SGS)

- ▶ provide baseline Sedimentary geology information and develop new methodologies
- ▶ includes quaternary geology, surficial geochemistry, paleozoic geology, aggregate resources and groundwater
- ▶ mapping surficial deposits, sediment sampling, field mapping, inventories, drilling

Evolving Into GIS: Geological Time?

PLANNING

FIELD DATA

DRAFT MAP

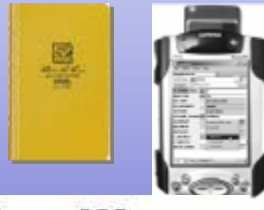
PUBLISH MAP



microstation



ArcView 3.2

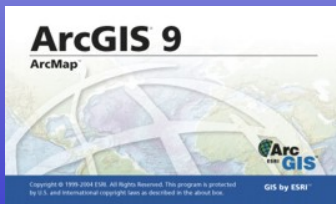


FIELDWORKER

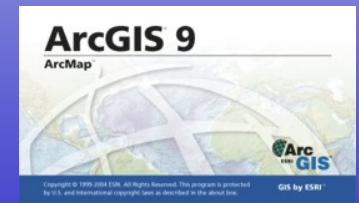
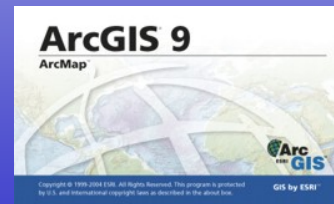
ArcView 3.2



microstation



GanFeld



TODAY 10 YRS AGO 20 YRS AGO

Why Adopt GIS for Geology Mapping?

- ▶ dynamically brings together spatial and attribute data
- ▶ wonderful for managing raster images (overlay, transparencies)
- ▶ can perform spatial analyses and query data
- ▶ objects can be related to one another
- ▶ dynamic mapping, easily change and display a variety of attribute data within a single map
- ▶ able to bring together data from many sources, formats, scales
- ▶ more comprehensive product for clients (more data available)

How Do You Convince Geologists to Adopt GIS?

- ▶ think like a field geologist !
- ▶ geologists must become confident using the system
- ▶ make the system easy to use, easy to learn, intuitive, simple
- ▶ must not take excessive effort or time

I think the iPAQ is helping to shield me from the flies!

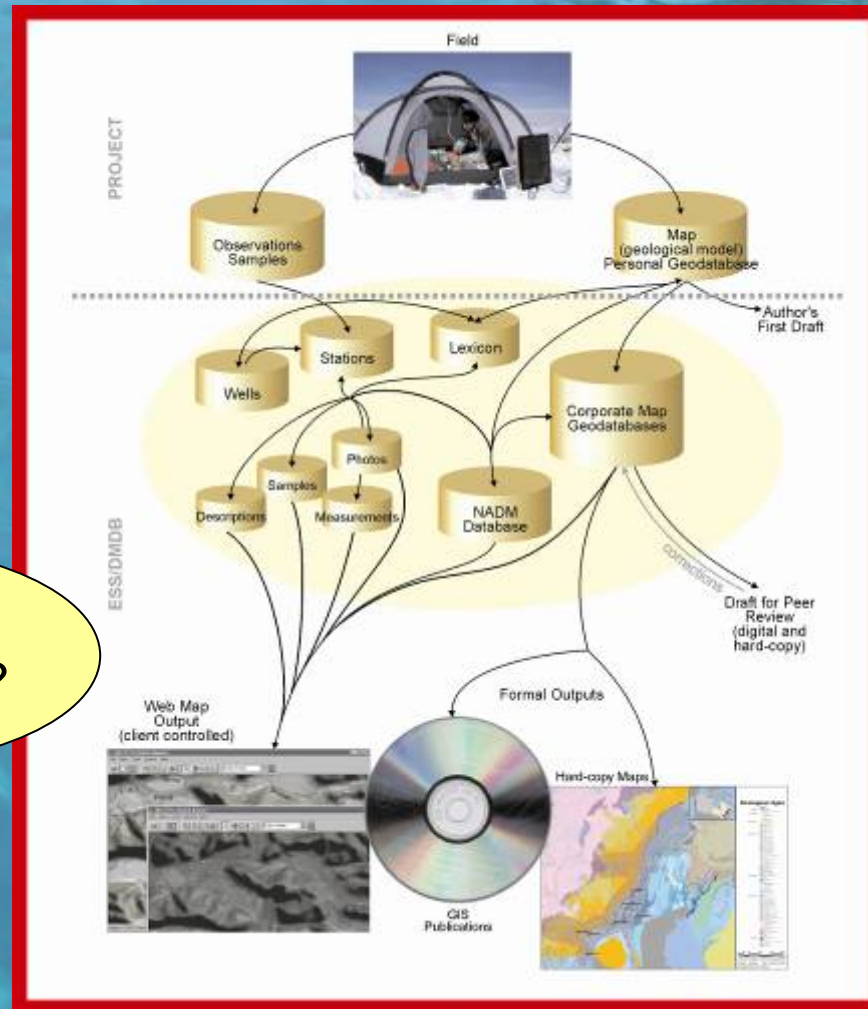


How Do You Convince Geologists to Adopt GIS?

