ArcGIS Geodatabase Schema for Geologic Map Production

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PREFACE

A general understanding of the ESRI geodatabase model would be beneficial when reading this document. Please refer to the accompanying poster at (http://ngmdb.usgs.gov/Info/dmt/docs/dohar06.pdf) for discussion below and note that the geodatabase schema that is represented is a DRAFT version.

A GEODATABASE FOR MAP PRODUCTION

This geodatabase schema has been designed to facilitate and manage digital data for the publication of geologic maps. In a production scenario, a personal geodatabase is created by each cartographer on their workstation. Geologic and non-geologic digital data are stored separately in respective feature datasets. All feature datasets and the feature classes contained within are prefixed by a seven-character string that represents the publication series and number (e.g., OF04780 represents Open File #4780). This ensures that all the files, when transferred from a personal geodatabase to an SDE enterprise geodatabase, will be unique. All digital base data are preserved in the original Shapefiles and stored outside of the geodatabase.

CARTOELEMENTS FEATURE DATASET

The CartoElements feature dataset contains non-geologic features that are used in preparing a geologic map. These consist of features such as the map border, UTM grid, leader lines, cross-section lines, base annotation, and masking polygons used with ArcMap's advanced layer masking option. Eventually over time, some of these features like the map border will be replaced with ArcObjects or macros used in ArcMap.

GEOLOGY FEATURE DATASET

The Geology feature dataset contains all the geologic features on the map that are represented by points, lines, and areas, as well as the bedrock and surficial geological units. Also included are topology rules that define the relationship between these features, a polygon feature that represents the area of interest, and geologic annotation. At a future date, raster geologic datasets will be a part of this dataset.

The geodatabase provides many options for managing these datasets efficiently, such as incorporating a subtype field and topology and domain validation. The three features classes that represent geologic area, point, and line features all contain a geodatabase subtype field named CATEGORY. Each unique value or subtype code in this subtype field can be viewed as a separate individual feature class. This provides better data management because common attribute fields can be shared by all features, with the ability to assign a different domain to each of these attribute fields for subtype code in the subtype field CATEGORY. Therefore, the attribute field FEATURE is assigned to a different domain for each unique subtype code. For example, the faults and folds subtype has the domain Faults and Folds assigned to the FEATURE attribute field, respectively (see Figure 1). The Faults domain contains the valid fault types that can be assigned to this field for any given feature, and the same can be said for the Folds domain. This method of managing data exists in the GeologyPoints, GeologyLines, and GeologyAreas feature classes since most features, depending on map scale, can be represented in any of these states.

The GeologyUnits feature class contains the bedrock and surficial geological polygons. In this feature class, the field MAPUNIT contains the unique value for each polygon feature. Several related tables are used to define each of these unique values. The first is the UnitComposition table, where each unique MAPUNIT value is defined as a composition of one or more geological units represented in the fields VENEER (used mostly for surficial geology maps), UNIT_1, UNIT_2, and UNIT_3. The geological units in these four fields are then related to the BedrockGeology or the SurficialGeology tables, each of which

