

Geologic Resources Inventory Program

U.S. National Park Service
Colorado State University



The National Park Service Geologic Resources Inventory Geology–GIS Geodatabase Data Model (V. 2.3)

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INTRODUCTION

The National Park Service (NPS) Geologic Resources Division (GRD) presently administers the Geologic Resources Inventory (GRI) Program, a program tasked with producing a summary report of each park's geologic resources, an evaluation of existing geologic maps, and the development of digital geologic–

Geographic Information Systems (GIS) data, as well as a geology–GIS data model to standardize geologic–GIS data (this document). The program is funded by the NPS Inventory and Monitoring Division (I&MD). Both visions are within the Natural Resource Stewardship and Science Directorate of the National Park Service. The GRI program itself is a cooperative endeavor to implement a systematic, comprehensive inventory of the geologic resources in 270 park units with significant natural resources. Cooperators include Colorado State University (CSU), U.S. Geological Survey (USGS), and many state geological surveys.

Digital Geologic–GIS Maps

Geologic maps are an integral component of the physical science inventories stipulated by the NPS in its Natural Resources I&M Guideline (NPS–75) and the 1997 NPS Strategic Plan. Bedrock and surficial geologic maps and supporting information provide the foundation for studies of groundwater, geomorphology, soils, and environmental hazards. Geologic maps describe the underlying physical habitat of many natural systems.

The NPS has identified GIS and digital cartographic products as fundamental resource management tools. There are few geologists employed at parks, thus these tools are particularly important to the NPS to aid resource managers in using geologic data for park management decisions.

The initial NPS GRI Geology–GIS Data Model was designed for ESRI coverage and shapefile formats and is available at <https://www.nps.gov/articles/gri-geodatabase-model.htm>. This data model was originally based on the Washington State ArcInfo GIS Data Model (Harris 1998), <http://pubs.usgs.gov/openfile/of98-487/harris.html>, and includes a few components of the North American Geologic Map Data Model (NADM), <http://ngmdb.usgs.gov/www-nadm/index.html>.

In the early 2000s, ESRI developed the geodatabase format for storing spatial data within a relational database management system (RDBMS). A geodatabase stores data in point, line and polygon feature classes that can be grouped into feature datasets, or logical groupings of feature classes that share the same spatial extent. A geodatabase has the added strength of allowing attribute validation rules, relationship classes and topological rules that maintain data integrity within and between feature classes.

NPS GRI GEOLOGY–GIS GEODATABASE DATA MODEL v. 2.3

The following text and tables outline Data Model specifications and common geodatabase terminology and concepts, as well as a geodatabase–based geology–GIS data model feature class list, and Data Dictionary. Data Model specifications are for ESRI 9.X personal geodatabase and ESRI 10.X file geodatabase implementation.

Geologic Time Symbols

Abbreviations or symbols for units of geologic time (e.g. C for Cambrian, J for Jurassic, and K for Cretaceous) adhere to standard USGS conventions, however, for units of geologic time that utilize a non-standard symbol for representation (e.g. Triassic is often represented by a “T” with subscript “R” attached), the data model adopts the text abbreviations proposed in Attachment B, p. 119 in Soller, David, R., et. al., 1997. Abbreviations of geologic time are always upper case (e.g., “TR” and not “Tr” or “tr” for Triassic).

Data Model Geologic Time Symbol List.

A complete list of unit age symbols used in the data model is listed below, sorted youngest to oldest.

Age Symbol	Unit of Geologic Time
R	Recent
H	Holocene
PE	Pleistocene
Q	Quaternary
N	Neogene
PL	Pliocene
MI	Miocene
PG	Paleogene
OL	Oligocene
E	Eocene
EP	Paleocene
T	Tertiary
CZ	Cenozoic
K	Cretaceous
J	Jurassic
TR	Triassic
MZ	Mesozoic
P	Permian
PN	Pennsylvanian
PM	Carboniferous or Pennsylvanian–Mississippian
M	Mississippian
D	Devonian
S	Silurian
O	Ordovician
C	Cambrian
PZ	Paleozoic
PC	Precambrian
PR	Proterozoic
Z	Z (Precambrian)
Y	Y (Precambrian)
X	X (Precambrian)
W	W (Precambrian)
UNK	Unknown

Geologic Unit Symbols and Compiled Geology–GIS Map Data

Geologic units are typically represented on geologic maps by text symbols that are most often a concatenation of the geologic age of the unit (see Geologic Time Symbols above; always upper case) and one or more (lower case) letters used to abbreviate the unit name. (e.g., the Cretaceous Dakota Sandstone might be denoted as “Kd”, whereas Quaternary Alluvium “Qal”). Some source maps may represent a geologic unit with only a lower case unit name symbol (e.g., “di” for “Dike” or “falp” for “flow al pahoehoe”). In these cases the geologic age symbol, if determinable, is concatenated with the unit name symbol (e.g., if “di” is Jurassic in age then “Jdi”, and if “falp” is Quaternary then “Qfalp”), otherwise the geologic symbol is as per the source map.

For GIS geologic data that is produced or compiled from more than one source map, geologic unit symbols (e.g. Qal, Kd, Jm) often need to be reconciled if different geologic units from different geologic maps share the same geologic unit symbol. As an example, if on one map “Dm” is the Mahantango Formation, yet on another map “Dm” represents the Marcellus Shale, one of the symbols needs to be

changed to resolve the conflict. In the example above, the symbol for the Mahantango Formation could be changed from “Dm” to “Dmh” to resolve the conflict.

Similarly, if a geologic unit present on more than one source map is represented by different geologic unit symbols, one symbol should be selected to represent the geologic unit in the compiled map. As an example, on one geologic map the geologic unit symbol for the Port Ewen Shale is “Dp”, but on another, the Port Ewen Shale is “Dpe”. To resolve this dilemma, “Dp” could be selected to represent the Port Ewen Shale on the compiled map.

Source map geologic unit symbols are preserved in the data model attribution in the SRC_SYM (Source Unit Symbol) field (see the SRC_SYM field in the Data Model Data Dictionary below), whereas unit symbols adopted to represent a geologic unit are stored in the GLG_SYM (Unit Symbol) field (see the GLG_SYM field in the Data Model Data Dictionary below). A unit with no unit symbol on the source map should have a value of “NA” in the SRC_SYM field.

Sorting Geologic Units

Most often, the first age referenced in the unit name can be used to sort geologic units. For example, MZ (Mesozoic) is younger than PZ (Paleozoic) and J (Jurassic) is older than K (Cretaceous). When age ranges exist such as MZPZ (Mesozoic/Paleozoic) or when eras and periods are both used as in MZ (Mesozoic) and J (Jurassic), the naming and sorting of geologic units fall primarily into four categories: Intra-era relationships (within an era), Inter-period relationships (between periods), Inter-era relationships (between eras), other unit subdivision differences and exceptions based on source information. The following protocol should be followed when sorting geologic units.

Intra-era relationships–

The most general or oldest unit is designated as older relative to its sub-units.

Example: Four units are defined as Mesozoic, Cretaceous, Jurassic and Triassic in age.

The units should appear in the following order: Cretaceous, Jurassic, Triassic and Mesozoic.

Inter-period relationships–

The unit containing the youngest rock is designated as younger, and the unit containing the oldest rock is designated as older.

Example: Four units are defined as Jurassic, Jurassic/Triassic, Jurassic/Triassic/Permian and Triassic/Permian in age. The units should appear in the following order: Jurassic, Jurassic/Triassic, Jurassic/Triassic/Permian and Triassic/Permian.

Inter-era relationships–

The first age referenced (the youngest) is used to define the sorting with the more general age, such as an era, being older than its period components.

Example: Four units are defined as Jurassic, Mesozoic/Paleozoic, Permian and Paleozoic/Precambrian.

The units should be sorted in the following order: Jurassic, Mesozoic/Paleozoic, Permian and Paleozoic/Precambrian.

Other unit subdivision differences–

When compiling maps together, if a unit is undivided on one map but divided on other map, the undivided unit is designated as the youngest unit with the subdivided units following in the order they appear on their respective source maps.

Example: On one map, the Snowbird Group appears undivided. On adjacent maps, the Snowbird Group is divided into Formation A, Formation B and Formation C. The correct sorting should be: Snowbird Group (undivided), Formation. A, Formation. B, then Formation. C.

Exceptions–

Exceptions occur when through a correlation of units or through mapped relationships a source defines an age relationship that cannot be represented using the above three categories. In this case, source map information supersedes all other conventions.

Once geologic units are sorted they are assigned a numeric value that serves to sort units from youngest (lowest value) to oldest (highest value). In the Data Model, these assigned numeric values are stored in the SORT_NO (Sort Number) field (see SORT_NO field in the Data Model Data Dictionary below). Typically integers are used to sort units, however, decimal numbers are frequently implemented to denote subunits or members of a particular unit.

Example: For the GRI Digital Geologic–GIS Map of Dinosaur National Monument and Vicinity, Colorado and Utah, the Chinle Formation (TRc) was assigned 42, whereas the Garta Member of the Chinle Formation (TRcg) was assigned 42.1.

Geologic Feature Classes and Data Model Feature Class Definitions

Geologic Feature Class – Shapefiles or geodatabase feature classes, containing geologic feature data that are created using data model feature class definitions.

Data Model Feature Class Definition – Geodatabase feature class templates used to create geologic feature classes.

Geologic features present on a geologic map can be grouped based upon the type of geologic feature and the spatial representation of that feature (i.e. polygon, line or point). Some features, such as geologic units, may be represented spatially either as an area (polygon) feature, a line feature and/or as a point feature depending on the nature and spatial extent of the unit, and/or the map scale the unit was mapped at. Thus, three different feature classes are needed to fully represent a geologic unit (depending on if the unit was mapped as an area, line and/or point).

Output data are represented using geologic feature classes with each geologic feature class utilizing a data model feature class definition as a template. More than one geologic feature class can share a data model feature class definition. As an example, contacts for ash units share geometry, attribute fields, topology rules, and relationship rules with dike swarm contacts and are represented using the same data model feature class, “Other Area Contacts and Boundaries” (see table below). Similarly, linear glacial features and linear volcanic features share the same data model feature class, “Linear Geologic Features and Extent Lines”, but are implemented in output data as separate geologic feature classes with separate domains utilized to denote the type of feature within the feature class (e.g., fissure, crest line of a crater etc. for linear volcanic features).

Data Model Implementation

The GRI Geodatabase Data Model version 2.1+ contains 19 data model feature class definitions that can be utilized to create 56 geologic feature classes. The data model feature class definition to be used for a specific geologic feature class is determined by: 1.) the geometry of the features, 2.) the topological (spatial) rules for the features, 3.) applicable relationship class rules, and the 4.) attribute fields needed to represent the features. See the Data Model Data Dictionary for additional details on implementation of data model feature class definitions and geologic feature classes.

Data Model Feature Class Definition (Abbreviation*)	Geologic Feature Class	Geologic Feature Class Abbreviation
<u>Geologic Units (GLG)</u>	Geologic Units	GLG
<u>Other Area Units (ARU)</u>	Ash Units	ASH
	Benthic Habitats	BEN
	Dike Swarms	DKS
	Igneous Bodies	IGN
	Surficial Units	SUR
<u>Area Types (ART)</u>	Alteration and Metamorphic Areas	AMA
	Aquifers	AQU
	Deformation Areas	DEF
	Glacial Area Features	GAF
	Hazard Area Features	HZA
	Mine Area Features	MAF
	Outcrops	OCR
	Weathering Area Features	WTH
<u>Geologic Contacts (GLGA)</u>	Geologic Contacts	GLGA
<u>Other Area Contacts and Boundaries (BND)</u>	Alteration and Metamorphic Area Boundaries	AMAA
	Aquifer Boundaries	AQUA
	Ash Contacts	ASHA
	Benthic Habitat Contacts	BENA
	Deformation Area Boundaries	DEFA
	Dike Swarm Contacts	DKSA
	Glacial Area Feature Boundaries	GAFA
	Hazard Area Feature Boundaries	HZAA
	Igneous Body Contacts	IGNA
	Outcrop Boundaries	OCRA
	Mine Area Feature Boundaries	MAFA
	Surficial Contacts	SURA
	Weathering Area Feature Boundaries	WTHA
<u>Geologic Line Units (GLN)</u>	Linear Dikes	DKE
	Linear Geologic Units	GLN
<u>Faults (FLT)</u>	Faults	FLT
<u>Folds (FLD)</u>	Folds	FLD
<u>Structure Contour, Other Value and Related Subsurface Lines (CN#)</u>	Structure Contour Lines and Other Value Lines	CN#
<u>Geologic Cross Section Lines (SEC)</u>	Geologic Cross Section Lines	SEC

Data Model Feature Class Definition (Abbreviation*)	Geologic Feature Class	Geologic Feature Class Abbreviation
<u>Linear Geologic Features and Extent Lines (LIN)</u>	Alteration and Metamorphic Features Lines	AML
	Aquifer Lines	AQL
	Geologic Line Features	GLF
	Glacial Features Lines	GFL
	Hazard Feature Lines	HZL
	Linear Joints	JLN
	Mine Line Features	MFL
	Observation, Observed Extent and Trend Lines	LIN
	Volcanic Line Features	VLF
<u>Geologic Point Units (GPT)</u>	Point Geologic Units	GPT
<u>Geologic Attitude Observation Localities (ATD)</u>	Geologic Attitude Observation Localities	ATD
<u>Geologic Observation Localities (GOL)</u>	Geologic Observation Localities	GOL
<u>Geologic Measurement Localities (GML)</u>	(Non-Attitude) Geologic Measurement Localities	GML
<u>Geologic Sample Localities (GSL)</u>	Geologic Sample Localities	GSL
<u>Geologic and Other Geology-Related Point Features (GPF)</u>	Alteration and Metamorphic Point Features	AMP
	Geologic Point Features	GPF
	Glacial Features Points	GFP
	Hazard Point Features	HZP
	Mine (and Mine Related) Point Features	MIN
	Volcanic Point Features	VPF
<u>Seismic Localities (SMC)</u>	Seismic Localities	SMC
<u>Map Symbolology (SYM)</u>	Map Symbolology	SYM

* Abbreviation of feature class in template geodatabase.

