

Integrating Style Files and Carto Representation into the Geological Map Flow Process

(The GSC's implementation of the FGDC geologic symbology)

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Abstract

This poster presents the process of creating Federal Geographic Data Committee (FGDC) and Geological Survey of Canada (GSC) symbols for an ESRI style file and Cartographic (carto) Representation. Additionally, a master Excel spreadsheet is used to generate domains for feature coding and symbolizing geologic features and to maintain harmony between the FGDC style item codes and carto representation rule IDs. The procedures below are in sequence and show as an example how fold feature symbols are managed. These procedures are integrated in the GSC's Geological Map Flow project to assist cartographers in map production.

symbol is based on an existing one, a description for its use in the legend, notes on the symbol's usage, and a detailed drawing of the symbol (giving as many dimensions as possible). This form is then passed on to a Legend Review Committee. This committee reviews the request and decides if an existing standard symbol should be used instead or if the new symbol should be created. This committee also fills out the second page of the form, which provides the database designers with the information needed to incorporate the new symbol into the bedrock or surficial data models. These data models store and manage geologic features from which the maps are derived. Once approval is given, the form is passed to the Symbol Steward, who then creates the symbol in the standard style file and as a carto representation.

Symbol Reference and Requisition

The FGDC Digital Cartographic Standard for Geologic Map Symbolization is used as the base point for the standard style file and carto representations that will be used in the Geological Map Flow process. The entire library of symbology has been created except for those that limitations in the ArcGIS software would not allow. Some of the map elements, such as state location maps, bar scales, and declination arrows, were not created. The Geological Map Flow project has other means to create these map surround elements.

If the author cannot find a suitable symbol in the FGDC standard (either because it does not exist in the standard or the author strongly feels that a second option is needed), the author fills out a Symbol Creation Form (fig. 1). On this form one states the type of symbol needed, colour, whether the

Font Creation

Each point symbol or line decoration is drawn to scale in CorelDraw (fig. 2). A template has been set up with a 420-millimeter (mm) by 420-mm bounding box which has been determined to be the optimal dimension, comparable to specifying the size of the symbol in an ArcGIS style file. After the symbol is drawn to scale, it must be determined to be a single object, and all lines must be converted to outlines. Once this is achieved, the symbol is centered on the template and scaled to 420 mm in its largest dimension with "keep aspect ratio" turned on. It is then exported to a TrueType font under the next available character number (available numbers are 33 to 126 and 161 to 255; others are system reserved).

5—FOLDS

REF NO	DESCRIPTION	SYMBOL	CARTOGRAPHIC SPECIFICATIONS*	NOTES ON USAGE*
5.1—Anticlines				
5.1.1	Anticline (1st option) Identity and existence certain, location accurate		arrow linewidth .2 mm color 100% magenta HB-8 5.5 mm line weight .25 mm 12.0 mm 1.475 mm	Place fold trace where axial surface of anticline intersects the ground surface.
5.1.2	Anticline (1st option) Identity or existence questionable, location accurate			Place arrows at places along fold trace to indicate overall fold type (anticline); do not place at specific locality where observation was made.
5.1.3	Anticline (1st option) Identity and existence certain, location approximate		3.5 mm 12.0 mm .75 mm .75 mm	Arrowheads may be added to show direction of plunge (see Section 5.10).
5.1.4	Anticline (1st option) Identity or existence questionable, location approximate			Open-arrowed ("2nd option") symbols may be used to show a second generation or another instance of a particular fold type.
5.1.5	Anticline (1st option) Identity and existence certain, location inferred		1.5 mm 12.0 mm .75 mm .75 mm	
5.1.6	Anticline (1st option) Identity or existence questionable, location inferred			
5.1.7	Anticline (1st option) Identity and existence certain, location inferred			

TO BE COMPLETED BY REQUESTER

SYMBOL CREATION FORM

Requested by: _____ Date submitted: mm/dd/yyyy

Type: Line Marker (point) Fill (area) Colour: Black CMYK: ____% ____% ____% ____%