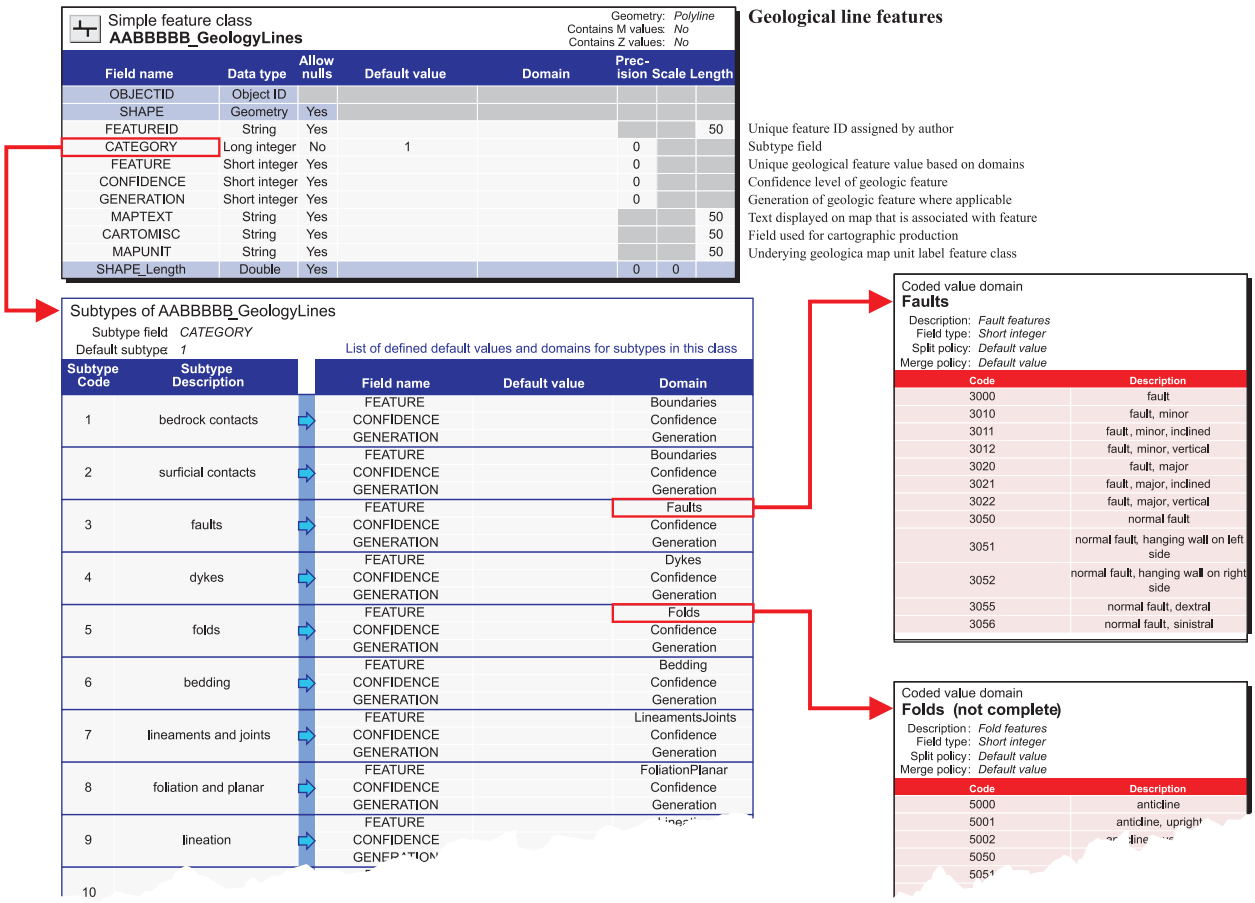

Figure 1. The CATEGORY field in the feature class is set as the subtype field, and its subtype codes are listed below. The subtype codes group geologic features in a common theme (e.g. faults, folds). For each subtype code, a separate domain listing all possible features of that subtype is assigned to the FEATURE field (e.g., the Faults domain is assigned to the FEATURE field for the faults subtype code).

further defines each geological unit and is comparable to the description that appears in the legend on the map. In addition, ID values in the field RELATION in the Unit-Composition table are related to the UnitRelation table that describes the relationship between one or more geological units (e.g., First unit is predominantly 60-80% coverage).

The MappedArea feature class simply stores one or more polygons that define the area of interest or geological study. The primary purpose of this feature is to ensure that all geological features exist within its boundaries, as part of the established topology rules. Also, the polygon features are used to define the FGDC element Data_Set_G-Polygon and for display in an index map on the final hardcopy version of the map.

The topology rules are basically those provided by the ESRI geodatabase model. As noted above, all geological features must exist within the boundaries of the MappedAreas feature class. In addition, it is also important to maintain coincidence of geological contacts, faults, and dykes to the outline of the geological units.

DOMAINS

Domains are used to constrain the values allowed in any particular field in a feature class or table. As mentioned above, each subtype value has a separate coded value domain that is assigned to the FEATURE field. Each of these domains contains the respective geologic features that have been compiled from the legend descriptions in GSC publications of the past ten years. Each geologic feature or description is assigned a code or a unique integer value in the 000's that corresponds to the subtype value (e.g., the subtype fault has a value of 3, and the Faults domain consists of coded values from 3000-3999). The use of domains aids in validating the feature attributes, ensures consistency and quality, and guarantees a homogenous dataset when combining the digital data from one or more geodatabases/publications.

CONCLUSION

The purpose of this geodatabase schema is to create a foundation for managing geological digital data in a map production environment. The ESRI geodatabase model provides the tools and validation methods to ensure a high quality output of data for geologic maps and the dissemination of digital data. These practices will continue to evolve as more datasets are incorporated.

REFERENCES

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