For structure contour lines and other value lines, the # in the data model feature class abbreviation (CN#) denotes a number assigned to the feature class abbreviation (e.g. CN1, CN2), allowing for multiple CN feature classes to exist. See Structure Contour and Other Value Lines (CN#) feature class in the Data Model Data Dictionary.

Differences Between Version 1.4 and Version 2.X Data Model Feature Classes

In the GRI Geodatabase Data Model version 1.4, a data model feature class definition existed for each type of geologic feature represented on a geologic map, equivalent to the geologic feature classes defined in this data model. New feature class definitions were added each time a new geologic feature type was identified. In the GRI Geodatabase Data Model version 2.X, as new geologic features are identified, they will utilize an existing data model feature class definition, rather than adding a new one.

Feature Datasets

In the NPS GRI Geology–GIS Geodatabase Data Model, geologic feature classes representing each of the geologic data layers on a single map are grouped into a feature dataset. All geologic feature classes that participate in the feature dataset share the same spatial reference (i.e. projection and datum). Feature datasets store spatial data and relationships, but do not store tables. Tables are stored within the geodatabase, but outside the feature dataset. Feature datasets are necessary for the creation of topological rules, which will be discussed later.

Data Model Geodatabase, Feature Dataset and Geologic Feature Class Naming Conventions

For maps that are dedicated to a NPS unit, whether a compiled map, or a single map, the map's alpha code is the NPS unit's unique four-letter NPS alpha code (NPS4 field in the master GRI digital map database). An NPS unit's alpha code is typically either the first two letters of the first two words in a NPS unit's name (e.g. Rocky Mountain National Park's NPS alpha code is ROMO), or the first four letters of the NPS unit's name if the unit's name is only one word (e.g. Arches National Park's four-letter NPS alpha code is ARCH). A few exceptions to this method of deriving NPS alpha codes exist (e.g. Carlsbad Caverns National Park is CAVE, not CACA).

If a digital geologic–GIS map is a USGS 7.5-minute quadrangle map, then the digital map's unique alpha code is derived from a NPS quadrangle of interest (qoi) table within a master GRI database (tbl_qoi) that lists unique three- or four-letter alpha codes for all USGS 7.5-minute quadrangles of NPS interest. Quadrangle alpha codes are derived using the same rule used to derive NPS unit alpha codes. In addition, quadrangle alpha codes are cross-referenced with NPS unit alpha codes to assure uniqueness. If a conflict with alpha codes exists, quadrangle alpha codes are changed rather than park codes. If, however, the dataset is for a 7.5-minute quadrangle map, yet is dedicated as a NPS unit map, then the unit's NPS alpha code is used, and not the quadrangle alpha code. A few 7.5-minute quadrangles actually have names that are only three letters in length (e.g. Igo and Ray). For these maps, the three-letter alpha code is the quadrangle name.

If a digital geologic–GIS map is not a park map, or a 7.5-minute quadrangle map, then a four-letter alpha code is produced using the same rules for derivation as a NPS unit and quadrangle alpha code. The alpha code is checked against NPS unit and quadrangle alpha codes, as well as existing non-unit and non-quadrangle map alpha codes, to assure uniqueness.

Geodatabases files (i.e. .mdb files) are named using the unique three- or four-letter alpha code assigned to a GRI digital geologic–GIS map, with the text “_geology” appended (concatenated) to the (lower case) map alpha code. As an example, if a GRI map's unique alpha code is “romo”, the geodatabase (.mdb) file name is “romo_geology.mdb”.

Feature datasets within a geodatabase are named according to the unique three- or four-letter alpha code assigned to the digital geologic–GIS map. As an example, if a GRI map's unique alpha code is “romo”, the feature dataset is named “romo”.

Geologic feature classes within a feature dataset employ a concatenation of the map's alpha code (lower case) with the unique three-letter feature class data model alpha or alpha-numeric abbreviation (converted to lower case) to produce their name. As examples, the Geologic Contacts feature class data model abbreviation is GLGA, whereas the Faults feature class data model abbreviation is FLT (see the Data Model Data Dictionary below). If the GRI map's unique alpha code is “romo” (lower case), the Geologic Contacts (GLGA) feature class would be named “romo” + “glga” = “romoglg”, whereas the Faults (FLT) feature class would be named “romo” + “flt” = “romoflt”.

Similarly, data model ancillary tables use a GRI map's unique three- or four-letter alpha code (lower case) concatenated with the table's data model abbreviation in their naming convention to relate the table to the feature dataset for the map and the feature classes contained therein. For example, if a map's unique GRI four-letter alpha code is "romo", the Geologic Unit Information (UNIT) table, abbreviated "unit" in the data model, would be "romo" + "unit" = "romounit".

Geologic feature classes and table names, abbreviations and aliases are listed in the Data Model Data Dictionary below.

Attribute Tables and Fields

Attribute tables consist of descriptive attribute fields that contain information about the features within a feature class.

Data Model Feature Class Attribute Field List.

The following table lists all of the attribute fields implemented within the data model for all feature classes. Attribute field parameters include field name, alias, data type, allow null values (Yes or No), field description, domain (name of the list or range of acceptable values for that field), and field width (precision, scale and length) are all listed and standard throughout the data model.

Field Name	FieldAlias	Data Type	Allow Nulls	Implemented Domain	Precision	Scale	Length
AM_ROT	ArcMap Rotation	Short Integer	No	Range	0	—	—
DEPTH	Depth	Double	No	—	8	3	—
DP	Dip/Plunge	Short Integer	No	Range/Coded	0	—	—
FNAME	Feature Name	Text	No	—	—	—	60
FSUBTYPE ⁽²⁾	Feature Subtype	Short Integer	No	Subtype	0	—	—
FTYPE	Feature Type	Short Integer	No	Coded	0	—	—
FUID	Unique Feature ID	Long Integer	No	—	0	—	—
FVALUE	Feature Value	Long Integer	No	Coded	0	—	—
GLG_SYM ⁽¹⁾	Unit Symbol	Text	No	—	—	—	12
GMAP_ID ⁽¹⁾	Source Map ⁽⁴⁾	Long Integer	No	Coded ⁽⁴⁾	0	—	—
LBL	Label	Text	Yes	—	—	—	60
LOC_ID	Location ID	Text	No	—	—	—	40
MAG	Magnitude	Float	No	—	0	0	4
NOTES	Notes	Text	No	—	—	—	254
OBJECT_ID*	NA	Object ID	—	—	—	—	—
PLUNGE	Plunge	Short Integer	No	Coded	0	—	—
POS	Positional Accuracy	Short Integer	No	Coded	0	—	—
SAM_AGE	Sample Age	Text	No	—	—	—	40
SAM_NO	Sample Number	Text	No	—	—	—	40
SEC_ABRV	Section Abbreviation	Text	No	—	0	—	6
SENS	Sensitivity	Short Integer	No	Coded	0	—	—
SHAPE*	NA	Geometry	Yes	—	—	—	—
SHAPE_Area*	NA	Double	Yes	—	0	—	—
SHAPE_Length*	NA	Double	Yes	—	0	—	—
SORT_NO	Sort Number	Double ⁽⁵⁾	No	—	0	0	8
SRC_ABRV	Source Abbreviation	Text	No	—	0	—	6
SRC_SYM	Source Unit Symbol	Text	No	—	—	—	12
SYM ⁽³⁾	Symbology	Text	No	—	—	—	60
ST	Strike/Trend	Short Integer	No	Range/Coded	0	—	—
UNITS	Units	Short Integer	No	Coded	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

- (1) Relationship class foreign key field (see Relationship Classes below).
- (2) Denotes a Subtype field (see Subtypes below).
- (3) Denotes an Optional field (see Optional Fields below).
- (4) In all feature classes the GMAP_ID field alias, “Source Map ID” is now changed to “Source Map”, and the MAP_PUB domain is now also adopted for the field. In the Source Map Information (MAP) table the field alias remains “Source Map ID” with no adopted domain.
- (5) The SORT_NO field was changed from a single float data type to a double float data type in 2013.

Most table attribute fields are applicable only to a single table, and thus are only listed with their respective table definition in the Data Dictionary section of this document and not here. The exceptions are the GLG_SYM and GMAP_ID fields, fields noted above that are “key fields” that relate a table to a feature class (see Relationship Classes below). In version 2.1, the HELP_ID field was dropped from all feature classes as a decision was made to no longer support feature-sensitive help between our digital geologic-GIS data and our ancillary map documents.

Optional Fields

The use of optional data model fields may be employed where warranted. Presently, the only optional field is the Symbology (SYM) field, a field used to symbolize features based on custom values when needed or warranted. The default field length for the SYM field is 60, however, this value can be increased to 100 or longer if needed. The field order should be after the Label (LBL) field.

Domains

Domains define acceptable values for attribute fields within tables in the geodatabase. Two types of domains exist in a geodatabase: coded value domains and range domains. Coded value domains list acceptable values and descriptions of those values to more concisely define a feature property or characteristic (e.g. a value of 1 indicates a ‘known or certain’ value for the positional accuracy of a feature). Descriptions, rather than the domain’s numeric values, appear by default in most attribute dialog boxes within ArcMap, making it simpler to understand the attribution of a given feature. Range domains list a range of acceptable numeric values (e.g. a strike/trend azimuth can only have a value from 0° (north) to 359°). In the Data Dictionary, attribute domain values are listed with their associated description.

Domain List for Data Model Feature Classes and Table Attribute Fields.

A list of geodatabase domains, domain types (i.e. coded or range), and applicable feature class or table (and their attribute field) are presented below. Domains applicable to more than one feature class (e.g. LINE_POS, see table below) are listed in the Data Dictionary with each feature class for which the domain is employed. All domain names ending with “_TYPE” indicated a feature type (Feature Type or FTYPE field) domain (e.g. types of faults; thrust fault, normal fault, reverse fault), and are unique to a particular feature class. This feature class is indicated using the feature class’s abbreviation (e.g., ATD) at the beginning of the domain name (e.g., ATD_LINEAR_TYPE). For Geologic Attitude Observation Localities (ATD) related to faulting and folding “FLT” and “FLD”, respectively, is used in domain naming, however, these domains are not applicable or used by either of the Fault (FLT) or Fold (FLD) features classes.

Domain Name	Domain Type	Applicable Feature Class(es) /Table (Attribute Field)
AMA_TYPE	Coded	AMA (FTYPE)
AML_TYPE	Coded	AML (FTYPE)
AMP_TYPE	Coded	AMP (FTYPE)
AQL_TYPE	Coded	AQL (FTYPE)
AQU_TYPE	Coded	AQU (FTYPE)
ATD_DP	Range	ATD (DP)

Domain Name	Domain Type	Applicable Feature Class(es) /Table (Attribute Field)
ATD_FLD_LINEAR ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_LINEAR ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_LINEAR_NOPLUNGE_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_LINEAR_VERT_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_PLANAR_NODIP_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_PLANAR_NOSTRIKE_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_PLANAR_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_FLT_PLANAR_VERT_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_HORIZ	Coded	ATD (DP)
ATD_LINEAR_HORIZ_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_LINEAR_NOPLUNGE_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_LINEAR_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_LINEAR_VERT_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_NA_DP	Coded	ATD (DP)
ATD_NA_ST	Coded	ATD (ST)
ATD_OTHER_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_PLANAR_HORIZ_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_PLANAR_NODIP_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_PLANAR_NOSTRIKE_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_PLANAR_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_PLANAR_VERT_TYPE ⁽¹⁾	Coded	ATD (FTYPE)
ATD_VERT	Coded	ATD (DP)
CN_WITH_VALUE_TYPE ⁽¹⁾	Coded	CN# (FTYPE)
CN_WITHOUT_VALUE_TYPE ⁽¹⁾	Coded	CN# (FTYPE)
CNT_POS	Coded	All Contact and Boundary Feature Classes (POS)
DATA_TYPE	Coded	MAP (GMAP_TYPE)
DEF_TYPE	Coded	DEF (FTYPE)
FLD_PLNG	Code	FLD (PLUNGE)
FLD_TYPE	Coded	FLD (FTYPE)
FLT_TYPE	Coded	FLT (FTYPE)
GAF_TYPE	Coded	GAF (FTYPE)
GFL_TYPE	Coded	GFL (FTYPE)
GFP_TYPE	Coded	GFP (FTYPE)
GLF_TYPE	Coded	GLF (FTYPE)
GML_COUNT_TYPE ⁽¹⁾	Coded	GML (FTYPE)
GML_ELEV_TYPE ⁽¹⁾	Coded	GML (FTYPE)
GML_FLT_TYPE ⁽¹⁾	Coded	GML (FTYPE)
GML_MUT_TYPE ⁽¹⁾	Coded	GML (FTYPE)
GML_UNITS	Coded	GML (UNITS)
GOL_TYPE	Coded	GOL (FTYPE)
GPF_TYPE	Coded	GPF (FTYPE)
GSL_AGE-DATE_TYPE ⁽¹⁾	Coded	GSL (FTYPE)
GSL_NON-AGE-DATE_TYPE ⁽¹⁾	Coded	GSL (FTYPE)
HZA_TYPE	Coded	HZA (FTYPE)
HZL_TYPE	Coded	HZL (FTYPE)
HZP_TYPE	Coded	HZP (FTYPE)
JLN_TYPE	Coded	JLN (FTYPE)
LIN_TYPE	Coded	LIN (FTYPE)
LINE_POS	Coded	All Non-Contact/Non-Boundary Line Feature Classes (POS)
LINE_LIMITED_POS	Coded	CN# (POS)
MAF_TYPE	Coded	MAF (FTYPE)
MAP_PUB ⁽³⁾	Coded	ALL (GMAP_ID)