Don't do this

- ▶ too complicated
- ▶ too complex
- ▶ not intuitive
- ▶ not easy to use

Where did my data go?

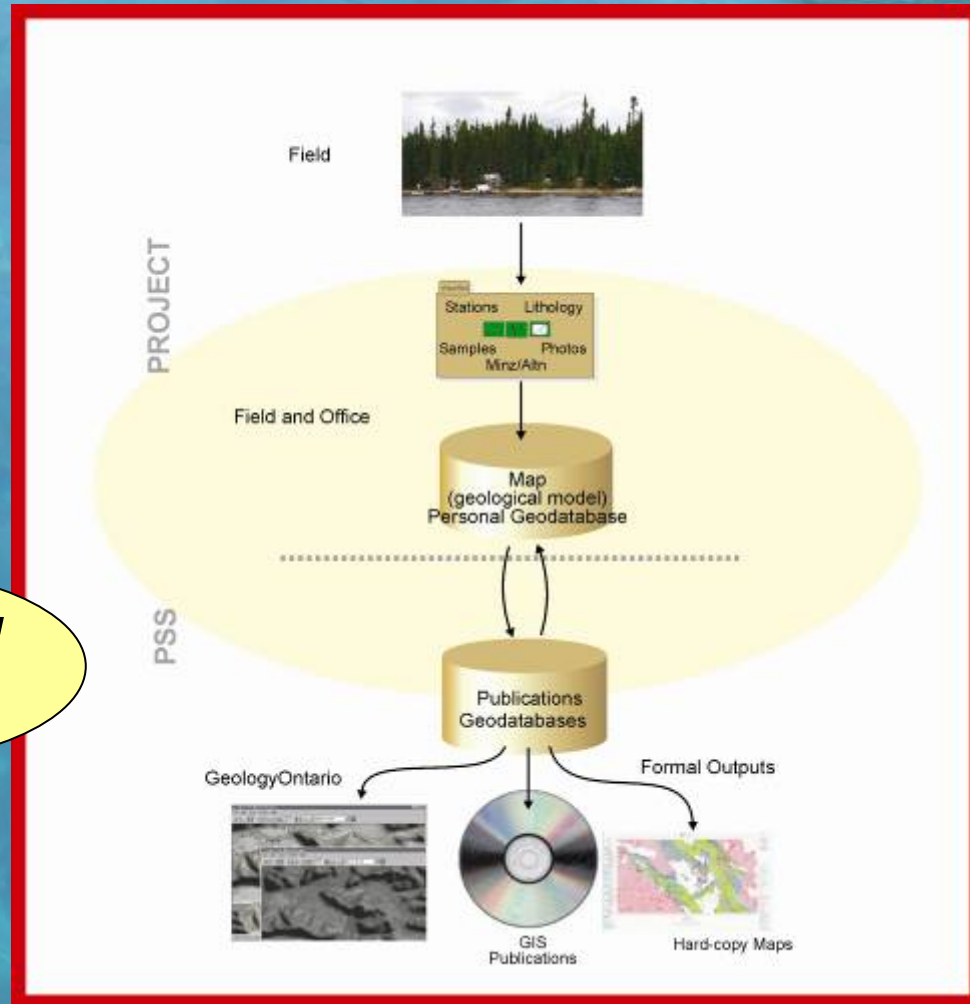


How Do You Convince Geologists to Adopt GIS?

Do this

- ▶ simple
- ▶ straightforward
- ▶ intuitive
- ▶ easy to use

I understand this!



Components of a Typical Mapping Project



- ▶ OGS geology mapping projects are normally 1 to 3 years
- ▶ area covered from 1 township to entire greenstone belts
- ▶ mapping scale from 1:20 000 or 1:50 000
- ▶ maps released every year
- ▶ compilation map and digital GIS product released at end of multi-year project

