Idaho Geologic Map Data in a Statewide Geodatabase

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INTRODUCTION

The Idaho Geological Survey has created a statewide ESRI Geodatabase for storing, managing, and distributing Idaho geologic map data. The model for this design resulted from work done by the Idaho Survey over the past 8 years. The work flow strategy around the implementation of the geodatabase improves the productivity of the survey by capturing map data using existing procedures and automating the migration processing of data tiles into feature classes in the statewide geodatabase.

HISTORY

Idaho has been collecting geologic map data in GIS format for 15 years. In 2003, six data sets were released in ArcInfo coverage and ArcView formats using Idaho's data model v2.1 (Stanford and MacKubbin, 2000). The methods currently used for geologic map data capture have been in place for more than 10 years (Freed and Stanford, 2005).

GEODATABASE DESIGN HIGHLIGHTS

The Idaho Statewide Geologic Map Geodatabase (ISGMG) follows the physical design of the Idaho Geologic Map Data Model v3.1, which evolved from the earlier Idaho model v2.1 (*http://www.idahogeology.org/Lab/datamodel.htm*). Key changes made to 2.1 allow data to be stored in one statewide database. The following are some of the highlight features of the ISGMG:

- The design is composed of four data groupings: Spatial, map unit, earth materials, and metadata.
- The design of the database allows for two levels of map object tracking or coding, by 30' x 60' tile or statewide.
- All contacts (poly boundaries) of a particular polygon are linked to the polygon.
- Additions and changes to earth materials section based on work done by the North American Data Model's Science Language Technical Team (SLTT) have been incorporated into the design (NADM-SLTT, 2004a, b).
- Descriptions from referenced geologic sources can be stored as well as URL links to IGS online PDF maps.
- Map unit history and changes are tracked.
- Object-level attribution including geologic source reference, line type, and feature name.

WORK FLOW AND THE GEODATABASE

Data Capture

The methods that the Idaho Geological Survey uses to capture geologic map data have been previously described (Freed and Stanford, 2005). One of the salient features of this data capture is the object-level (feature) attributing. This attributing is designed to facilitate the eventual compilation of 1:24,000-scale geologic map data (from 7.5-minute quadrangles) into 30 x 60 minute tiles of map data at 1:100,000 scale. These tiles then become the basic spatial-data building blocks for the Survey's mapping program and the statewide database. Publication as a traditional geologic map occurs for many of the 1:24,000 maps and for all of the 1:100,000-scale maps. However, the database behind these publications is considered of primary importance. Simplification of map data may be done for map publication, but all original spatial data are maintained in the database for each tile.

GIS Processing, Quality Control, and Data Migrations

Map data are migrated to the statewide geodatabase via software tools where data processing, quality-control, and finally, migration of the 30 x 60 minute tiles into the statewide database occurs. There are tools for each geologic layer in the geodatabase. Currently, layers include the following:

- Map units (contacts and polygons)
- Faults
- Folds
- Measurements (e.g., strike and dip)
- Miscellaneous line symbols
- Miscellaneous point symbols
- Miscellaneous polygon overlays (for example, loess).

New layer types can be added and do not necessarily need to cover the entire state.

During the migration process, the software tool creates fields as needed to conform and merge the tile data to the ISGMG. Part of the quality control processing includes checking the attributes on new data against existing controlled vocabularies in the geodatabase. If attributes are missing in the geodatabase, either the new data must be changed or the necessary attributes must be added to the correct ISGMG pick lists.

During the migration, each tool checks to see if the tile layer being migrated already exists in the database. If a tile layer is present it is deleted before the new data are migrated.

Descriptive Data Capture

The descriptive information about geologic map data are captured using MS Access forms created for this purpose. Currently there are two major categories for descriptive data capture: map unit description and earth material description.

Map unit descriptions are provided by the geologist who compiled the map tile. Descriptions are parsed into the appropriate data fields, where possible. Entire text versions of map unit descriptions are also captured. Entire descriptions from geologic sources used in the compilation can also be entered.

Each map unit can have many earth materials associated with it, and each earth material can have many attributes. Where possible, controlled vocabularies are being compiled or exist for various attributes stored.

Geologic Reference Attributes and Other Pick Lists

The reference for the geologic source of every map object is stored in the database. The reference listing is updated as map capture proceeds. These bibliographic sources can be used both for query and metadata purposes by the user. Other pick lists include geologic structures, line types, symbols, and special feature names.

FGDC Metadata

The Idaho Survey collects FGDC-compliant metadata for these data. A combination of ESRI built-in tools and 3rd -party plug-in tools are used (*http://www.insideidaho.org/whatsnew/whatsnew.htm#News*).