Domain Name	Domain Type	Applicable Feature Class(es) /Table (Attribute Field)
MFL_TYPE	Coded	MFL (FTYPE)
MIN_TYPE	Coded	MIN (FTYPE)
MJ_LITH	Coded	UNIT (MJ_LITH)
NA_UNITS	Coded	CN# ⁽²⁾ (UNITS)
NA_VALUE	Coded	GML ⁽²⁾ (GLG_SYM and SRC_SYM)
NO_TYPE	Coded	No FTYPE value
NUM_NA_VALUE	Coded	CN# ⁽²⁾ (VALUE)
OCR_TYPE	Coded	OCR (FTYPE)
POINT_POS	Coded	All Point Feature Classes (POS)
ROTATION	Range	ATD, AMP, GFP, GOL, GPF, HZP, MIN SYM and VPF (all AM_ROT)
SENS	Coded	GOL, GPF, GML, GSL, MAF, MAFA, MFL, MIN and VPF
SMC_TYPE	Coded	SMC (FTYPE)
SMC_UNITS	Coded	SMC (DUNITS)
STRIKE_ROTATION	Range	ATD (ST)
SYM_FLD_TYPE ⁽¹⁾	Coded	SYM (FTYPE)
SYM_FLT_TYPE ⁽¹⁾	Coded	SYM (FTYPE)
SYM_OTHER_TYPE ⁽¹⁾	Coded	SYM (FTYPE)
UNITS	Coded	CN# ⁽²⁾ (UNITS)
VLF_TYPE	Coded	VLF (FTYPE)
VPF_TYPE	Coded	VPF (FTYPE)
WTH_TYPE	Code	WTH (FTYPE)

(1) Denotes a domain associated with a subtype (see text below).

(2) Domain applicable only to certain subtypes of the feature class (see text below).

(3) Custom domain of GMAP_ID values and text containing the map publisher, map series number and map scale. As an example, “U.S. Geological Survey GQ-1047 (1:24000 scale)”. Applicable to all feature classes but not the Source Map Information (MAP) table.

All domains have a split policy of “duplicate” and a merge policy of “default”. These policies dictate how a domain attribute field is populated when a feature is either split (split policy) or merged (merge policy). A split policy of “duplicate” assigns the domain value of the initial feature to the resulting features after a split has been performed. A merge policy of “default” assigns the domain default value to the merged feature (the only merge policy option for coded domains).

Subtypes

Subtypes are used in geodatabases to subdivide feature class data into logical groups sharing default attribute field values, domains (see Domains above), and/or topology rules (see Topology Rules below). Subtypes are implemented at the data model feature class level, rather than after the creation of geologic data layer–base feature classes in output data. Subtypes are defined by integer values stored in an attribute field in a feature class’s attribute table. See the Data Dictionary for subtypes listed by feature class with their associated domains.

Relationship Classes

Relationship classes store information about how geodatabase objects, such as tables and feature classes, are related. At present, relationship classes are used to relate a feature (e.g. a geologic unit, fault, mine feature) to its source map information (table), and to relate geologic unit features to a table containing additional information about the geologic unit such as unit name, age, major lithology type, etc. Relationship classes are implemented after the translation of data model feature classes to geologic data

layer-based feature classes in output data. See the Data Dictionary for relationship classes presently defined in the data model.

For each relationship class in the Data Dictionary, the following items are presented: name, relationship type (simple or composite), cardinality rule (one-to-one, one-to-many, many-to-one or many-to-many), and origin and destination objects with primary and foreign key fields, respectively. Simple relationship classes describe associations between geodatabase objects such as feature classes and tables that exist independently of each other, whereas composite relationships describe associations between geodatabase objects that are dependent on each other, in which the origin object controls the lifetime of the destination object. In a composite relationship, deleting or changing a record in the origin object deletes or changes related records in the destination object.

In a relationship class, the origin object is related to the destination object through a field, termed the primary key in the former and the foreign key in the latter. Relationship classes can be stored within a feature dataset (relating to geodatabase objects such as tables), outside the feature dataset, or outside a feature dataset relating to feature classes contained within. In the NPS Geology-GIS Geodatabase Data Model, simple, one-to-many, relationship classes stored within a feature dataset are used to relate ancillary tables to feature classes. A limitation of relationship classes in ArcGIS is that nulls must be allowed in the foreign key and primary key fields in the related objects in order to allow for deletion or merging of features in the destination data. In the data model, nulls will not be allowed in these fields because it violates typical database design, and if editing of related features is needed, the relationship class is temporarily deleted, then re-established.

Topological Rules

Topological rules model spatial relationships within a single feature class or between two different feature classes. This helps to ensure that, for instance, features from different feature classes that were originally spatially coincident remain coincident and that potential errors, such as dangles and self-intersections, can be averted or corrected. Topological rules are implemented after the translation of data model feature classes to geologic data layer-based feature classes in output data.

In order to create a topology, participating feature classes must be within the same feature dataset, sharing a common spatial reference (see Feature Datasets above). Topological rules can also be defined for subtypes of features in one or more feature classes. See the Data Dictionary below for additional information.

Feature classes that participate in a topology can be assigned a topology rank. Topology ranks can range from 1 (highest rank) to 50 (lowest rank), depending on how many are needed to describe feature class relationships. When topology is validated, features in a feature class with a lower topology rank (higher rank value) are snapped, within the defined cluster tolerance, to the location of features in the feature class with the higher topology rank (lower rank value). Presently, topology ranks are not utilized in this data model because the cluster tolerance is set sufficiently low to render it unimportant which feature moves during validation. When features participating in a topology are edited using the Topology Edit Tool, they are edited as edges in which features defined by the topological rules to be spatially coincident move together.

The cluster tolerance to be used for a topology within a specific map/feature dataset is under investigation. Setting a cluster tolerance too high can cause features to move a longer than acceptable distance during topology validation. Similarly, setting a cluster tolerance too low can result in topological errors not being identified – for instance, where two features should be coincident and are not. The cluster tolerance will be based on the source map's scale, thus larger for a less detailed map and smaller

for a more detailed map. The cluster tolerance will be such that movement during validation will be confined to within the width of the thinnest line on the source map image.

For detailed information regarding ESRI geodatabase topology rules see ESRI ArcGIS 9.X and 10.X software.

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1.2.3

NPS GRI GEOLOGY–GIS GEODATABASE DATA MODEL DATA DICTIONARY

Data Model Feature Class Definitions

At present, there are 54 geologic data layer–based geologic feature classes, and two ancillary information tables presented in the Data Model Data Dictionary. The ‘blue prints’ or schema for all of these feature classes are defined using only 19 data model feature classes, definitions that are either a 1.) applicable to a single geologic (data layer–based) feature class, or a 2.) applicable to multiple features classes that share a common schema (i.e., data model parameters), varying only in feature class name (alias), abbreviation and feature type domain. Often area (polygon) features require two geologic feature classes to represent both the area (feature), as well as the related attributed lines (i.e., contacts/boundaries) that form the boundaries of these areas. *FC_Abbrev* is used to denote the feature class abbreviation were it varies depending on the geologic data layer being implemented by a data model feature class.

Data model feature class definitions are organized by geometry, with polygon feature classes listed first, followed by lines and points. Tables are discussed last.

POLYGON (AREA) FEATURE CLASSES

GEOLOGIC UNITS

Feature class consists of geologic units mapped as area (polygon) features.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Geologic Units (GLG)

SPATIAL TYPE: Polygon Feature Class

RELATED (LINE) FEATURE CLASS: Geologic Contacts (GLGA)

NUMBER OF ATTRIBUTE FIELDS: 11

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	–	–	–	–	–
SHAPE*	Geometry	Yes	–	–	–	–
FUID	Long Integer	No	–	0	–	–
GLG_SYM ⁽²⁾	Text	No	–	–	–	40
SRC_SYM	Text	No	–	–	–	40
SORT_NO	Double	No	–	0	0	8
NOTES	Text	No	–	–	–	254
LBL	Text	Yes	–	–	–	60
GMAP_ID ⁽¹⁾	Long Integer	No	–	0	–	–
SHAPE_Length*	Double	Yes	–	0	–	–
SHAPE_Area*	Double	Yes	–	0	–	–

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Relationship class foreign key field to UNIT table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each polygon. The field values range from 1 to n, where n is the number of polygons in the feature class.

GLG_SYM (Unit Symbol) Age–lithology symbol/code of the geologic unit. The symbol/code is usually identical to the SRC_SYM (source map) age–lithology symbol/code (see SRC_SYM field description below). The field is used as a foreign key field in a many–to–one relationship with the Geologic Unit Information (UNIT) table (see the Geologic Unit Information (UNIT) table definition, and this feature class’s Relationship Classes text below).

SRC_SYM (Source Unit Symbol) Source map age–lithology symbol/code of the geologic unit. The symbol/code is usually identical to the GLG_SYM age–lithology symbol/code (see GLG_SYM field description above). Calculate to “NA” if there is no source unit symbol.

SORT_NO (Sort Number) Number used to sort geologic map units, typically from youngest (low) to oldest (high). Values assigned to each geologic unit are dependent on the geologic units that comprise the compiled NPS Unit geologic map. Subdivisions of geologic units are often denoted by assigning the same integer component of a decimal number to each division of the geologic unit and using the decimal fraction to differentiate the subdivisions. A value of 0 is typically assigned to water areas.

NOTES (Notes) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For geologic units the label should equal the GLG_SYM field (see field description above), however, for water and non–attributed polygons or areas the field should be left blank, or with a <NULL VALUE>. The name of a named–water body (e.g., Granby Lake) can be populated in the label field.

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many–to–one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: None presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Not Have Gaps	GLG – All	GLG – All
Must Not Overlap	GLG – All	GLG – All
Boundary Must Be Covered By	GLG – All	GLGA – All

RELATIONSHIP CLASSES:

Relationship Class Name: UNIT_GLG_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT
Primary Key Field: GLG_SYM
Destination Class Table: GLG
Foreign Key Field: GLG_SYM

Relationship Class Name: MAP_GLG_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: GLG
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the SORT_NO field (see field description above) to represent and sort, typically from youngest geologic unit to oldest geologic unit, geologic units present in the data layer. Water is assigned, as per FGDC Digital Cartographic Standard for Geologic Map Symbolization guidelines, a RGB value of 204, 255, 255 (Cyan = 20%). If warranted, the SYM (alias Symbology; a text field with a default field length of 60) can be utilized to symbolize features.

SPECIAL FEATURE CLASS RULES:

- 1.) Coincidental Geologic Unit (GLG) and Related Geologic Contact (GLGA) Lines: Feature class boundaries are coincident with their related and attributed contact lines, and thus are present in both this feature class and its related Geologic Contacts (GLGA) features class. Coincidence is maintained via topology rules (see Type Feature Class Topology Rules above).
- 2.) Water and Ice Areas: Non-intermittent areas of water; area rivers, lakes, ponds and reservoirs, are to be captured in the Geologic Units (GLG) and Geologic Unit Contacts (GLGA) feature classes. If, however, the 'underlying' geologic unit or units can be visually discerned on the source map, then these areas are not to be captured in the Geologic Units (GLG) and Geologic Unit Contacts (GLGA) feature classes (see Special Feature Class Rule 1 above). Intermittent bodies are not to be captured unless the 'underlying' geologic unit or units cannot be visually discerned on the source map. Captured water areas are denoted in the GLG_SYM and SRC_SYM fields (see field descriptions above) with the text 'Water', and a SORT_NO (see field description above) value of 0. Ice is typically always captured (text is "Ice") with a SORT_NO value of 0.1.
- 3.) Deformation Zones: Areas mapped as deformation zones (e.g. fault or shear zones) are captured in the Area Deformation Zone (DEF) and Area Deformation Zone Boundary (DEFA) feature classes unless the lithology of the deformation zone is not indicated (i.e. a deformation zone is essentially a mapped 'geologic unit'). If captured in the Geologic Units (GLG) feature class, then these areas are denoted in the NOTES fields (see field descriptions above) with the text 'deformation zone', 'fault zone', 'shear zone' or source map unit symbol code if applicable.

OTHER AREA UNITS

Feature class consists of units mapped as area (polygon) features that are separate from base geologic units, such as bedrock or traditional geologic map units. See the feature class name/alias (abbreviation) list below for additional information on what geologic features are represented by this data model feature class. Bedrock or traditional geologic map units are captured in the Geologic Units (GLG) feature class (see Feature Class Special Rules below).

TYPE: Multiple Feature Class Definition (6 Geologic Feature Classes Defined)

FEATURE CLASS NAME/ALIAS (ABBREVIATION) LIST: Ash Units (ASH), Bedrock Units (BED), Benthic Habitat Units (BEN), Dike Swarms (DKS), Igneous Bodies (IGN) and Surficial Units (SUR)

SPATIAL TYPE: Polygon Feature Class

RELATED (LINE) FEATURE CLASS: Other Area Contacts and Boundaries (may be optional; see the related feature class type definition Special Feature Class Rules)

NUMBER OF ATTRIBUTE FIELDS: 11

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
GLG_SYM ⁽²⁾	Text	No	—	—	—	40
SRC_SYM	Text	No	—	—	—	40
SORT_NO	Double	No	—	0	0	8
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—
SHAPE_Area*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Relationship class foreign key field to UNIT table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each polygon. The field values range from 1 to n, where n is the number of polygons in the feature class.