Integrating GIS into Every Step of a Mapping Project

planning



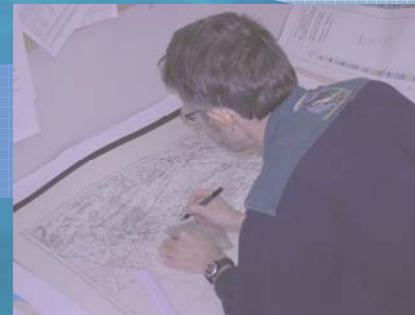
fieldwork



pulling data together



create map



publish map



distribute data



Planning

Planning mapping projects is much easier with GIS

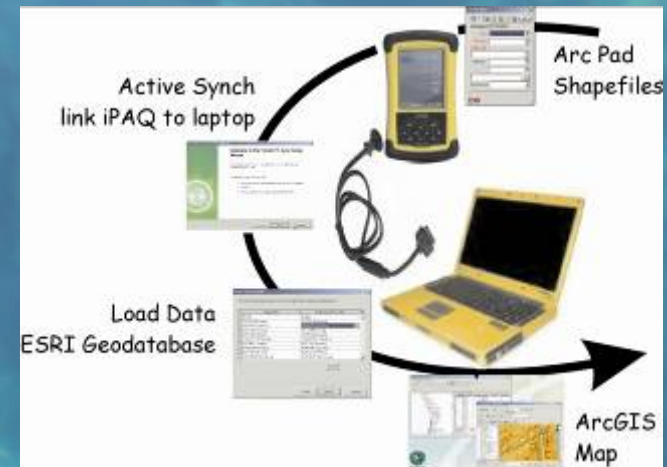
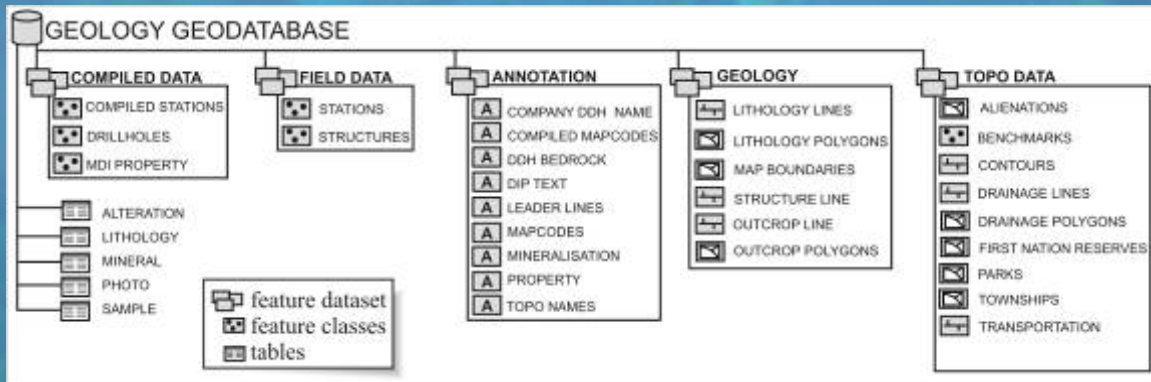


- ▶ managers plan mapping projects by overlaying many data layers (*existing mapping coverage, areas with mineral potential, active mining claims*)
- ▶ geologists rely on a large compilation of data layers for reconnaissance of their mapping area and to plan logistics like camp sites, traverses, transportation (*topography, imagery*)
- ▶ geologists can now leave for the field with incredible insight into the geology of their area having studied existing data within a GIS (*geophysics, historic maps, assessment work maps, geochemistry, deposits*)

Planning

Planning mapping projects involves designing databases and assessing hardware needs

- ▶ GIS databases are designed in the planning stage
- ▶ databases include all compiled data as well as a series of template feature classes for housing field data
- ▶ construct the field data collection system
- ▶ plan out hardware requirements (*laptop, iPAQs, GPS*)



GIS in the Field

What do PGS Geologists Collect in the Field?



- ▶ PGS mappers record observations at areas of exposed Precambrian bedrock, or ‘outcrop’
- ▶ observations about the type of rock they see, and important features related to that rock, as well as samples taken and photos
- ▶ map out the ‘shape’ of the outcrop
- ▶ record the point location of the observation based on a GPS recording

GIS in the Field

Why Collect Field Data Digitally?



- ▶ have data recorded digitally from point of observation
- ▶ reduce time spent at night digitising paper field notes into laptop
- ▶ form-based entry standardises data collection, reducing omissions/errors/ambiguity
- ▶ structure provides a baseline for students to follow
- ▶ picklists provide data standardisation
- ▶ can perform spatial and attribute queries while in the field

GIS in the Field – the last frontier



‘getting geologists to collect data digitally at the outcrop means developing a system that is advantageous for them to use’

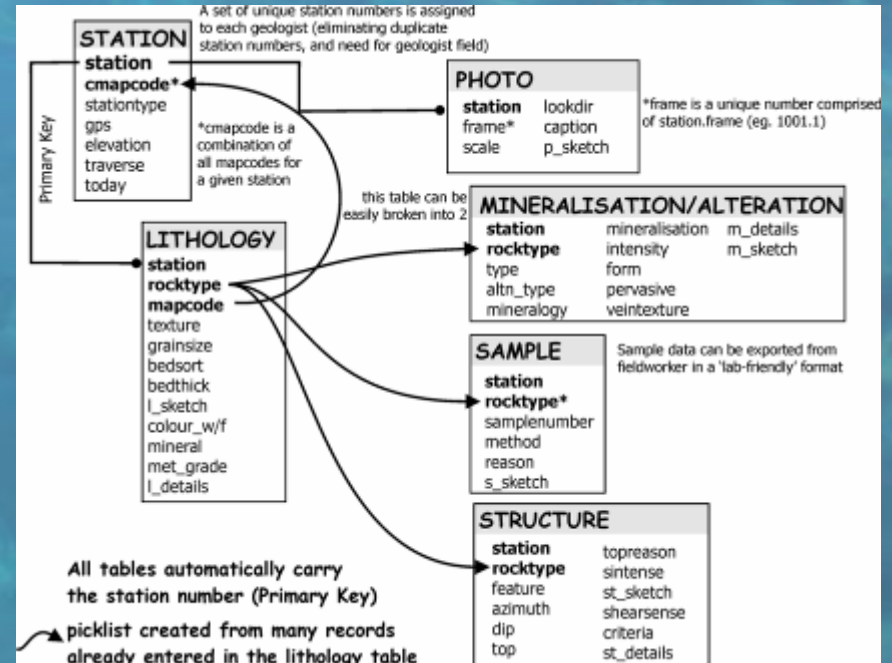
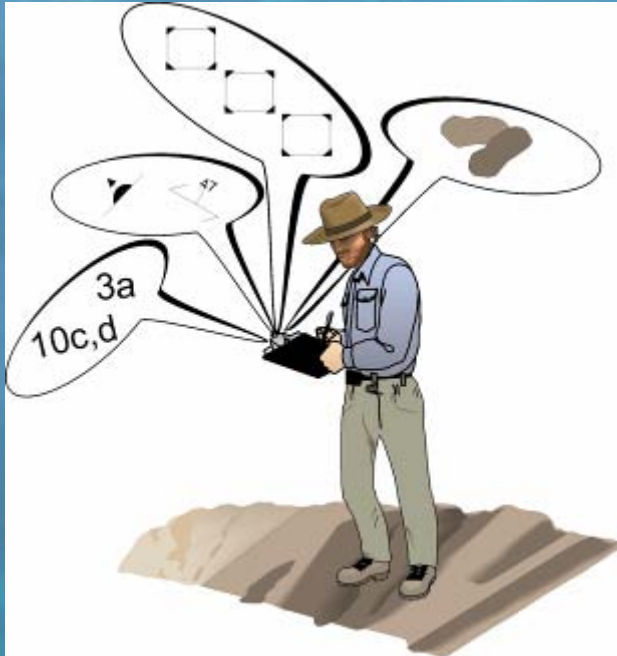
How did we develop our successful system? By balancing flexibility with standards