Reference to existing symbol: Document: _____ Symbol: _____

Associated Text Position: _____ FGDC Category: _____
 Suggest New Category: _____

FGDC Description: _____

Notes on Usage: _____

Detailed Drawing: _____

Instructions and Samples on page 3

TO BE COMPLETED BY LEGEND REVIEW COMMITTEE

FEATURE ATTRIBUTES

Requested by: _____ Date submitted: mm/dd/yyyy

Approved: Declined: By: _____ Date: mm/dd/yyyy

Reason: _____

Use FGDC Description as written on page 1
 Modified FGDC Description: _____

Use Notes on Usage as written on page 1
 Modified Notes on Usage: _____

Bedrock Feature Class: _____ Surficial Feature Class: _____

Lines
 Feature: _____
 Subfeature: _____
 Confidence: _____
 Attitude: _____
 Generation: _____

Points
 Feature: _____
 Subfeature: _____
 Generation: _____
 Method: _____
 Status: _____

Areas
 Feature: _____
 Subfeature: _____
 Status: _____

Symbol Created by: _____ Date created: mm/dd/yyyy Assigned FGDC#: _____

Figure 1. Symbol reference and requisition. The top portion of the figure depicts a piece of the FGDC standard from which authors can choose symbology (FGDC, 2006). If a symbol does not exist, the forms depicted on the bottom are used to draw and describe the new symbol for a Legend Committee to approve. The second page of the form is used to fill out information needed about the new symbol so the database designers can add it to the standard geodatabase.

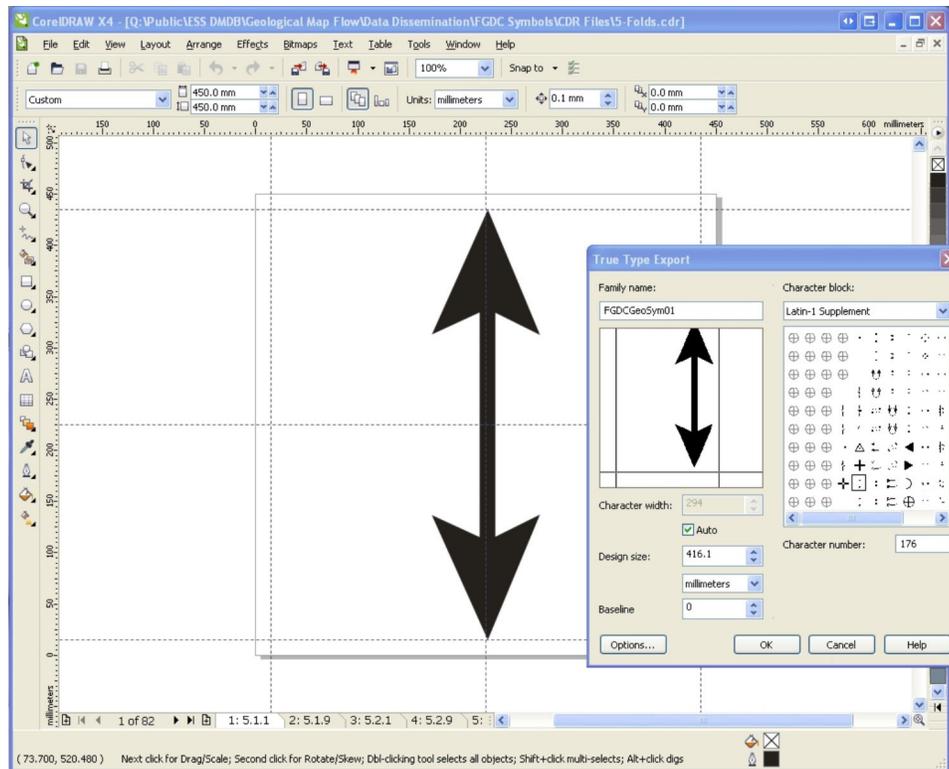


Figure 2. Font creation in Corel Draw.