GLG_SYM (Unit Symbol) Age–lithology symbol/code of the unit. The symbol/code is usually identical to the SRC_SYM (Source Unit Symbol) age–lithology symbol/code (see SRC_SYM field description below). The field is used as a foreign key field in a many–to–one relationship with the Geologic Unit Information (UNIT) table (see the Geologic Unit Information (UNIT) table definition, and this feature class’s Relationship Classes text below).

SRC_SYM (Source Unit Symbol) Source map age–lithology symbol/code of the unit. The symbol/code is usually identical to the GLG_SYM age–lithology symbol/code (see GLG_SYM field description above). Calculate to “NA” if there is no source unit symbol.

SORT_NO (Sort Number) Number used to age-sort units, typically from youngest (low) to oldest (high). Values assigned to each unit are dependent on the units that comprise the compiled NPS Unit geologic map. Subdivisions of units are often denoted by assigning the same integer component of a decimal number to each division of the unit and using the decimal fraction to differentiate the subdivisions. A value of 0 is typically assigned to water areas.

NOTES (Notes) Text notes on feature. Calculate to "NA" if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For other area units the label should equal the GLG_SYM field (see field description above), however, for water and non-attributed polygons or areas the field should be left blank, or with a <NULL VALUE>. The name of a named-water body (e.g., Granby Lake) can be populated in the label field.

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: None presently exist for these feature classes.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Not Have Gaps	FC_Abbrev – All	FC_Abbrev – All
Must Not Overlap	FC_Abbrev – All	FC_Abbrev – All
Boundary Must Be Covered By	FC_Abbrev – All	FC_Abbrev + A – All

RELATIONSHIP CLASSES:

Relationship Class Name: UNIT_FC_Abbrev_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT
Primary Key Field: GLG_SYM
Destination Class Table: FC_Abbrev
Foreign Key Field: GLG_SYM

Relationship Class Name: MAP_FC_Abbrev_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: FC_Abbrev
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the SORT_NO field (see field description above) to represent and sort, typically from youngest geologic unit to oldest geologic unit, geologic units present in the data layer. Water is assigned, as per FGDC Digital Cartographic Standard for Geologic Map Symbolization guidelines, a RGB value of 204, 255, 255 (Cyan = 20%). If warranted, the SYM (alias Symbology; a text field with a default field length of 60) can be utilized to symbolize features.

SPECIAL FEATURE CLASS RULES:

- 1.) Coincidental Area Unit Boundaries and Related Contact/Boundary Lines: Feature class boundaries are coincident with their related and attributed contact/boundary lines, and thus are present in both this feature class and its related Other Area Contacts and Boundaries features class. Coincidence is maintained via topology rules (see Topology Rules above).
- 2.) Ash Unit (ASH) and Geologic Unit (GLG) Polygons: If an ash unit polygon doesn't overlap with one or more geologic unit polygons, then the ash unit polygon is captured in the Geologic Units (GLG) feature class, and not in the ASH feature class.
- 3.) Dike Swarm (DKS) and Geologic Unit (GLG) Polygons: If a dike swarm is essentially a mapped 'geologic unit, and the spatial extent of the dike swarm polygon doesn't overlap with one or more geologic unit polygons, then the dike swarm polygon is captured in the Geologic Units (GLG) feature class, and not in the DKS feature class.
- 4.) Surficial Unit (SUR) and (Bedrock) Geologic Unit (GLG) Polygons: The SUR feature class only exists for surficial unit polygons that have bedrock units underlying them that are delineated by concealed and/or inferred contacts. In this case the surficial unit polygon is captured in the Surficial Units (SUR) feature class, and the contacts that define that polygon captured in the Surficial Contacts (SURA) feature class. The underlying bedrock geologic unit, and the contacts that define that polygon are captured in the Geologic Units (GLG), and Geologic Contacts (GLGA) features classes, respectively.
- 5.) Water and Ice Areas: Non-intermittent areas of water; area rivers, lakes, ponds and reservoirs, are captured in this feature classes only if the underlying (bedrock) geologic unit is delineated by concealed and/or inferred contacts. If the 'underlying' geologic unit or units is not delineated by concealed and/or inferred contacts, then these areas are to be captured in the Geologic Units (GLG) and Geologic Unit Contacts (GLGA) feature classes. Intermittent bodies are not to be captured unless the 'underlying' geologic unit or units cannot be visually discerned on the source map. Captured water areas are denoted in the GLG_SYM and SRC_SYM fields (see field descriptions above) with the text 'Water', and a SORT_NO (see field description above) value of 0. Ice is typically always captured (text is "Ice") with a SORT_NO value of 0.1.

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AREA TYPES

Feature class consists of area features that represent a type of geologic or geology-related feature. See the feature class name/alias (abbreviation) list below for additional information on what geologic features are represented by this data model feature class.

TYPE: Multiple Feature Class Definition (8 Geologic Feature Classes Defined)

FEATURE CLASS NAME/ALIAS (ABBREVIATION) LIST: Alteration and Metamorphic Areas (AMA), Aquifers (AQU), Deformation Areas (DEF), Glacial Area Features (GAF), Hazard Area Features (HZA), Mine Area Features (MAF), Outcrops/Exposure (OCR) and Weathering Area Features (WTH)

SPATIAL TYPE: Polygon Feature Class

RELATED (LINE) FEATURE CLASS: Other Area Contacts and Boundaries (may be optional; see the related feature class type definition Special Feature Class Rules)

NUMBER OF ATTRIBUTE FIELDS: 11

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
SENS ⁽²⁾	Short Integer	No	Coded	0	—	—
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—
SHAPE_Area*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) The Sensitivity (SENS) field is only applicable with the Mine Area Features (MAF) feature class, and therefore the field is only present in this feature class.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each area polygon. The field values range from 1 to n, where n is the number of polygons in the feature class.

FTYPE (Feature Type) Coded value (domains listed below by geologic feature type) used to indicate the type of area feature.

Alteration and Metamorphic Areas (AMA; AMA_TYPE domain)

Coded Domain Value	Definition
1	area of hydrothermal alteration
2	area of contact metamorphism
3	clinker

Coded Domain Value	Definition
4	saprolite
5	area of well developed foliation
6	area of hornfels alteration
7	area of sericitic alteration

Aquifer Areas (AQU; AQU_TYPE domain)

Coded Domain Value	Definition
1	confined
2	unconfined

Deformation Areas (DEF; DEF_TYPE domain)

Coded Domain Value	Definition
1	fault zone
2	shear zone
3	mylonite zone
4	ductile deformation
5	ground-crack zone
6	structural zone
7	high-strain zone
8	breccia zone
9	deformation area
10	area of shattered rock

Glacial Area Features (GAF; GAF_TYPE domain)

Coded Domain Value	Definition
1	area of knob-and kettle-topography
2	rock glacier
3	area of ice extent
4	area morainial crest
5	glacial veneer
6	glacial lake
7	area of thermokarst topography
8	glacial basin
9	kettle
10	end moraine
11	glacially derived topographic high
12	aufeis zone
13	altiplanation terrace
14	kame

Hazard Area Features (HZA; HZA_TYPE domain)

(HZA) Coded Domain Value	Definition
1	area of gas seep
2	sinkhole
3	landslide
4	earth flow
5	gully
6	subsidence area
7	volcanic eruption
8	lahar
9	headscarp
10	debris flow
11	debris slide
12	debris spread
13	earth slide
14	rock fall
15	rock flow
16	rock slide
17	soil slide
18	liquefaction susceptibility area
19	collapsible-soil susceptibility area
20	gypsiferous soil rock
21	expansive soil
22	expansive rock
23	expansive soil or rock
24	area of collapsed and mega-brecciated strata
25	slump block
26	slope movement
27	debris slide and flow
28	debris blowout
29	dissolution feature

Mine Area Features (MAF; MAF_TYPE domain)

(MAF) Coded Domain Value (*)	Definition
1	area mine
2	gravel pit
3	borrow pit
4	tailings pile
5	tailings pond
6	settling pond
7	leaching pond
8	evaporation pond
9	manmade fill

(MAF) Coded	
Domain Value (*)	Definition
10	gravel stockpile
11	mine dump
12	ore body
13	lode
14	gas field
15	borrow area
16	excavated ditch, trench or waterway
17	mill site
18	pit
19	oil field
20	oil and gas field
21	quarry
22	area of excavation
23	slag pile
24	sand pit
25	sand and gravel pit
26	clay pit
27	area of numerous prospects
28	slag flow
29	strip mine

(*) All Mine Area Feature (MAF) Feature Type (FTYPE) domain values are ‘sensitive’, and therefore the Sensitivity (SENS) field domain value needs to be SENS = 1 (sensitive feature).

Outcrops/Exposure (OCR; OCR_TYPE domain)

Coded	
Domain Value	Definition
1	extensive outcrops
2	scattered outcrops
3	outcrop
4	area of shallow bedrock
5	area of good exposure
6	area of intermittent exposure
7	area of no exposure
8	type of exposure uncertain

Weathering and Weathered Area Features (WTH; WTH_TYPE domain)

Coded	
Domain Value	Definition
1	patterned ground associated with basalt weathering
2	weathered coastal plain formations

SENS (Sensitivity) Coded value (SENS domain) that designates if a feature is considered a sensitive feature or a non-sensitive feature. The field is only present in the Mine Area Features (MAF) feature class, and as all Mine Area Feature (MAFA) features are considered ‘sensitive’ for data distribution purposes the value should always be “sensitive feature” (SENS = 1).

Coded Domain Value	Definition
1	sensitive feature

NOTES (Notes) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For features with appropriate labeling text (e.g. Johnson Mill Site or Abandoned) this text should populate this field. In some cases the type of feature (i.e., FTYPE field; see field description above) may serve as a label (e.g., Fault Zone or Mine Dump; note that the case sensitivity was changed to Title Case for labeling). For area features with no desirable label text the field should be left blank with a <NULL> value.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: None presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Not Overlap	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Boundary Must Be Covered By	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> + A – All

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_ *FC_Abbrev* _Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: *FC_Abbrev*
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the FTYPE (Feature Type) field (see field description above) to represent area features present in this data layer (sort as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Coincidental Area Type Boundaries and Related Contact/Boundary Lines: Feature class boundaries are coincident with their related and attributed contact/boundary lines, and thus are present in both this feature class and its related Other Area Contacts and Boundaries features class. Coincidence is maintained via topology rules (see Topological Rules above).
- 2.) Map Units: If an area type feature is essentially a mapped 'geologic unit, and the spatial extent of the area (polygon) doesn't overlap with one or more geologic unit polygons, then the area polygon is captured in the Geologic Units (GLG) feature class, or if more relevant in an Other Area Unit feature class (e.g., a glacial area feature that is a mapped geologic unit may be captured in the Surficial Units (SUR) feature class).

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LINE FEATURE CLASSES

GEOLOGIC CONTACTS

Feature class type consists of attributed geologic contacts and boundary lines that define (area) geologic units.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Geologic Contacts (GLGA)

SPATIAL TYPE: Line Feature Class

RELATED (POLYGON) FEATURE CLASS: Geologic Units (GLG)

NUMBER OF ATTRIBUTE FIELDS: 9

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FSUBTYPE ⁽²⁾	Short Integer	No	Subtype	0	—	—
POS	Short Integer	No	Coded	0	—	—
NOTES	Text	No	—	—	—	254
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line feature. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FSUBTYPE (Feature Subtype) Designates geologic contact lines that are simply geologic contact lines or that are contact lines coincident with Faults (FLT) lines.

Subtype Value	Definition
0	Contact (default value)
1	Contact/Fault (FLT)

POS (Position) Coded value (CNT_POS domain) that designates the positional accuracy and/or concealment of a contact/map boundary line. Refer to the source map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried
9	gradational
10	quadrangle boundary
11	map boundary
12	water or shoreline
13	water or shoreline, approximate
14	ice or glacial
15	ice or glacial, approximate
16	subaqueous (inferred)
17	scratch boundary

NOTES (Notes) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: Two subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	GLGA – All	GLGA – All
Must Not Have Dangles	GLGA – All	GLGA – All
Must Not Intersect or Touch Interior	GLGA – All	GLGA – All
Must Not Self-Intersect	GLGA – All	GLGA – All
Must Be Covered By Boundary Of	GLGA – All	GLG – All
Must Be Covered By Feature Class Of	GLGA – Contact/Fault	FLT – Fault/Contact
Must Not Overlap With	GLGA – Contact	FLT – Fault

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_GLGA_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: GLGA
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the POS field (see field description above) to represent geologic contacts and boundary lines present in this data layer (sort as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Coincidental Contact/Boundary and Related Area Feature Class Boundary Lines: Feature class lines are coincidental with their related unattributed Area Unit feature class contact/boundary lines, and thus are present in both this feature class and their related Area Unit features class. Coincidence is maintained via topology rules (see Topology Rules above).
- 2.) Coincidental Geologic Contact (GLG) and Fault (FLT) Lines: Geologic Contact (GLGA) lines coincident with Fault (FLT) lines (FSUBTYPE = 1; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) feature class. Coincidence is maintained via topology rules (see Topology Rules above).
- 3.) Faulted Contact/Boundary Line Directionality: Faulted contact/boundary lines (FSUBTYPE = 1; see FSUBTYPE field descriptions above) are captured with the down-thrown fault block, if applicable, on the 'right side' of the line. The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node', and moving to the line's end or 'to node'.
- 4.) Water/Shoreline Contacts Coincident with the Map Boundary: Water/shoreline contacts that are coincident with a map boundary should be attributed as water/shoreline (POS = 12 or 13), and the text "map boundary" added to the feature's Notes field. This conveys that the contact/boundary is water/shoreline through attribution and symbology, but also that the line contributes to defining the map's extent.