- ▶ compile set of important user needs
- ▶ scope out and test major data collection software
- ▶ field testing various systems
- ▶ design database and forms that geologists will use while also meeting the requirements of an OGS standard data model
- ▶ develop a method to integrate field data into the GIS database
- ▶ try out new hardware (iPAQs, GPS units)

What do Geologists Need?

Fundamentals

- collect spatial data (points, lines, polygons)
- collect attribute data tied to spatial objects
- relational database structure (many attributes per 1 station)



What do Geologists Need?

Design

- form-based data entry provides a mechanism for organising data collection
- user-friendly and intuitive software design/structure
- incorporates sketches and photos

Automatic Incrementing

Pull values from another form page

Sketch

Calculated Field

Nested Picklist

RX_TYPE	New	wackesiltstone
FEATURE	+	BEDGF
AZIMUTH		20
DIP		10
TOP	+	W
TOPREASON	+	Pillows
LSINTENSE	+	lin strong
ST_DETAILS		
ST_SKETCH		Enter
SHEARSENSE	+	N-up
CRITERIA	+	Steps
EASTING	=	672921.0
NORTHING	=	5217135.0

breccia

- +colour index
- +intrusive
- +Metamorphic
- +minerals
- +sedimentary

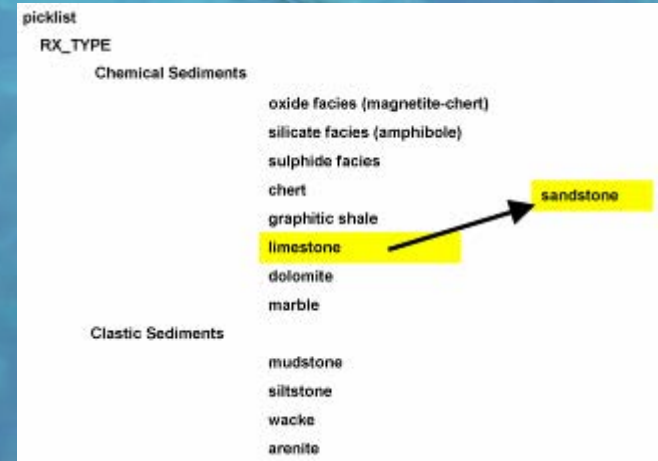
breccia

- auto
- hyaloclastite
- pillow fragment
- pyroclastic
- tuff

What do Geologists Need?