Create Style Item and Check Symbol

Once the TrueType font has been updated, the complete symbol is created using the ArcGIS Style Manager (fig. 3). Each layer of the symbol is built to specifications provided on the Symbol Creation Form (for example, mark/gap line pattern, size of marker, colour). The new symbol is categorized according to which FGDC category it best fits and given a style item number that matches the FGDC standard. The newly created symbol is then brought into an ArcGIS .mxd and checked for sizing, orientation, and point of origin. Sizes may have to be adjusted to achieve specified dimensions, and offset values may have to be applied to point symbols so the point of origin occurs in the correct location.

Generate Carto Representation

All symbols in the style file are imported/converted into carto representation rules and stored in a master geodatabase template under the appropriate representation that corresponds to a feature class in the geodatabase (fig. 4). Each representation rule is checked to ensure that sizing and spacing accuracy was maintained after the conversion. A master Excel spreadsheet exists to aid in maintaining the sequence

of carto representation RuleIDs. It contains a worksheet for each feature class that has the FGDC reference number and description, the style file number for “match to style,” and the assigned RuleID. These fields are critical in the following steps, where domains are created and a consistent relationship exists between style number and the RuleID.

Convert Table to Domain

The fields STYLE_NO and STYLE_DESC_EN in each Excel worksheet are used to create a coded value domain for each feature class in the project geodatabase (fig. 5). This procedure is required to be applied to each feature class in the geodatabase. In the future, a geoprocessing tool could be created to automate this process.

Assign Domain

In ArcCatalog, each of the domains is then assigned to the SYMBOL field in each of the corresponding feature classes (fig. 6). The SYMBOL field is then used in ArcMap, to render the feature on the map using “Match to Symbols in a Style.”

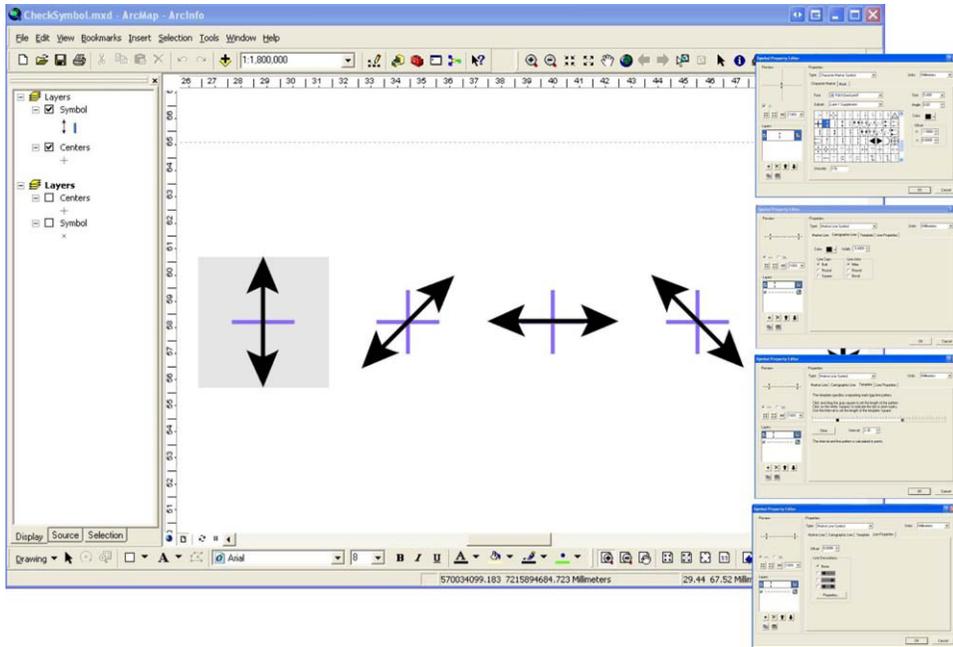


Figure 3. Creating the style item and checking the symbol in ArcGIS.