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OTHER AREA CONTACTS and BOUNDARIES

Feature class type consists of attributed contacts and boundary lines that delineate area unit and area type features. See the feature class name/alias (abbreviation) list below for additional information on what geologic features are represented by this feature class type definition.

TYPE: Multiple Feature Class Definition (13 Geologic Feature Classes Defined)

FEATURE CLASS NAME/ALIAS (ABBREVIATION) LIST: Alteration and Metamorphic Area Boundaries (AMAA), Aquifer Boundaries (AQAA), Ash Contacts (ASHA), Benthic Habitat Contacts (BENA), Deformation Area Boundaries (DEFA), Dike Swarm Boundaries (DKSA), Glacial Area Feature Boundaries (GAFA), Hazard Area Feature Boundaries (HZAA), Igneous Body Contacts (IGNA), Mine Area Feature Boundaries (MAFA), Outcrop Boundaries (OCRA), Surficial Contacts (SURA) and Weathering Area Features (WTHA)

SPATIAL TYPE: Line Feature Class

RELATED (POLYGON) FEATURE CLASS: Other Area Units or Other Area Types

NUMBER OF ATTRIBUTE FIELDS: 10

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FSUBTYPE ⁽²⁾	Short Integer	No	Subtype	0	—	—
POS	Short Integer	No	Coded	0	—	—
SENS ⁽³⁾	Short Integer	No	Coded	0	—	—
NOTES	Text	No	—	—	—	254
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Denotes a Subtype field.

(3) The Sensitivity (SENS) field is only applicable with the Mine Area Feature Boundaries (MAFA) feature class, and therefore the field is only present in this feature class.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line feature. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FSUBTYPE (Feature Subtype) Designates contact/boundary lines that are simply contact/boundary lines, contact/boundary lines that are coincident with Geologic Contacts (GLGA) lines, and/or that are coincident with Fault (FLT) lines.

Subtype Value	Definition
0	Feature (default value)
1	Feature/Fault (FLT)

Subtype Value	Definition
2	Feature/Contact (GLGA)
3	Feature/Fault (FLT)/Contact (GLGA)

POS (Position) Coded value (CNT_POS domain) that designates the positional accuracy and/or concealment of a contact/boundary line. Refer to the source map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried
9	gradational
10	quadrangle boundary
11	map boundary
12	water or shoreline
13	water or shoreline, approximate
14	ice or glacial
15	ice or glacial, approximate
16	subaqueous (inferred)
17	scratch boundary

SENS (Sensitivity) Coded value (SENS domain) that designates if a feature is considered a sensitive feature or a non-sensitive feature. The field is only present in the Mine Area Feature Boundaries (MAFA) feature class, and as all Mine Area Feature Boundaries (MAFA) features are considered 'sensitive' for data distribution purposes the value should always be "sensitive feature" (SENS = 1).

Coded Domain Value	Definition
1	sensitive feature

NOTES (Notes) Text notes on feature. Calculate to "NA" if there is no pertinent information to be added to this field.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: Four subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class type definition.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	<i>FC_Abbrev – All</i>	<i>FC_Abbrev – All</i>
Must Not Have Dangles	<i>FC_Abbrev – All</i>	<i>FC_Abbrev – All</i>
Must Not Intersect or Touch Interior	<i>FC_Abbrev – All</i>	<i>FC_Abbrev – All</i>
Must Not Self-Intersect	<i>FC_Abbrev – All</i>	<i>FC_Abbrev – All</i>
Must Be Covered By Boundary Of	<i>FC_Abbrev – All</i>	<i>Polygon FC_Abbrev – All</i>
Must Be Covered By Feature Class Of	<i>FC_Abbrev – Contact/Fault</i>	<i>FLT – Fault/Contact</i>
Must Not Overlap With	<i>FC_Abbrev – Contact</i>	<i>FLT – Fault</i>

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_ *FC Abbrev* _Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: *FC Abbrev*
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the POS field (see field description above) to represent geologic contacts and boundary lines present in this data layer (sort as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Feature class may be optional if the following criteria are satisfied: a) There is no observed coincidence between lines in this feature class and fault or geologic contact feature classes; b) there are no boundary lines surrounding the associated polygon feature class; or c) there are boundary lines, but they do not appear to have any positional accuracy associated with them (i.e., they are purely cartographic).
- 2.) Coincidental Contact/Boundary and related Area Feature Class Boundary Lines: Feature class lines are coincidental with their related unattributed Area Unit or Area Type feature class contact/boundary lines, and thus are present in both this feature class and their related Area Unit or Area Type features class. Coincidence is maintained via topology rules (see Topology Rules above).
- 3.) Coincidental Contact/Boundary, Fault (FLT) and Geologic Contact (GLG) Lines: Contact/Boundary lines coincident with Fault (FLT) lines (FSUBTYPE = 1; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) feature class. Contact/Boundary lines

coincident with Geologic Contacts (GLGA) lines (FSUBTYPE = 2; see FSUBTYPE field description above) are present in this feature class as well as the Geologic Contacts (GLGA) feature class. Contact/Boundary lines coincident with Fault (FLT) and Geologic Contact (GLGA) lines (FSUBTYPE = 3; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) and Geologic Contacts (GLGA) feature classes. Coincidence is maintained via topology rules (see Topology Rules above).

- 4.) Faulted Contact/Boundary Line Directionality: Faulted contact/boundary lines (FSUBTYPE = 1 and FSUBTYPE = 3; see FSUBTYPE field descriptions above) are captured with the down-thrown fault block, if applicable, on the 'right side' of the line. The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node', and moving to the line's end or 'to node'.
- 5.) Water/Shoreline Contacts Coincident with the Map Boundary: Water/shoreline contacts that are coincident with a map boundary should be attributed as water/shoreline (POS = 12 or 13), and the text "map boundary" added to the feature's Notes field. This conveys that the contact/boundary is water/shoreline through attribution and symbology, but also that the line contributes to defining the map's extent.

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GEOLOGIC LINE UNITS

Feature class consists of geologic units mapped as linear (line) features. See the feature class name/alias (abbreviation) list below for additional information on which geologic features are represented by this feature class type definition.

TYPE: Multiple Feature Class Definition (2 Geologic Feature Classes Defined)

FEATURE CLASS NAME/ALIAS (ABBREVIATION) LIST: Linear Dikes (DKE) and Linear Geologic Units (GLN)

SPATIAL TYPE: Line Feature Class

NUMBER OF ATTRIBUTE FIELDS: 13

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FSUBTYPE ⁽³⁾	Short Integer	No	Subtype	0	—	—
POS	Short Integer	No	Coded	0	—	—
GLG_SYM ⁽²⁾	Text	No	—	—	—	40
SRC_SYM	Text	No	—	—	—	40
SORT_NO	Double	No	—	0	0	8
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

- * Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).
(1) Relationship class foreign key field to MAP table (see Relationship Classes below).
(2) Relationship class foreign key field to UNIT table (see Relationship Classes below).
(3) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line feature. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FSUBTYPE (Feature Subtype) Designates linear unit lines that are simply linear unit lines, linear unit lines that are coincident with Geologic Contacts (GLGA) lines, and/or that are coincident with Fault (FLT) lines.

Subtype Value	Definition
0	Feature (default value)
1	Feature/Fault (FLT)
2	Feature/Contact (GLGA)
3	Feature/Fault (FLT)/Contact (GLGA)

POS (Position) Coded value (LINE_POS domain) that designates the positional accuracy and/or concealment of a linear unit line. Refer to the source map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried

GLG_SYM (Unit Symbol) Age–lithology symbol/code of the geologic line unit. The symbol/code is usually identical to the SRC_SYM (Source Unit Symbol) age–lithology symbol/code (see SRC_SYM field description below). The field is used as a foreign key field in a many–to–one relationship with the Geologic Unit Information (UNIT) table (see the Geologic Unit Information (UNIT) table definition, and this feature class’s Relationship Classes text below).

SRC_SYM (Source Unit Symbol) Source map age–lithology symbol/code of the geologic line unit. The symbol/code is usually identical to the GLG_SYM age–lithology symbol/code (see GLG_SYM field description above). Calculate to “NA” if there is no source unit symbol.

SORT_NO (Sort Number) Number used to sort geologic map units, typically from youngest (low) to oldest (high). Values assigned to each geologic line unit are dependent on the geologic units that comprise the compiled NPS Unit geologic map. Subdivisions of geologic units are often denoted by

assigning the same integer component of a decimal number to each division of the geologic unit and using the decimal fraction to differentiate the subdivisions. A value of 0 is typically assigned to water areas.

NOTES (Notes) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For geologic line units the label should equal the GLG_SYM field (see field description above). For geologic lines units with no applicable unit symbol the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: Four subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class type definition.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Must Not Intersect or Touch Interior	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Must Not Self-Intersect	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Must Not Overlap With	<i>FC_Abbrev</i> – Line	GLGA – All
Must Be Covered By Feature Class Of	<i>FC_Abbrev</i> – Line/Contact	GLGA – Contact
Must Be Covered By Feature Class Of	<i>FC_Abbrev</i> – Line/Fault/Contact	GLGA – Contact/Fault
Must Not Overlap With	<i>FC_Abbrev</i> – Line	FLT – All
Must Be Covered By Feature Class Of	<i>FC_Abbrev</i> – Line/Fault	FLT – Fault

RELATIONSHIP CLASSES:

Relationship Class Name: UNIT_ *FC Abbrev* _Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT
Primary Key Field: GLG_SYM
Destination Class Table: *FC Abbrev*
Foreign Key Field: GLG_SYM

Relationship Class Name: MAP_ *FC Abbrev* _Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: *FC Abbrev*
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the SORT_NO and POS fields (see field descriptions above) to represent and sort linear geologic units present in the data layer (as per age number, from youngest geologic unit to oldest geologic unit, then position domain value, as per domain order).

Feature symbology is partially derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A. Line color is as per source or defined geologic unit color value. For symbol customization linear dike units may utilize FGDC reference numbers 01.03.01 to 01.03.12.

SPECIAL FEATURE CLASS RULES:

- 1.) Coincidental Geologic Line Unit, Geologic Contact (GLGA) and Fault (FLT) Lines: Geologic Line Unit lines coincident with Fault (FLT) lines (FSUBTYPE = 1; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) feature class. Geologic Line Unit lines coincident with Geologic Contacts (GLGA) lines (FSUBTYPE = 2; see FSUBTYPE field description above) are present in this feature class as well as the Geologic Contacts (GLGA) feature class. Geologic Line Unit lines coincident with Fault (FLT) and Geologic Contact (GLGA) lines (FSUBTYPE = 3; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) and Geologic Contacts (GLGA) feature classes. Coincidence is maintained via topology rules (see Topology Rules above).
- 2.) Faulted Geologic Line Unit Directionality: Faulted geologic line unit lines (FSUBTYPE = 1 and FSUBTYPE = 3; see FSUBTYPE field description above) are captured with the down-thrown fault block, if applicable, on the 'right side' of the line. The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node', and moving to the line's end or 'to node'.
- 3.) Dikes and Other Linear Units Present Together: If both linear dikes and other non-dike linear units are present together one feature class (GLN) should be utilized and the feature class alias changed to Linear Geologic Units and Dikes.

- 4.) Subaqueous Lines: Geologic line units that are subaqueous (i.e., beneath water) should be attributed as inferred (POS = 7) and the text “subaqueous” added to the Notes field.

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FAULTS

Feature class consists of faults mapped as linear (line) features.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Faults (FLT)

SPATIAL TYPE: Line Feature Class

NUMBER OF ATTRIBUTE FIELDS: 12

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	–	–	–	–	–
SHAPE*	Geometry	Yes	–	–	–	–
FUID	Long Integer	No	–	0	–	–
FTYPE	Short Integer	No	Coded	0	–	–
FSUBTYPE ⁽³⁾	Short Integer	No	Subtype	0	–	–
POS	Short Integer	No	Coded	0	–	–
FNAME	Text	No	–	–	–	60
NOTES	Text	No	–	–	–	254
LBL	Text	Yes	–	–	–	60
SYM	Text	No	–	–	–	60
GMAP_ID ⁽¹⁾	Long Integer	No	–	0	–	–
SHAPE_Length*	Double	Yes	–	0	–	–

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(3) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FTYPE (Feature Type) Coded value (FLT_TYPE domain) used to differentiate fault type, as determined by fault separation/offset and/or displacement. Refer to the source map legend for graphical representation of faults, as well as the accompanying map notes and/or report on fault types.