Use-ability

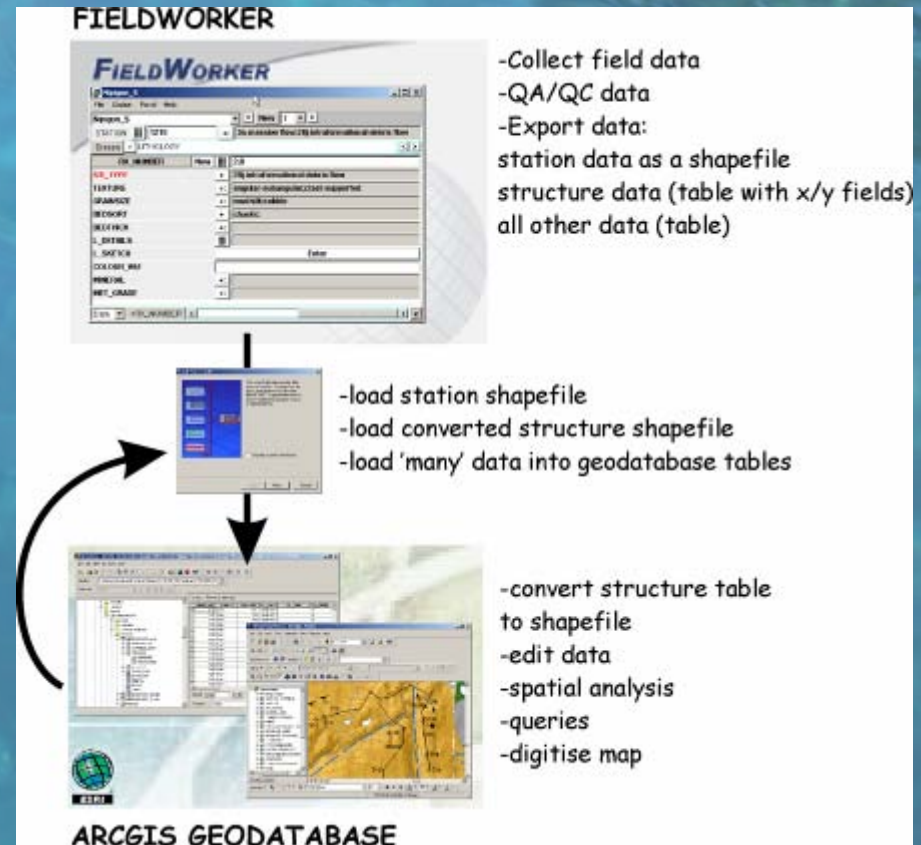
- must be user friendly and straight forward
- functionality built in for users to easily make small changes to form design elements (ie. picklists)
- system has to keep up with the geologist (speed)
- system is stable
- system is manageable within a remote field camp environment (*doesn't rely on internet*)



What do Geologists Need?

Integration

- must be easy to bring field data into central GIS database
- database/form design must fit with standardized data model requirements



Cool Tools for Digital Field Mapping

Hardware

- fast processing speed
- economically feasible
- support for GPS data
- screens visible in direct sunlight
- long battery life
- rugged



Software

- software specifically designed for field data on a PDA
- GIS software for PDAs

PDA Data Collection Software Options

2 MAIN TYPES OF SOFTWARE:

Data collection and Map Viewing (GIS)

- ▶ form based collection of data
- ▶ data can be viewed spatially with a backdrop of a geology map, topographic data, landsat image, geophysical image
- ▶ point data shown as a symbol and can have related attributes shown as labels

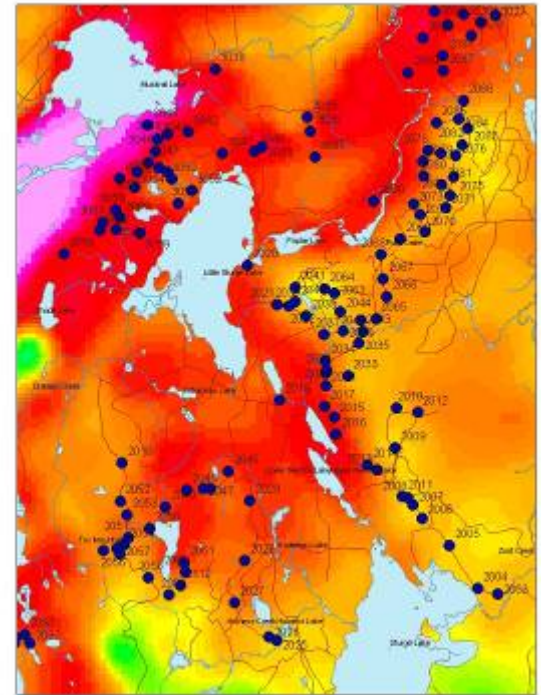
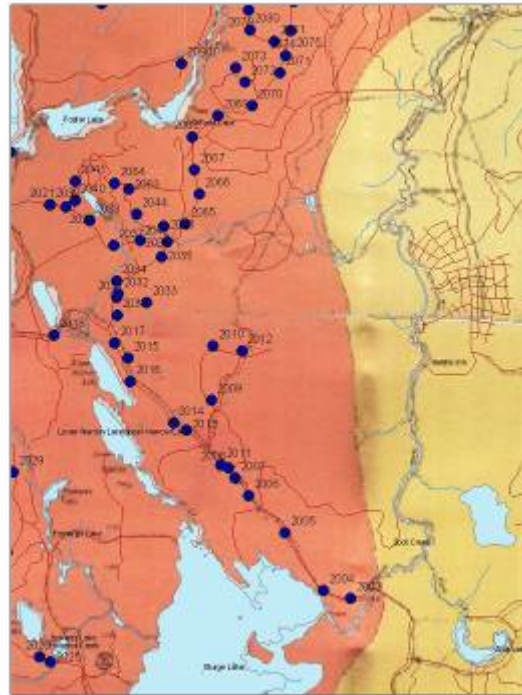
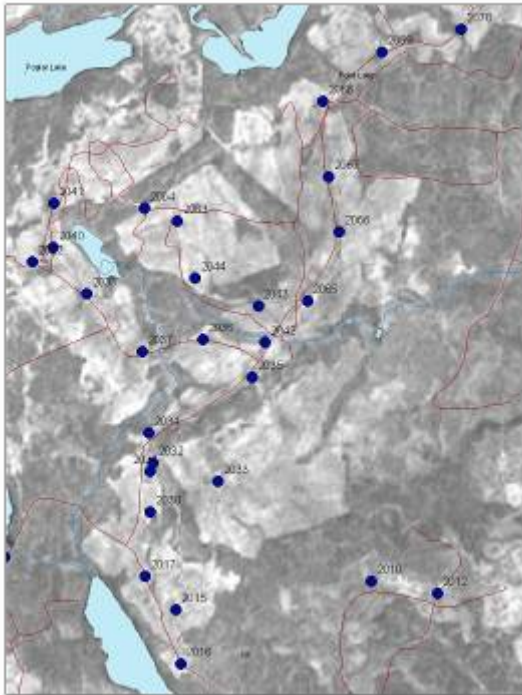
Data collection only