Master Geodatabase Template

1	REF_NO	DESCRIPTION_EN	STYLE_NO	STYLE_DESC_EN	RULE_ID	VERSION	FGDC_REF
222	5.9.29	Monocline, anticlinal bend (2nd option) - Identify and existence certain, location	05.09.29	5.9.29) Monocline, anticlinal bend (2nd option) - Identify and existence certain, location inferred	221	1	FGDC-STD-013-2006
223	5.9.30	Monocline, anticlinal bend (2nd option) - Identify or existence questionable, location	05.09.30	5.9.30) Monocline, anticlinal bend (2nd option) - Identify or existence questionable, location inferred	222	1	FGDC-STD-013-2006
224	5.9.31	Monocline, anticlinal bend (2nd option) - Identify and existence certain, location	05.09.31	5.9.31) Monocline, anticlinal bend (2nd option) - Identify and existence certain, location concealed	223	1	FGDC-STD-013-2006
225	5.9.32	Monocline, anticlinal bend (2nd option) - Identify or existence questionable, location	05.09.32	5.9.32) Monocline, anticlinal bend (2nd option) - Identify or existence questionable, location concealed	224	1	FGDC-STD-013-2006
226	5.9.33	Monocline, synclinal bend (1st option) - Identify and existence certain, location	05.09.33	5.9.33) Monocline, synclinal bend (1st option) - Identify and existence certain, location accurate	225	1	FGDC-STD-013-2006
227	5.9.34	Monocline, synclinal bend (1st option) - Identify or existence questionable, location	05.09.34	5.9.34) Monocline, synclinal bend (1st option) - Identify or existence questionable, location accurate	226	1	FGDC-STD-013-2006
228	5.9.35	Monocline, synclinal bend (1st option) - Identify and existence certain, location	05.09.35	5.9.35) Monocline, synclinal bend (1st option) - Identify and existence certain, location approximate	227	1	FGDC-STD-013-2006
229	5.9.36	Monocline, synclinal bend (1st option) - Identify or existence questionable, location	05.09.36	5.9.36) Monocline, synclinal bend (1st option) - Identify or existence questionable, location approximate	228	1	FGDC-STD-013-2006
230	5.9.37	Monocline, synclinal bend (1st option) - Identify and existence certain, location	05.09.37	5.9.37) Monocline, synclinal bend (1st option) - Identify and existence certain, location inferred	229	1	FGDC-STD-013-2006
231	5.9.38	Monocline, synclinal bend (1st option) - Identify or existence questionable, location	05.09.38	5.9.38) Monocline, synclinal bend (1st option) - Identify or existence questionable, location inferred	230	1	FGDC-STD-013-2006
232	5.9.39	Monocline, synclinal bend (1st option) - Identify and existence certain, location	05.09.39	5.9.39) Monocline, synclinal bend (1st option) - Identify and existence certain, location concealed	231	1	FGDC-STD-013-2006
233	5.9.40	Monocline, synclinal bend (1st option) - Identify or existence questionable, location	05.09.40	5.9.40) Monocline, synclinal bend (1st option) - Identify or existence questionable, location concealed	232	1	FGDC-STD-013-2006
234	5.9.41	Monocline, synclinal bend (2nd option) - Identify and existence certain, location	05.09.41	5.9.41) Monocline, synclinal bend (2nd option) - Identify and existence certain, location accurate	233	1	FGDC-STD-013-2006
235	5.9.42	Monocline, synclinal bend (2nd option) - Identify or existence questionable, location	05.09.42	5.9.42) Monocline, synclinal bend (2nd option) - Identify or existence questionable, location accurate	234	1	FGDC-STD-013-2006
236	5.9.43	Monocline, synclinal bend (2nd option) - Identify and existence certain, location	05.09.43	5.9.43) Monocline, synclinal bend (2nd option) - Identify and existence certain, location approximate	235	1	FGDC-STD-013-2006
237	5.9.44	Monocline, synclinal bend (2nd option) - Identify or existence questionable, location	05.09.44	5.9.44) Monocline, synclinal bend (2nd option) - Identify or existence questionable, location approximate	236	1	FGDC-STD-013-2006
238	5.9.45	Monocline, synclinal bend (2nd option) - Identify and existence certain, location	05.09.45	5.9.45) Monocline, synclinal bend (2nd option) - Identify and existence certain, location inferred	237	1	FGDC-STD-013-2006
239	5.9.46	Monocline, synclinal bend (2nd option) - Identify or existence questionable, location	05.09.46	5.9.46) Monocline, synclinal bend (2nd option) - Identify or existence questionable, location inferred	238	1	FGDC-STD-013-2006
240	5.9.47	Monocline, synclinal bend (2nd option) - Identify and existence certain, location	05.09.47	5.9.47) Monocline, synclinal bend (2nd option) - Identify and existence certain, location concealed	239	1	FGDC-STD-013-2006
241	5.9.48	Monocline, synclinal bend (2nd option) - Identify or existence questionable, location	05.09.48	5.9.48) Monocline, synclinal bend (2nd option) - Identify or existence questionable, location concealed	240	1	FGDC-STD-013-2006