Coded Domain Value	Definition
1	thrust fault
2	reverse fault
3	low-angle normal fault

Coded Domain Value	Definition
4	normal fault
5	right-lateral strike-slip fault
6	left-lateral strike-slip fault
7	reverse right-lateral strike-slip fault
8	reverse left-lateral strike-slip fault
9	normal right-lateral strike-slip fault
10	normal left-lateral strike-slip fault
11	unknown offset/displacement fault
12	high-angle reverse fault
13	detachment fault/decollement
14	high-angle fault
15	right-lateral fault, vertical displacement/offset unknown
16	left-lateral fault, vertical displacement/offset unknown
17	gravity slide plane
18	overturned thrust fault
19	high-angle right-lateral strike-slip fault
20	high-angle left-lateral strike-slip fault
21	overturned detachment fault/decollement
22	vertical fault
23	thrust right-lateral strike-slip fault
24	thrust left-lateral strike-slip fault
25	ductile fault
26	normal fault, horizontal displacement/offset unknown
27	fault scarp
28	shear zone
29	tear fault
30	tectonic slide
31	extensional fault
32	low-angle fault, unknown or unspecified displacement/offset
33	ductile shear zone
34	oblique, right-lateral, reverse slip fault
35	oblique, left-lateral, reverse slip fault
36	normal and/or oblique-slip fault
37	high-angle normal fault
38	right-lateral low-angle thrust fault
39	left-lateral low-angle thrust fault
40	right-lateral high-angle normal fault
41	left-lateral high-angle normal fault
42	low-angle thrust fault
43	right-lateral tear fault
44	left-lateral tear fault

FSUBTYPE (Feature Subtype) Designates fault lines that are simply fault lines or that are coincident with Geologic Contact (GLGA) lines.

Subtype Value	Definition
--------------------------	-------------------

Subtype Value	Definition
0	Fault (default value)
1	Fault/Contact (GLGA)

POS (Position) Coded value (LINE_POS domain) that designates the positional accuracy and/or concealment of a fault line. Refer to the source map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried

FNAME (Feature Name) Name of the fault, if any. Fault lines that contact a map edge may have a fault name indicated on an adjacent geologic map. Fault lines without an assigned name have a value of 'NA'.

NOTES (Notes) Text notes on feature. Calculate to "NA" if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For named fault lines the label should equal the fault name (i.e., FNAME field; see field description above). For unnamed fault lines the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: Two subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	FLT – All	FLT – All
Must Not Intersect or Touch Interior	FLT – All	FLT – All
Must Not Self-Intersect	FLT – All	FLT – All
Must Be Covered By Feature Class Of	FLT – Fault/Contact	GLGA – Contact/Fault
Must Not Overlap With ⁽¹⁾	FLT – Fault	GLGA – Contact

(1) Topology rule “GLGA–Contact Must Not Overlap With FLT – .Fault” also exists, and thus this topology rule is typically not implemented as the rule is redundant.

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_FLT_Relate
Relationship Type: Simple
Cardinality: One–to–Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: FLT
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the FTYPE and POS fields (see field descriptions above) to represent features in this data layer (sort feature type domain value, as per domain order, then position domain value, as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Faulted Contacts and Other Faulted Lines: Faulted contact lines (FLT_SUB = 1; see FSUBTYPE field description above) are present in the Faults (FLT) and Geologic Contact (GLGA) feature class. Fault lines may also be present in other contact feature classes, as well as linear unit features classes, however, coincidence is established and maintained (via topology rules) using subtypes and topology rules set up in those other feature classes and not in this feature class.
- 2.) Fault Line Directionality: Faults lines are captured with the down–thrown fault block, if applicable, on the ‘right side’ of the line. The ‘right’ and ‘left’ sides of a line are determined from ‘starting’ at the line’s ‘from node’, and moving to the line’s end or ‘to node’.
- 3.) Fault Observations and Symbology “Snapping”: Fault observations (e.g. fault dip; ATD FSUBTYPE values = 13 – 19; see Geologic Attitude Observation Localities (ATD) feature class), and certain fault symbology (SYM FSUBTYPE value = 0; see Fault, Fold and Other Map Symbology (SYM) feature class) are required to “snap” to the fault line where the observation was measured or where the fault–related symbology is present. At present, no topology rule is established in this feature class to enforce this rule.
- 4.) Subaqueous Lines: Fault lines that are subaqueous (i.e., beneath water) should be attributed as inferred (POS = 7) and the text “subaqueous” added to the Notes field.

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FOLDS

Feature class consists of linear fold axis and hinge lines.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Folds (FLD)

SPATIAL TYPE: Line Feature Class

NUMBER OF ATTRIBUTE FIELDS: 12

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
POS	Short Integer	No	Coded	0	—	—
PLUNGE	Short Integer	No	Coded	0	—	—
FNAME	Text	No	—	—	—	60
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	Yes	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FLD_ID (Unique Feature ID) Unique sequential identification number for each line. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FTYPE (Feature Type) Coded value (FLD_TYPE domain) used to differentiate fold type. Refer to the source map legend for graphical representation of folds, as well as the accompanying map notes and/or report on fold types.

Coded Domain Value	Definition
1	anticline
2	syncline
3	overturned anticline
4	overturned syncline
5	monocline, anticlinal bend
6	monocline, synclinal bend
7	antiform
8	synform
9	overturned antiform
10	overturned synform
11	neutral fold with vertical axis

Coded Domain Value	Definition
12	asymmetrical anticline
13	asymmetrical syncline
14	monocline
15	fold hinge length exposed at surface
16	hinge line
17	antiformal syncline
18	synformal anticline
19	cleavage trough
20	fold axis, fold type unknown or indeterminable
21	trace of axial surface
22	cleavage arch
23	tightly folded antiforms and synforms
24	line indicating distance between fold hinges exposed on the surface
25	foliation from line
26	inverted anticline
27	inverted syncline
28	antiform or synform
29	elongate dome

POS (Position) Coded value (LINE_POS domain) that designates the positional accuracy and/or concealment of a fold line. Refer to the source geologic map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried

PLUNGE (Plunge) A coded value (FLD_PLNG domain) that designates the attitude or inclination of a fold axis.

Coded Domain Value	Definition
1	unknown or undeterminable (default value)
2	plunging
3	double plunging
4	non-plunging (horizontal)

FNAME (Feature Name) Name of the fold, if any. Fold lines that contact a map edge may have a fold name indicated on an adjacent geologic map. Fold lines without an assigned name have a value of 'NA'.

NOTES (Notes) Text notes on feature. Calculate to "NA" if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For named fold lines the label should equal the fold name (i.e., FNAME field; see field description above). For unnamed fold lines the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: None presently exist for the FLD feature class. Subtypes (and associated topological rules) may be added if there is observed geological coincidence between features and geologic contacts or faults.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	FLD – All	FLD – All
Must Not Intersect or Touch Interior	FLD – All	FLD – All
Must Not Self-Intersect	FLD – All	FLD – All

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_FLD_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: FLD
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the FTYPE and POS fields (see field descriptions above) to represent folds present in the data layer (sort feature type domain value, as per domain order, then position domain value, as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A. Line color for all fold lines is 100% magenta.

SPECIAL FEATURE CLASS RULES:

- 1.) **Plunging Fold Lines:** Fold lines that end with a plunge arrow should extend to the 'tip' of the plunge arrowhead symbol. Plunging fold lines are to be captured in the direction of plunge, as indicated on the source map. Thus, the starting or 'from node' should be the 'starting point' of the line. If a fold is doubly plunging and there is no indicator or symbol that denotes where a fold axis changes plunge direction, then the fold should be split at a point that is approximately midway between the two fold plunge direction symbols (i.e. fold plunge arrowheads) that indicate the change in fold plunge direction. Fold lines should then plunge in the appropriate direction from this approximate point.
- 2.) **Fold Symbology "Snapping":** Fold symbology (SYM FSUBTYPE (Feature Subtype) value = 1; see Fault, Fold and Other Map Symbology (SYM) feature class) is required to "snap" to the related fold line. At present no topology rule is established in this feature class to enforce this rule.
- 3.) **Subaqueous Lines:** Folds that are subaqueous (i.e., beneath water) should be attributed as inferred (POS = 7) and the text "subaqueous" added to the Notes field.

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STRUCTURE CONTOUR, OTHER VALUE and RELATED SUBSURFACE LINES

Feature class consists of structure contour lines, other lines with an associated values (e.g. isopach thickness lines, paleotopography contour lines), and related subsurface lines (e.g. subsurface faults and folds that are related to structure contour lines).

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Structure Contour, Other Value, and Related Subsurface Lines (CN#)

SPATIAL TYPE: Line Feature Class

NUMBER OF ATTRIBUTE FIELDS: 13

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
FSUBTYPE ⁽³⁾	Short Integer	No	Subtype	0	—	—
POS	Short Integer	No	Coded	0	—	—
FVALUE	Long Integer	No	Coded	0	—	—
UNITS	Short Integer	No	Coded	0	—	—
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(3) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FTYPE (Feature Type) Coded value domains, associated with two subtypes (see FSUBTYPE field description below), are used to indicate the type of CN# line. Refer to the source map legend for graphical representation of these lines, as well as the accompanying map notes and/or report on line types.

Coded Domain Value	Definition	Name of Domain
1	structure contour line	CN_WITH_VALUE
2	paleotopography contour line	CN_WITH_VALUE
3	isopach line	CN_WITH_VALUE
4	subsurface fold	CN_WITHOUT_VALUE
5	subsurface fault	CN_WITHOUT_VALUE
6	aeromagnetic gradient line	CN_WITH_VALUE

Coded Domain Value	Definition	Name of Domain
7	strand line	CN_WITH_VALUE and CN_WITHOUT_VALUE
8	stream-terrace scarp	CN_WITH_VALUE and CN_WITHOUT_VALUE
9	depth to bedrock	CN_WITH_VALUE
10	structure datum boundary	CN_WITHOUT_VALUE
11	subsurface limit of geologic unit	CN_WITHOUT_VALUE
12	isochore line	CN_WITH_VALUE
13	depression structure contour line	CN_WITH_VALUE

FSUBTYPE (Feature Subtype) Designates feature lines that have an associated measured value (e.g. elevation and thickness), and feature lines that do not.

Subtype Value	Definition	Associated Domain for CN_TYPE (Feature Type)
0	Without Measurement	CN_WITHOUT_VALUE
1	With Measurement (default value)	CN_WITH_VALUE

POS (Position) Coded value (LINE_POS or LINE_LIMITED_POS domain) that designates the positional accuracy and/or concealment of a line. Refer to the source geologic map legend for graphical representation of line accuracy and concealment. For feature types with a subtype associated with a calculated value (With Measurement or CN_WITH_VALUE) such as a structure contour line, paleotopography line, isopach line, aeromagnetic gradient line or depth to bedrock line these use a more limited domain with values of just known or certain (POS = 1), or approximate (POS = 2). Structure datum boundary and subsurface limit of geologic unit lines also adopt this domain value range. For the remaining feature type values the position (POS) value is restricted to the remaining line position domain (LINE_POS domain), although some feature type values such as subsurface fold and subsurface fault are never considered concealed (POS = 3) or concealed and queried (POS = 6) based upon the fact that the feature is more calculated and projected at depth, and not ever “concealed” by a concealing geologic unit.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried

FVALUE (Feature Value) Value associated with CN# line (FSUBTYPE = 1; see FSUBTYPE field description above). Examples include elevation/contour values, and isopach thickness values. Assign 99999 if a CN# line is without a measurement value (FSUBTYPE = 0; see FSUBTYPE field description above).

UNITS (Units) Coded value (UNITS domain) that denotes the units of measure or value associated with a line (e.g. feet or meters; see FVALUE field description above).

Coded	
Domain Value	Definition
0	NA
1	meters
2	feet
3	centimeters

NOTES (Notes) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For lines with an applicable measurement value (i.e., FVALUE not equal to 99999 and thus FTYPE = 1; “With Measurement”) the field should be populated with that value. For lines populated with a FVALUE = 99999 (i.e., FTYPE = 0; “Without Measurement” or simply without any applicable value) the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

DOMAINS: The following domains exist for lines without a measured value (FVALUE) and related measurement value units (UNITS).

Domain Name (Value)	Domain Type	Applicable Attribute Field(s)	Associated Subtypes
NUM_NA_VALUE (99999)	–	FVALUE	Without Measurement
NA_UNITS (0)	Coded	UNITS	Without Measurement

SUBTYPES: Two subtypes, stored in the FSUBTYPE (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	CN# – All	CN# – All
Must Not Intersect or Touch Interior	CN# – All	CN# – All
Must Not Self-Intersect	CN# – All	CN# – All

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_CN#_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: CN#
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the FTYPE and POS fields (see field descriptions above) to represent lines present in the data layer (sort feature type domain value, as per domain order, then position domain value, as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Multiple CN# Feature Classes in a Feature Dataset: More than one CN# feature class may be required to capture all feature class lines if different “sets” of related lines (e.g. structure contour lines, as well as related subsurface fault and fold lines) are present. Each set of related lines (e.g. structure contour lines that “mark” the “top of Dakota Sandstone”) is considered to be a different CN# feature class within the feature dataset. The # in CN# denotes a number assigned to a structure contour or ‘other’ value line feature class, starting with the number 1 (e.g. CN1, CN2).
- 2.) Subaqueous Lines: Lines that are subaqueous (i.e., beneath water) should be attributed as inferred (POS = 7) and the text “subaqueous” added to the Notes field.

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GEOLOGIC CROSS SECTION LINES

Feature class consists of geologic cross section lines.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Cross Section Lines (SEC)

SPATIAL TYPE: Line Feature Class

NUMBER OF ATTRIBUTE FIELDS: 10

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
SEC_ABRV	Text	No	—	0	—	10
SRC_ABRV	Text	No	—	0	—	10
NOTES	Text	No	—	0	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line. The field values range from 1 to n, where n is the number of features/lines in the feature class.

SEC_ABRV (Section Abbreviation) Unique GRI map cross section abbreviation. To create a unique GRI cross section abbreviation a number is assigned to each source map with one or more cross sections (starting with the number “1”). This assigned source map number is then added after each letter of each cross section abbreviation. As an example, for first source map the number “1” is added after each letter of each cross section so that of A–A’ is changed to A1–A1’, B–B’ is changed to B1–B1’ and so on.