- ▶ no map viewing capability
- ▶ strictly data entry tool



We Want to See Our Data in the Field!

The ability to 'see' stations on a variety of map images while on a traverse is proving very useful for making decisions.



So, What Software Do We Use?



We Use ArcPad

BENEFITS

- ▶ ArcPad is a natural extension of ArcGIS
- ▶ easy for geologists to 'learn' software
- ▶ for use on a hand-held computer or laptop
- ▶ data stored in shapefile format
- ▶ form based data collection
- ▶ full mapping capabilities
- ▶ very easy data migration between field and mapping software



<http://www.esri.com/software/arcpad/index.html>

But What About My Special Needs?

ArcPad Limitations

ArcPad “out of the box”:

- ▶ did not meet our exceptional form design needs
- ▶ did not support relational linking of collected data (1:many)
- ▶ the functionality we need could be added to ArcPad via programming



GanFeld - Arc Pad designed specifically for Geological Mapping !



- ▶ Geological Survey of Canada (GSC)
- ▶ customised Arc Pad application
- ▶ support for 'relational' data entry (via linked .dbf tables)
- ▶ specially designed data entry forms for geological mapping
- ▶ freely available to anyone

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<http://dev.geosemantica.net>



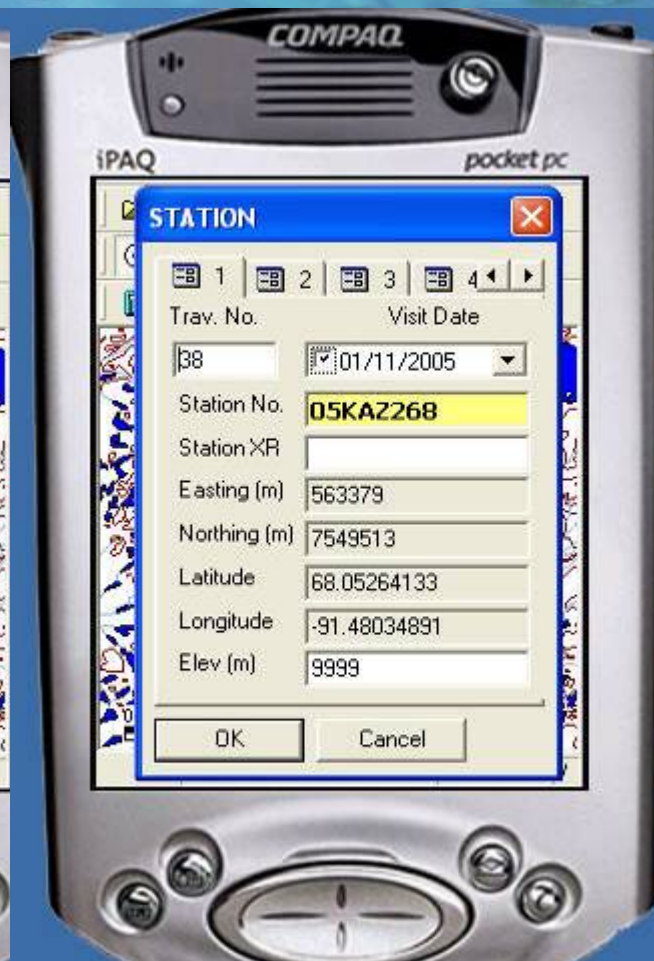
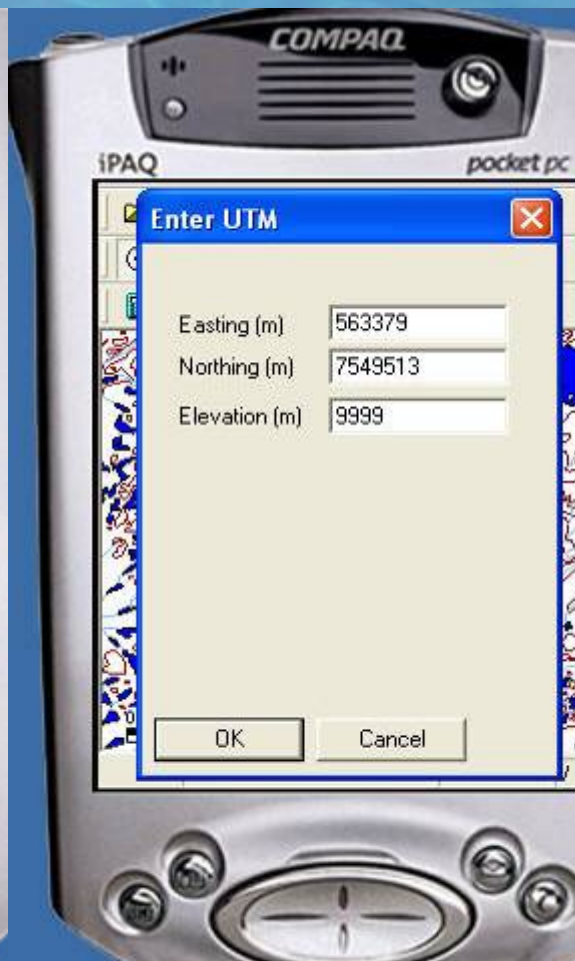
Natural Resources
Canada