Figure 4. Generating the carto representation. This gives a view of the master spreadsheet that is maintained to keep correlation (circled in red) between the carto representation RULE_IDs that are stored in a master geodatabase template and the Symbol number stored in the standard style file.

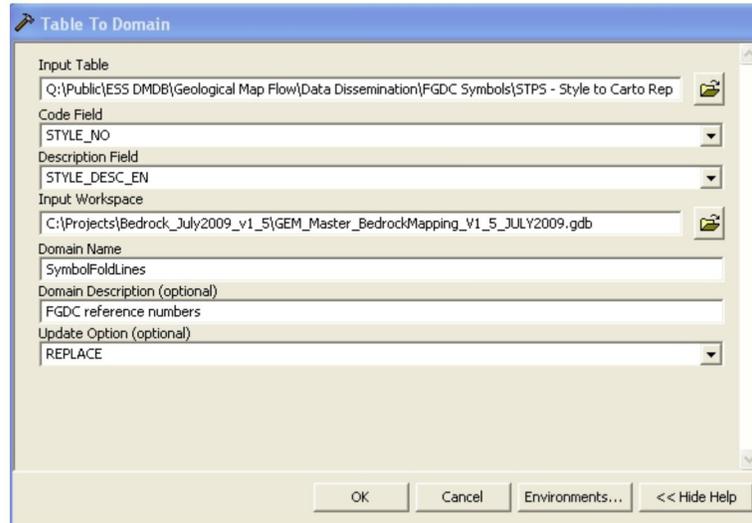


Figure 5. Converting symbols in the table to domains.