SRC_ABRV (Source Abbreviation) Cross section abbreviation (e.g. A–A’) on source map.

NOTES (Notes) Text notes on the cross section. Calculate to “see the GRI Ancillary Map Information Document (#code#_#maptype#.pdf) for the cross section graphic”.

LBL (Label) Text label for feature. For cross section lines the label should equal the cross section abbreviation (e.g., A–A’: see SEC_ABRV field description above). For cross section lines with no abbreviation the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: None presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	SEC – All	SEC – All
Must Not Intersect or Touch Interior	SEC – All	SEC – All

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_SEC_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: SEC
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes single feature symbolization, typically a thick black line, and thus is not dependent on any attribute field of the feature class.

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES: None presently exist for this feature class.

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LINEAR GEOLOGIC FEATURES and EXTENT LINES

Feature class definition consists of geologic features mapped as lines, as well as geologic extent lines. See the feature class name/alias (abbreviation) list below for additional information on what geologic features are represented by this feature class type definition.

TYPE: Multiple Feature Class Definition (9 Geologic Feature Classes Defined)

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Alteration and Metamorphic Lines (AML), Aquifer and Subsurface Water Lines (AQL), Glacial Feature Lines (GFL), Geologic Line Features (GLF), Hazard Feature Lines (HZL), Linear Joints (JLN), Observation, Observed Extent and Trend Lines (LIN), Mine Feature Lines (MFL) and Volcanic Line Features (VLF)

SPATIAL TYPE: Line Feature Class

NUMBER OF ATTRIBUTE FIELDS: 13

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
FSUBTYPE ⁽²⁾	Short Integer	No	Coded	0	—	—
POS	Short Integer	No	Coded	0	—	—
SENS ⁽³⁾	Short Integer	No	Coded	0	—	—
FNAME	Text	No	—	—	—	60
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
SHAPE_Length*	Double	Yes	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Denotes a Subtype field.

(3) The Sensitivity (SENS) field is only applicable with the Mine Feature Lines (MFL) feature class, and therefore the field is only present in this feature class.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each line. The field values range from 1 to n, where n is the number of features/lines in the feature class.

FTYPE (Feature Type) Coded value (domains listed below by feature class) used to differentiate the type of feature. Refer to the source map legend for graphical representation of these features, as well as the accompanying map notes and/or report.

Alteration and Metamorphic Lines (AML; AML_TYPE domain)

Coded Domain Value	Definition
1	metamorphic grade line (isograd lines)
2	linear contact metamorphic feature

Aquifer and Subsurface Water Lines (AQL; AQL_TYPE domain)

Coded Domain Value	Definition
1	general recharge to discharge flow line
2	recharge for buried aquifers

Glacial Features Lines (GFL; GFL_TYPE domain)

Coded Domain Value	Definition
1	moraine crest
2	glacial movement direction line
3	ridge crest of fluted landform or drumlin
4	glacial meltwater channel
5	crevasse
6	end moraine
7	orientation of drumlinoid feature
8	limit of ice extent/margin
9	esker
10	glacial terrace
11	kame-terrace scarp
12	rock glacier crest
13	long axis of drumlin
14	limit of glacial deposits
15	up-dip limit of geologic unit beneath glacial cover
16	glacial lake spillway
17	till ridge
18	moraine ridge
19	moraine scarp
20	glacial linear feature
21	glacial ridge
22	long axis of drumlin, direction of glacial ice movement indicated
23	generalized direction of glacial melt-water drainage
24	boundary between stratified drift deposits
25	kettle depression hachure
26	gaps or cols to which melt-water streams were graded
27	preglacial valley
28	glacial spillway channel margin
29	esker, transport direction known
30	limit of ice extent/margin, ice side known
31	glacially grooved or fluted till

Geologic Line Features (GLF; GLF_TYPE domain)

Coded Domain Value	Definition
1	lineament
2	escarpment
3	resistant bed
4	conspicuous bed
5	linear feature
6	terrace margin
7	channel edge
8	structural zone
9	aeromagnetic trend line
10	giant current ripples
11	spring line
12	seep line
13	closed depression
14	buried fluvial terrace riser
15	ridge crest/axis
16	garnet-bearing zone
17	fracture
18	quartz vein
19	calcium carbonate vein
20	outcrop
21	terrace
22	bedform crest
23	brecciated zone
24	abandoned channel
25	dune crest
26	blowout scarp
27	fossil beach
28	drainage from piedmont
29	comb-layered igneous rocks
30	abandoned channel
31	wave cut cliff
32	piedmonite-bearing layer
33	mineralized vein
34	abandoned beach and wave-cut bluff
35	river channel cut bank
36	bedrock ledge
37	fracture with offset
38	shattered rock
39	sackung
40	vein
41	relict cataract of flood event
42	marker bed
43	marine beach ridge or strandline
44	marine wave-cut scarp

Hazard Feature Lines (HZL; HZL_TYPE domain)

Coded Domain Value	Definition
1	sinkhole
2	landslide direction
3	height reached by mudflow event
4	avalanche track
5	top of landslide block
6	head of landslide
7	rockfall susceptibility line
8	debris flow susceptibility line
9	landslide escarpment/scarp
10	debris flow
11	gully
12	earth flow
13	slump direction
14	creep direction
15	mass movement sole
16	main toe of landslide
17	debris slide
18	tension scar
19	collapse structure
20	rock slide scarp

Linear Joints (JLN; JLN_TYPE domain)

Coded Domain Value	Definition
1	joint

Observation, Observed Extent and Trend Lines (LIN; LIN_TYPE domain)

Coded Domain Value	Definition
1	unconformity
2	paleoshoreline
3	stratigraphic section line
4	linear trend line
5	paleotopographic line
6	form line indicating general trend of bedding
7	general direction of transport of deposits
8	upland divide of watershed
9	extent of abundant dunes and blowouts
10	basin extent
11	providence extent
12	drainage divide
13	longitudinal dune orientation
14	point bar (fluvial) accretion
15	thalweg

Coded Domain Value	Definition
16	relict stream
17	flood plain confluence
18	paleochannel
19	generalized trend of foliation or schistosity
20	extent of flood event at maximum stage
21	flow direction of flood event
22	trend of dune field
23	dip direction of paleoscope
24	upper limit of marine submergence
25	form line

Mine Feature Lines (MFL; MFL_TYPE domain)

(MFL) Coded Domain Value (*)	Definition
1	contour strip/auger mine
2	fissure vein
3	quarry
4	excavated ditch, trench or waterway
5	placer mine
6	limit of excavation
7	strip mine

(*) All Mine Feature Lines (MFL) Feature Type (FTYPE) domain values are 'sensitive', and therefore the Sensitivity (SENS) field domain value needs to be 1 (sensitive feature).

Volcanic Line Features (VLF; VLF_TYPE domain)

Coded Domain Value	Definition
1	crater
2	pit crater
3	eruptive fissure
4	non-eruptive fissure
5	lava channel
6	lava pond
7	flow ridge, furrow, crack
8	flow direction line
9	crest line of crater
10	lava tube
11	caldera boundary
12	tuff ring
13	ash bed
14	prominent flow layering
15	trend of volcanic bedding
16	base of ash cloud deposits
17	top of surge beds
18	internal flow contact
19	lava ridge

Coded Domain Value	Definition
20	lava cascades
21	tuff marker bed
22	lava flow front

FSUBTYPE (Feature Subtype) Designates feature lines that are simply feature lines, feature lines that are coincident with Geologic Contacts (GLGA) lines, and/or that are coincident with Fault (FLT) lines.

Subtype Value	Definition
0	Feature (default value)
1	Feature/Fault (FLT)
2	Feature/Contact (GLGA)
3	Feature/Fault (FLT)/Contact (GLGA)

POS (Position) Coded value (LINE_POS domain) that designates the positional accuracy and/or concealment of a linear joint line. Refer to the source geologic map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain
2	approximate
3	concealed
4	queried
5	approximate and queried
6	concealed and queried
7	inferred
8	inferred and queried

SENS (Sensitivity) Coded value (SENS domain) that designates if a feature is considered a sensitive feature or a non-sensitive feature. The field is only present in the Mine Feature Lines (MFL) feature class, and as all Mine Feature Lines (MFL) features are considered 'sensitive' for data distribution purposes the value should always be "sensitive feature" (SENS = 1).

Coded Domain Value	Definition
1	sensitive feature

FNAME (Feature Name) Name of the feature, if any. Feature lines without an assigned name have a value of 'NA'.

NOTES (Notes) Text notes on feature. Calculate to "NA" if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For features with appropriate labeling text (e.g. Twelvemile Fissure) this text should populate this field. In some cases the type of feature (i.e., FTYPE field; see field description above) may serve as a label (e.g., Outcrop or Debris Flow; note that the case sensitivity was

changed to Title Case for labeling). For features with no desirable label text the field should be left blank with a <NULL> value.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: Four subtypes, stored in the FSUBTYPE (see field description above), presently exist for this feature class type definition.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Must Be Single Part	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Must Not Intersect or Touch Interior	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Must Not Self-Intersect	<i>FC_Abbrev</i> – All	<i>FC_Abbrev</i> – All
Must Not Overlap With	<i>FC_Abbrev</i> – Line	GLGA – All
Must Be Covered By Feature Class Of	<i>FC_Abbrev</i> – Line/Contact	GLGA – Contact
Must Be Covered By Feature Class Of	<i>FC_Abbrev</i> – Line/Contact/Fault	GLGA – Fault/Contact
Must Not Overlap With	<i>FC_Abbrev</i> – Line	FLT – All
Must Be Covered By Feature Class Of	<i>FC_Abbrev</i> – Line/Fault	FLT – Fault

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_ *FC_Abbrev* _Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: *FC_Abbrev*
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the FTYPE and POS fields (see field descriptions above) to represent features present in the data layer (sort feature type domain value, as per domain order, then position domain value, as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Coincidental Linear Geologic Features and Extent Lines, Geologic Contact (GLGA) and Fault (FLT) Lines: Linear Geologic Features and Extent Lines coincident with Fault (FLT) lines (FSUBTYPE = 1; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) feature class. Linear Geologic Features and Extent Lines coincident with Geologic Contacts (GLGA) lines (FSUBTYPE = 2; see FSUBTYPE field description above) are present in this feature class as well as the Geologic Contacts (GLGA) feature class. Linear Geologic Features and Extent Lines coincident with Fault (FLT) and Geologic Contact (GLGA) lines (FSUBTYPE = 3; see FSUBTYPE field description above) are present in this feature class as well as the Faults (FLT) and Geologic Contacts (GLGA) feature classes. Coincidence is maintained via topology rules (see Topology Rules above)
- 2.) Alteration and Metamorphic Line (AML) Directionality: Alteration and metamorphic lines (features that indicate alteration and/or metamorphic grade have the right-side of the line in the direction of lower grade (see FTYPE field description above). The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node', and moving to the line's end or 'to node'.
- 3.) Glacial Feature Line (GFL) Directionality: Glacial feature lines that represent or depict a direction of glacial ice movement (GFL FTYPE = 2; see FTYPE field description above), glacial meltwater channel flow (GFL FTYPE = 4 or GFL FTYPE = 28), or glacial sediment transport (GFL FTYPE = 29) are to be captured in the direction of movement, flow or transport, as indicated on the source map. Thus, the starting or 'from node' should be the 'starting point' of the line. For glacial feature lines with a slope or down-direction such as a crevasse (GFL FTYPE = 5) or till ridge (GFL FTYPE = 17), these feature lines are captured with the down-direction or slope on the 'right side' of the line (see FTYPE field description above). The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node' and moving to the line's 'end' or 'to node'.
- 4.) Hazard Feature Line (HZL) Directionality: Hazard feature lines that represent or depict a direction of movement, for example a landslide direction (HZL FTYPE = 2) or an avalanche track (HZL FTYPE = 4), are to be captured in the direction of movement, as indicated on the source map. Thus, the starting or 'from node' should be the 'starting point' of the line. For hazard feature lines with a slope or down-direction such as a sink hole (HZL FTYPE = 1), or height reached by a mudflow event (HZL FTYPE = 3), these feature lines are captured with the down-direction or slope on the 'right side' of the line (see FTYPE field above). The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node' and moving to the line's 'end' or 'to node'.
- 5.) Mine Feature Line (MFL) Directionality: For mine feature lines with a slope or down-direction such as a contour strip/auger mine (MFL FTYPE = 1), these feature lines are captured with the down-direction or slope on the 'right side' of the line (see FTYPE field above). The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node' and moving to the line's 'end' or 'to node'.
- 6.) Observation, Observed Extend and Trend Line (LIN) Directionality: General direction of transport of deposit lines (LIN FTYPE = 7), are to be captured in the direction of movement, as indicated on the source map (see FTYPE field description above).

- 7.) Volcanic Line Feature (VLF) Directionality: Flow direction lines (VLF FTYPE = 8) are to be captured in the direction of flow, as indicated on the source map. Thus, the starting or 'from node' should be the 'starting point' of the line. For crater lines (VLF FTYPE = 1), pit crater lines (VLF FTYPE = 2), flow ridge lines (VLF FTYPE = 7), crest line of crater (VLF FTYPE = 9), and caldera boundary (VLF FTYPE = 11) lines are captured with the down-direction or slope on the 'right side' of the line (see FYPTE field description above). The 'right' and 'left' sides of a line are determined from 'starting' at the line's 'from node' and moving to the line's 'end' or 'to node'.
- 8.) Subaqueous Lines: Lines that are subaqueous (i.e., beneath water) should be attributed as inferred (POS = 7) and the text "subaqueous" added to the Notes field.