Ressources naturelles
Canada

Canada



GanFeld - Flexible Location Entry



Natural Resources
Canada

Ressources naturelles
Canada

Canada

GanFeld - Robust Forms



Natural Resources Canada
Ressources naturelles Canada

Canada

GanFeld and the PGS



Success in 2007!

- ▶ field tested GanFeld this summer by 6 field crews
- ▶ partnered with the GSC to customise GanFeld to meet the OGS data model requirements
- ▶ made additional functionality to GanFeld (ie. collecting polygons)



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Pulling data together



Making the Most of Field Time

- ▶ the GIS database is now the central repository for all data tied to a mapping project
- ▶ a key component of this database is field data
- ▶ collected digital field data is loaded into the database every day
- ▶ having field data in a GIS database has given geologists the ability to make interpretations while in the field
- ▶ seeing data in a GIS helps adds significant value
- ▶ geologists now finish a field season with a basic geology map in hand

Creating a geology map

We have all our data in one place and it's both spatial and attributed!



*I've had it
with all this
paper!*

- ▶ “I don’t know how I made maps before GIS”
- ▶ geologists use an incredibly diverse amount of data to construct interpreted maps
- ▶ interpretations are based on spatial relationships between attributed data (*structures, lithologies, minerals, geochemistry*)
- ▶ GIS is powerful tool which enables the geologist to dynamically view data and see key relationships

Publishing maps

It's all about cartography !



- ▶ the most popular venue for disseminating OGS project data remains the paper map
- ▶ building a successful paper geology map is easy with robust GIS cartographic tools
- ▶ GIS cartographic tools allow us to pull out key attributes and effectively display them on a map face
- ▶ ‘replication’ functionalities allow for a ‘paper’ version of the map be produced without affecting the original data (*can simplify data for paper*)
- ▶ GIS databases can be ‘versioned’ so that various staff can make edits throughout the publishing process

Distributing data

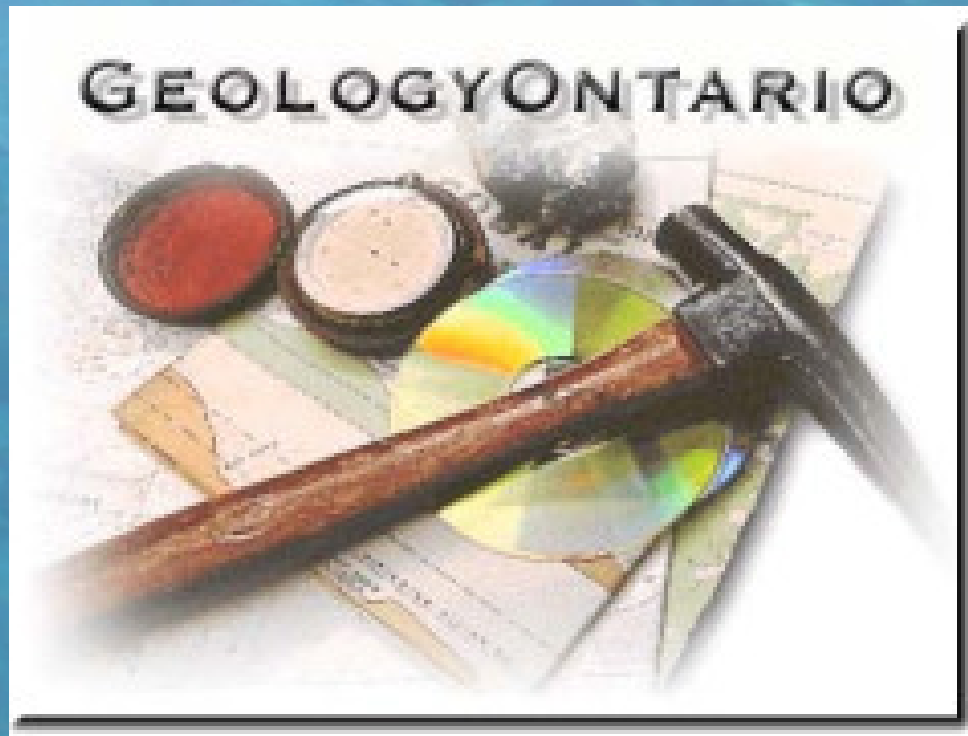
Tying in With Corporate GIS !