SOFTWARE TOOLS FOR MIGRATING DATA INTO THE STATEWIDE GEODATABASE

The IGS software tool set is a series of ETL scripts (Extract Transfer and Load). These scripts are used to manipulate and load 1:24,000-scale geological data into the Idaho state wide geological database. The tools were built using ArcGIS 9.2 SP1 model builder inside ArcCatalog. ModelBuilder provides a graphical modeling framework for designing and implementing geoprocessing models that can include system tools, scripts, models, and data. ModelBuilder helps make geoprocessing tasks more streamlined and efficient. In the example shown in Figures 1-3, the IMP_FC object holds the logic for processing the information. This logic is VB Script produced by ModelBuilder. The model accepts inputs from the user and executes the code. Tools are grouped together for logical execution.

SUMMARY

The Idaho Geological Survey captures geologic mapping data in a standardized format. Tiles of map data are migrated to a statewide geodatabase using tools developed in ModelBuilder. Centralizing data from separate tile or data sets allows the Idaho Survey to efficiently manage, update, and distribute one uniform set of data. The geodatabase can easily be used for online map data delivery services.

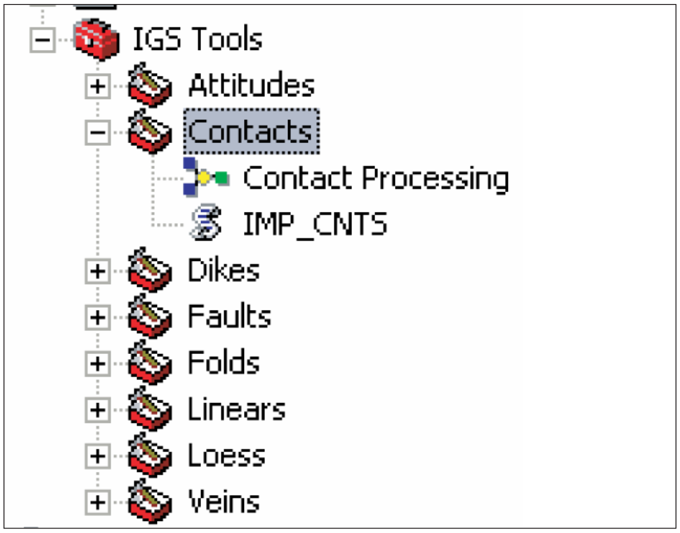

Figure 1. The IGS Tool Set as represented in ArcCatalog. Each model is associated with a VB Script which holds the logic. In this figure, the model "Contact Processing" uses the script "IMP_CNTS" to process the geologic contacts. Each model is responsible for extracting 24K geological data stored in ArcInfo coverage format, performing several data transformations, loading the information into a statewide geodatabase.