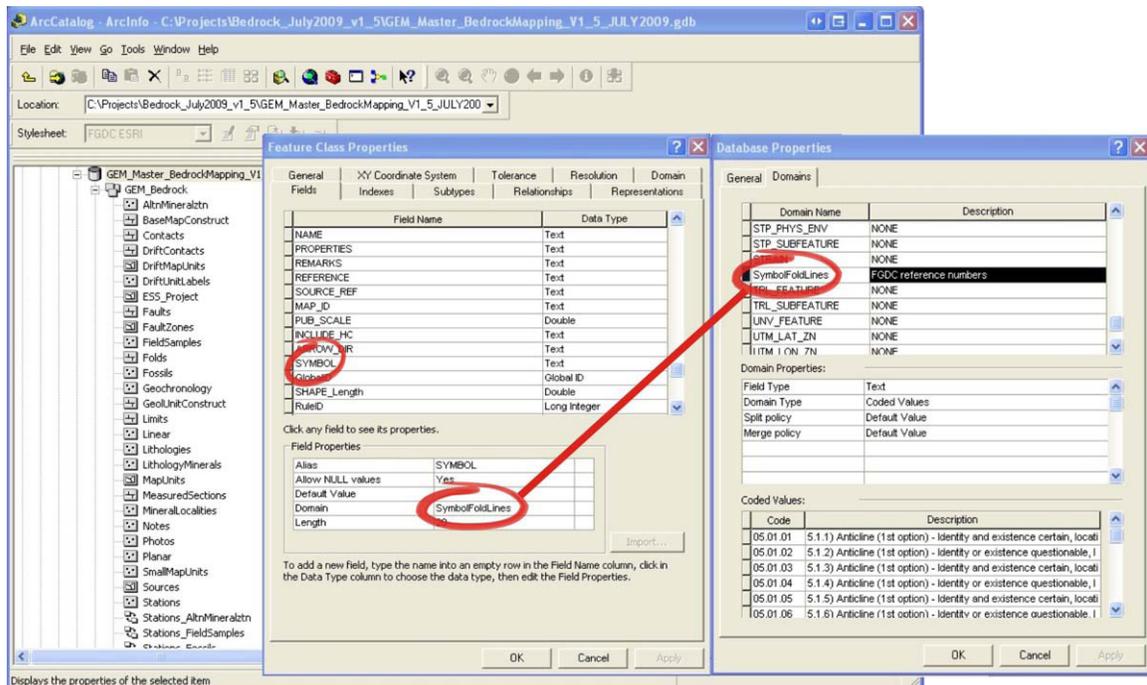


Figure 6. Assigning domains to the feature's Symbol field.

Copy Carto Representations

Using the Capture Representation Tool (Clark, 2009), copy the carto representation rules from the master geodatabase template for each feature class in the project geodatabase. Browse to the desired feature class in the master geodatabase and supply a name for the new representation class (fig. 7). This tool ensures that the RuleID number sequence is maintained as listed in each Excel worksheet.

Join Table

In ArcMap, join each individual Excel worksheet to the layer's attribute table in order to calculate the RuleID field (fig. 8). The join is based on the SYMBOL value in the layer and the STYLE_NO in each Excel worksheet (many to one).

Feature Coding

An FGDC symbol from the domain description (for example, "5.1.2 – Anticline (1st option). Identity or existence questionable, location accurate") is assigned to the SYMBOL field (fig. 9). The coded value domain (05.01.02) is actually used in the "Match to Style." This provides a simple method for geologists to symbolize features during map compilation as well as providing some standardization.

With the Excel worksheet joined to the layer attributes, the RuleID can be calculated to equal the value of the RULE_ID field in the joined Excel worksheet. This will ensure that the carto representation rule ID matches the FGDC symbol stored in the SYMBOL field.

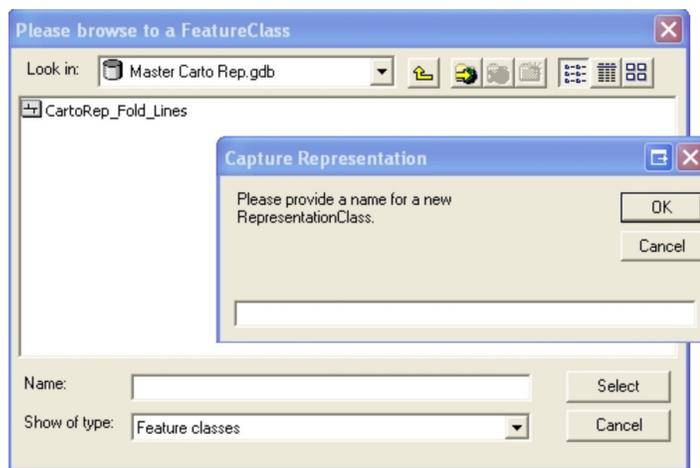


Figure 7. Copying carto representation rules for each feature class from the master geodatabase template to the project geodatabase.