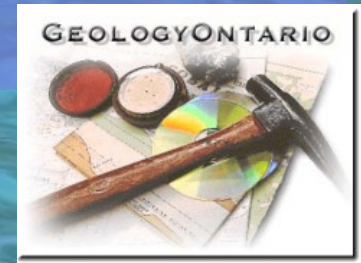
- ▶ clients are demanding that OGS data be both discoverable and deliverable
- ▶ many clients are now GIS-enabled
- ▶ we want to provide clients with our project-based GIS data
- ▶ working together with our corporate GIS systems to make our GIS project data available
- ▶ internally, geologists see great benefit in building a central corporate style GIS ‘repository’ for project-based data

Corporate GIS for the OGS

- Information and Marketing Section -



IM Section Manages Corporate GIS for the OGS



IMS mission

The heart of information delivery for the division and promoter of Ontario's geoscience opportunities, IMS strives to deliver high-quality products, information and services to many clients throughout the world.

Information Services

- ▶ publications services section, digital data distribution, geoscience library
- ▶ heart of information delivery
- ▶ produce all OGS data products
- ▶ disseminate data to clients

Marketing Services

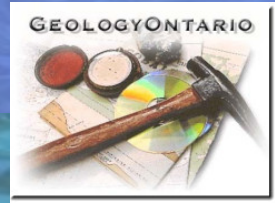
- ▶ administer trade and investment activities
- ▶ promote mineral development opportunities

Corporate GIS Data Is On The Web



Helping our clients access
OGS data through web
discovery and delivery

- ▶ the OGS strives to help our clients by improving access to our services and information
- ▶ traditionally, services were only available in person, and information was only available for purchase as hard copy reports and maps
- ▶ IMS is making access to OGS data available anywhere by anyone via corporate GIS systems



A powerful web portal for accessing Ontario's Geoscience Data

- ▶ Ontario's on-line Geology Super Store!
- ▶ launched March 2007
- ▶ over 1 terrabyte of data, maps and reports have been downloaded since its inception
- ▶ focus on making our data discoverable and downloadable
- ▶ developed with 'out of the box' technology (ESRI ArcSDE, ArcIMS, Oracle)
- ▶ geoscience publications, exploration assessment files, abandoned mines and geoscience databases now accessible via the internet

<http://www.ontario.ca/geology>

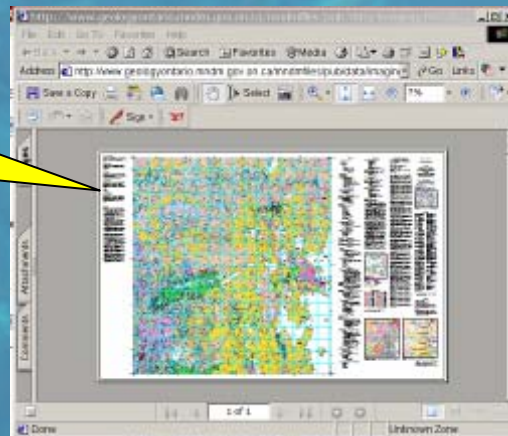
lots of ways to search our data !

Search Databases	<ul style="list-style-type: none">* Search Assessment File Research Imaging (AFRI)* Search OGS Publications (OGS PUB)* Search Mineral Deposits Inventory (MDI)* Search Litho geochemistry (LGC)* Search Drill Hole Database (DDH)* Abandoned Mines information System (AMIS)
Search text content of Publication Files	This search interface provides the ability to search for text within a Mining Publication PDF document. This "free-text" searching can be combined with searches against data associated to the Publication file. For example, you can use "Diamond" as a search term while entering "1974" as the Year and "Moore" as the Author.
Search text content of Assessment (AFRI) Files	This search interface provides the ability to search for text within an AFRI file PDF document. This "free-text" searching can be combined with searches against data associated to the AFRI file. For example, you can use "Diamond" as a search term while entering "Southeastern Ontario" as the Resident Geologist District and "Moore" as the Author. That particular search would return all documents that contain the text "Diamond" where the Resident Geologist District is Southern Ontario and the Author of the AFRI file has the last name Moore

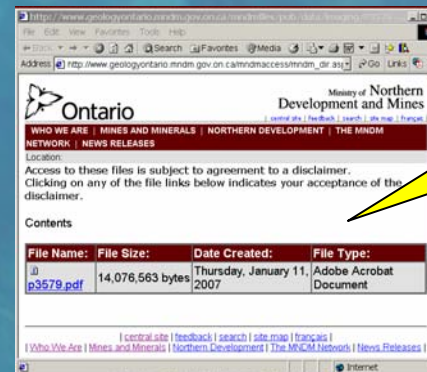
I can add data via map services!



I can see OGS maps !



I can download reports, maps and digital data!



GIS is Integrating the OGS!



- ▶ project GIS systems are helping geologists to better map Ontario's geology
- ▶ corporate GIS has revolutionised public access to OGS data
- ▶ continuing to further integrate project GIS data with corporate GIS systems will benefit our clients, ourselves and the geological knowledge base of Ontario



Phew, it works!

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