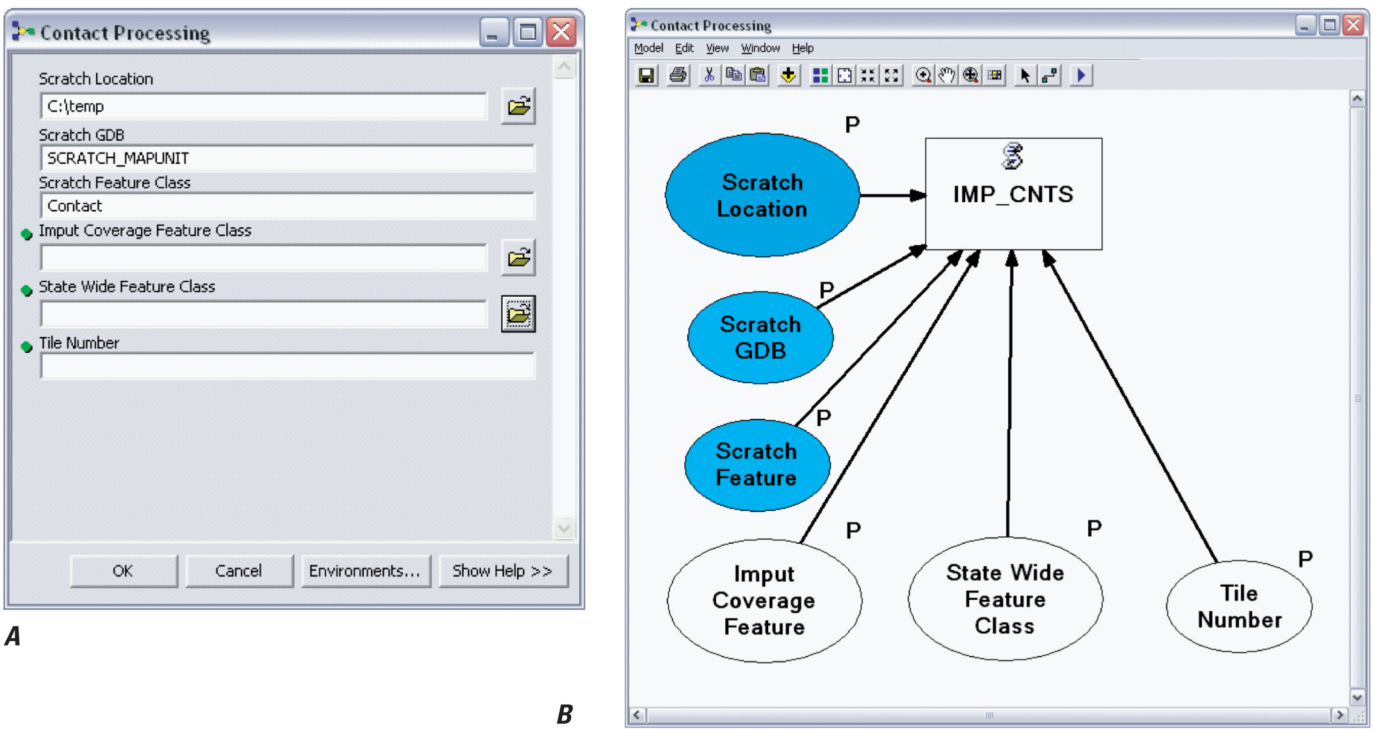

Figure 2. *A*. Input form for the Contact Processing model. The model expects user input for: the input coverage name, output location in the State Wide Geodatabase, and the tile number associated with the coverage area. The model creates a scratch workspace while performing the transformation, and loads the geologic contacts into the statewide Geodatabase. *B*. Diagram of the Contact Processing model.

```
' ---------------------------------------------------------------------------
' ImportContacts.vbs
' Created on: Thu Dec 28 2006 12:56:37 PM
'   (generated by ArcGIS/ModelBuilder)
' Usage: ImportContacts <Scratch_Location> <Scratch_GeoDatabase> <Scratch_Feature_Class> <Imput_Coverage_Feature_Class> <
' ---------------------------------------------------------------------------

' Create the Geoprocessor object
set gp = WScript.CreateObject("esriGeoprocessing.GPDispatch.1")

' Load required toolboxes...
gp.AddToolbox "C:/ArcGIS/ArcToolbox/Toolboxes/Conversion Tools.tbx"
gp.AddToolbox "C:/ArcGIS/ArcToolbox/Toolboxes/Data Management Tools.tbx"

' Script arguments...
Scratch_Location = wscript.arguments.item(0)
if Scratch_Location = "#" then
 Scratch_Location = "C:\temp"
end if

Scratch_GeoDatabase = wscript.arguments.item(1)
if Scratch_GeoDatabase = "#" then
 Scratch_GeoDatabase = "SCRATCH_CONTACTS"
end if

Scratch_Feature_Class = wscript.arguments.item(2)
if Scratch_Feature_Class = "#" then
 Scratch_Feature_Class = "Contact"
end if

Imput_Coverage_Feature_Class = wscript.arguments.item(3)
if Imput_Coverage_Feature_Class = "#" then
 Imput_Coverage_Feature_Class = ""
end if

State_Wide_Feature_Class = wscript.arguments.item(4)
if State_Wide_Feature_Class = "#" then
 State_Wide_Feature_Class = ""
end if

Tile_Number = wscript.arguments.item(5)
if Tile_Number = "#" then
 Tile_Number = ""
end if

Tile_Number = "IGS-" & Tile_Number
Expression = "[MAP_ID] = '" & Tile_Number & "'"

' Local variables...
Row_Count = ""
ScratchGDB = Scratch_Location & "\" & Scratch_GeoDatabase & ".mdb"
sFC = Scratch_Location & "\" & Scratch_GeoDatabase & ".mdb" & "\" & Scratch_Feature_Class
pFC = Scratch_Location & "\" & Scratch_GeoDatabase & ".mdb" & "\" & "Rock"
ScratchTMP = Scratch_Location & "\" & Scratch_GeoDatabase & ".mdb"

State_Wide_GDB = Left(State_Wide_Feature_Class,Len(State_Wide_Feature_Class)-16)
Imput_POLY_Coverage_Feature_Class = Left(Imput_Coverage_Feature_Class,Len(Imput_Coverage_Feature_Class)-3) & "polygon"
State_Wide_POLY_Feature_Class = Left(State_Wide_Feature_Class,Len(State_Wide_Feature_Class)-7) & "Rock"
```

Figure 3. A sample of code within the VB Script object IMP_CNTS.

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