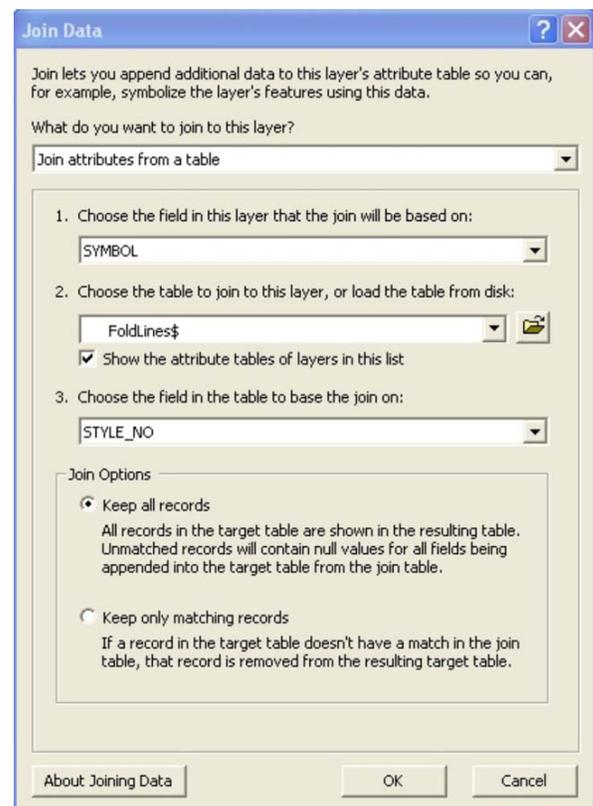


Figure 8. Joining attributes in the master Excel spreadsheet to each feature class attribute table.

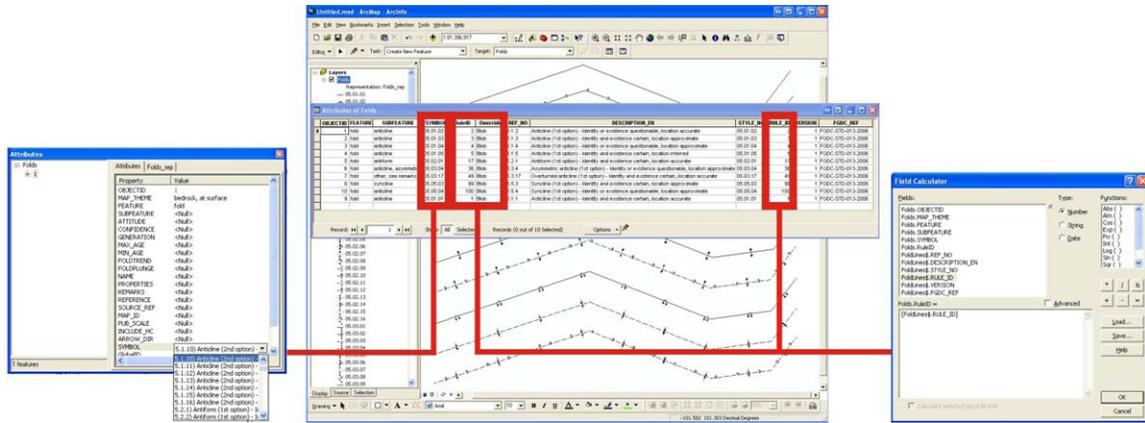


Figure 9. Feature coding. The left side depicts assigning an FGDC symbol (with domain description) to the Symbol field of the feature class. The coded value of the domain (which is the style file symbol number) is used to render the feature using “Match to Symbol in a Style.” The right side depicts assigning the RULE_ID value from the joined master spreadsheet to the carto representation RULE_ID of the feature class.

References

Clark, Ryan, 2009, Arizona Geological Survey, Capture representations: An ArcScript available as a download from ESRI Support Center, <http://arcscrips.esri.com>.

Federal Geographic Data Committee [prepared for the Federal Geographic Data Committee by the U.S. Geological Survey], 2006, FGDC Digital Cartographic Standard for Geologic Map Symbolization: Reston, Va., Federal Geographic Data Committee Document Number FGDC-STD-013-2006, 290 p., 2 plates, http://ngmdb.usgs.gov/fgdc_gds/.

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