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POINT FEATURE CLASSES

GEOLOGIC POINT UNITS

Feature class consists of geologic units mapped as point features.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Point Geologic Units (GPT)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 11

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
POS	Short Integer	No	Coded	0	—	—
GLG_SYM ⁽²⁾	Text	No	—	—	—	40
SRC_SYM	Text	No	—	—	—	40
SORT_NO	Double	No	—	0	0	8
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Relationship class foreign key field to UNIT table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of a point geologic unit. Refer to the source map legend for graphical representation of line accuracy and concealment.

Coded Domain Value	Definition
1	known or certain (default value)
2	approximate

GLG_SYM (Unit Symbol) Age–lithology symbol/code of the point geologic unit. The symbol/code is usually identical to the SRC_SYM (Source Unit Symbol) age–lithology symbol/code (see SRC_SYM field description below). The field is used as a foreign key field in a many–to–one relationship with the Geologic Unit Information (UNIT) table (see the Geologic Unit Information (UNIT) table definition, and this feature class’s Relationship Classes text below).

SRC_SYM (Source Unit Symbol) Source map age–lithology symbol/code of the point geologic unit. The symbol/code is usually identical to the GLG_SYM age–lithology symbol/code (see GLG_SYM field description above). Calculate to “NA” if there is no source unit symbol.

SORT_NO (Sort Number) Number used to sort geologic map units, typically from youngest (low) to oldest (high). Values assigned to each geologic unit are dependent on the geologic units that comprise the compiled NPS Unit geologic map. Subdivisions of geologic units are often denoted by assigning the same integer component of a decimal number to each division of the geologic unit and using the decimal fraction to differentiate the subdivisions.

NOTES (Notes) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. For geologic point units the label should equal the GLG_SYM field (see GLG_SYM field description above). For geologic point units with no applicable unit symbol the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many–to–one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: None presently exist for this feature class.

TOPOLOGICAL RULES: None presently exist for this feature class.

RELATIONSHIP CLASSES:

Relationship Class Name: UNIT_GPT_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT
Primary Key Field: GLG_SYM
Destination Class Table: GPT
Foreign Key Field: GLG_SYM

Relationship Class Name: MAP_GPT_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: GPT
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization is based upon the SORT_NO field (see field description above) to represent and sort, from youngest geologic unit to oldest geologic unit, geologic units present in the data layer.

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A. A point unit symbol maybe customized using a symbol other than a simple circular dot.

SPECIAL FEATURE CLASS RULES: None presently exist for this feature class.

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GEOLOGIC ATTITUDE OBSERVATION LOCALITIES

Feature class consists of attitude and fault attitude measurement observation localities.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Geologic Attitude Observation Localities (ATD)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 13

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
FSUBTYPE ⁽²⁾	Short Integer	No	Subtype	0	—	—
POS	Short Integer	No	Coded	0	—	—
ST	Short Integer	No	Range/Coded	0	—	—
DP	Short Integer	No	Range/Coded	0	—	—
NOTES	Text	No	—	—	—	254
AM_ROT	Short Integer	No	Range	0	—	—
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Coded value (see FSUBTYPE field description below for a list of FTYPE.domains) used to indicate the type of geologic attitude measurement or observation. Refer to the source geologic map legend for graphical representation of attitude features. FTYPE values are presently grouped into sixteen different coded value domains (presented below) which are associated with the sixteen different subtypes listed above. Definitions of attitude observations with a dip/plunge value between 1⁰ to 89⁰ are referred to as “inclined”.

Coded Domain Value	Definition	Name of Domain
1	strike and dip of inclined beds	ATD_PLANAR_TYPE
2	strike and dip of inclined overturned beds	ATD_PLANAR_TYPE
3	strike of vertical beds	ATD_PLANAR_VERT_TYPE
4	horizontal beds*%	ATD_PLANAR_HORIZ_TYPE
5	strike and dip of inclined beds, tops known from	ATD_PLANAR_TYPE

Coded Domain Value	Definition	Name of Domain
6	sedimentary structures strike and dip of inclined overturned beds, tops known from sedimentary structures	ATD_PLANAR_TYPE
7	strike and dip of inclined beds, tops known from sedimentary structures, dot indicates top of beds	ATD_PLANAR_TYPE
8	strike and dip of inclined variable bedding	ATD_PLANAR_TYPE
9	approximate strike and dip of inclined beds	ATD_PLANAR_TYPE
10	strike of beds, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
11	strike of overturned beds, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
12	strike of beds, tops known from sedimentary structures, amount of dip unspecified#	ATD_PLANAR_NODIP_TYPE
13	strike of variable bedding, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
14	approximate strike of beds, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
15	strike of variable vertical beds	ATD_PLANAR_VERT_TYPE
16	strike and dip of inclined beds in phacoids in shear zones	ATD_PLANAR_TYPE
17	strike and dip of inclined beds in phacoids in shear zones, tops known from sedimentary structures	ATD_PLANAR_TYPE
18	strike of beds in phacoids in shear zones, tops known from sedimentary structures, amount of dip unspecified#	ATD_PLANAR_NODIP_TYPE
19	strike and average dip of crumpled, plicated, crenulated, or undulatory beds	ATD_PLANAR_TYPE
20	strike and dip of inclined foliation parallel to bedding (coplanar)	ATD_PLANAR_TYPE
21	strike of vertical foliation parallel to bedding (coplanar)	ATD_PLANAR_VERT_TYPE
22	strike and dip of inclined variable bedding and foliation	ATD_PLANAR_TYPE
23	strike and dip of inclined foliation	ATD_PLANAR_TYPE
24	strike of vertical foliation	ATD_PLANAR_VERT_TYPE
25	horizontal foliation*%	ATD_PLANAR_HORIZ_TYPE
26	strike and dip of inclined variable foliation	ATD_PLANAR_TYPE
27	strike of foliation, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
28	strike of variable vertical foliation	ATD_PLANAR_VERT_TYPE
29	strike and dip of inclined joints	ATD_PLANAR_TYPE
30	strike of joints, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
31	strike of vertical joints	ATD_PLANAR_VERT_TYPE
32	trend and plunge of inclined lineation	ATD_LINEAR_TYPE
33	vertical lineation	ATD_LINEAR_VERT_TYPE
34	horizontal lineation	ATD_LINEAR_HORIZ_TYPE
35	trend of lineation, plunge unspecified#	ATD_LINEAR_NOPLUNGE_TYPE
36	strike and dip of inclined cleavage	ATD_PLANAR_TYPE
37	strike of cleavage, dip unspecified#	ATD_PLANAR_NODIP_TYPE
38	trend and plunge of inclined minor antiform	ATD_LINEAR_TYPE
39	trend and plunge of inclined minor synform	ATD_LINEAR_TYPE
40	trend of minor antiform, plunge amount unspecified#	ATD_LINEAR_NOPLUNGE_TYPE
41	trend of minor synform, plunge amount unspecified#	ATD_LINEAR_NOPLUNGE_TYPE

Coded Domain Value	Definition	Name of Domain
42	<NO FEATURE AT PRESENT>	
43	trend of oriented inclusions#	ATD_LINEAR_NOPLUNGE_TYPE
44	strike and dip of inclined layering or banding (compositional, flow)	ATD_PLANAR_TYPE
45	strike of vertical layering or banding (compositional, flow)	ATD_PLANAR_VERT_TYPE
46	<NO FEATURE AT PRESENT>	
47	fault dip amount, dip direction indicated	ATD_FLT_PLANAR_TYPE
48	<NO FEATURE AT PRESENT>	
49	<NO FEATURE AT PRESENT>	
50	<NO FEATURE AT PRESENT>	
51	vertical fault plane	ATD_FLT_PLANAR_VERT_TYPE
52	<NO FEATURE AT PRESENT>	
53	drag fold, hinge line of small fold#	ATD_LINEAR_NOPLUNGE_TYPE
54	dip of inclined contact, dip direction indicated*	ATD_PLANAR_TYPE
55	strike and dip of inclined contorted foliation	ATD_PLANAR_TYPE
56	strike of contorted vertical foliation	ATD_PLANAR_VERT_TYPE
57	<NO FEATURE AT PRESENT>	
58	<NO FEATURE AT PRESENT>	
59	<NO FEATURE AT PRESENT>	
60	<NO FEATURE AT PRESENT>	
61	<NO FEATURE AT PRESENT>	
62	<NO FEATURE AT PRESENT>	
63	<NO FEATURE AT PRESENT>	
64	<NO FEATURE AT PRESENT>	
65	<NO FEATURE AT PRESENT>	
66	<NO FEATURE AT PRESENT>	
67	<NO FEATURE AT PRESENT>	
68	<NO FEATURE AT PRESENT>	
69	strike and dip of inclined foliation, folded	ATD_PLANAR_TYPE
70	strike and dip of inclined foliation with inclusions	ATD_PLANAR_TYPE
71	strike of vertical foliation with inclusions	ATD_PLANAR_VERT_TYPE
72	dip of inclined overturned contact*	ATD_PLANAR_NOSTRIKE_TYPE
73	neutral fold with vertical fold axis#	ATD_LINEAR_VERT_TYPE
74	<NO FEATURE AT PRESENT>	
75	<NO FEATURE AT PRESENT>	
76	strike of layering (flow, compositional), dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
77	dip of inclined feature*	ATD_PLANAR_NOSTRIKE_TYPE
78	dip of inclined slickensides*	ATD_PLANAR_NOSTRIKE_TYPE
79	<NO FEATURE AT PRESENT>	
80	<NO FEATURE AT PRESENT>	
81	<NO FEATURE AT PRESENT>	
82	<NO FEATURE AT PRESENT>	
83	strike and dip of inclined axial plane of fold	ATD_PLANAR_TYPE
84	strike of vertical axial plane of minor fold	ATD_PLANAR_VERT_TYPE
85	trend and plunge of inclined minor fold axis	ATD_LINEAR_TYPE
86	trend of horizontal minor fold axis	ATD_LINEAR_HORIZ_TYPE
87	component of dip*	ATD_PLANAR_NOSTRIKE_TYPE

Coded Domain Value	Definition	Name of Domain
88	strike of approximately vertical joints	ATD_PLANAR_VERT_TYPE
89	strike and dip of inclined beds, inferred	ATD_PLANAR_TYPE
90	dip of anticlinal fold limb*	ATD_PLANAR_NOSTRIKE_TYPE
91	dip of synclinal fold limb*	ATD_PLANAR_NOSTRIKE_TYPE
92	dip of monoclinical fold limb*	ATD_PLANAR_NOSTRIKE_TYPE
93	<NO FEATURE AT PRESENT>	
94	<NO FEATURE AT PRESENT>	
95	paleocurrent direction indicator#	ATD_LINEAR_NOPLUNGE_TYPE
96	axis of m/w fold (crest of refolded fold)	ATD_LINEAR_TYPE
97	strike and dip of inclined dike	ATD_PLANAR_TYPE
98	strike of vertical dike	ATD_PLANAR_VERT_TYPE
99	trend and plunge of intersection between dominant foliation and bedding	ATD_LINEAR_TYPE
100	strike and dip of inclined vein	ATD_PLANAR_TYPE
101	strike of vertical vein	ATD_PLANAR_VERT_TYPE
102	strike and dip of fault zone	ATD_FLT_PLANAR_TYPE
103	trend of glacial striations#	ATD_LINEAR_NOPLUNGE_TYPE
104	strike and dip of sedimentary parting	ATD_PLANAR_TYPE
105	strike and dip of inclined igneous fabric	ATD_PLANAR_TYPE
106	strike of vertical cleavage	ATD_PLANAR_VERT_TYPE
107	strike and dip of inclined bedding and cleavage	ATD_PLANAR_TYPE
108	trend and plunge of intersection of bedding and cleavage	ATD_LINEAR_TYPE
109	trend and plunge of inclined slickenlines or grooves	ATD_LINEAR_TYPE
110	trend of horizontal intersection of bedding and cleavage	ATD_LINEAR_HORIZ_TYPE
111	minor fold of/in cleavage#	ATD_LINEAR_NOPLUNGE_TYPE
112	horizontal schistosity*%	ATD_PLANAR_HORIZ_TYPE
113	trend and plunge of intersection of cleavage and cleavage	ATD_LINEAR_TYPE
114	<NO FEATURE AT PRESENT>	
115	<NO FEATURE AT PRESENT>	
116	trend and plunge of inclined linear feature	ATD_LINEAR_TYPE
117	trend of horizontal linear feature	ATD_LINEAR_HORIZ_TYPE
118	trend and plunge of inclined crenulation	ATD_LINEAR_TYPE
119	strike and dip of inclined sheeting	ATD_PLANAR_TYPE
120	strike of vertical sheeting	ATD_PLANAR_VERT_TYPE
121	strike and dip of inclined schistosity	ATD_PLANAR_TYPE
122	strike of vertical schistosity	ATD_PLANAR_VERT_TYPE
123	strike and dip of inclined pseudo cleavage	ATD_PLANAR_TYPE
124	strike and dip of inclined extensional fractures	ATD_PLANAR_TYPE
125	horizontal cleavage*%	ATD_PLANAR_HORIZ_TYPE
126	strike and dip of fault as seen in outcrop	ATD_PLANAR_TYPE
127	trend and plunge of inclined fold axis	ATD_LINEAR_TYPE
128	trend and plunge of inclined minor anticline	ATD_LINEAR_TYPE
129	trend and plunge of inclined minor syncline	ATD_LINEAR_TYPE
130	trend and plunge of inclined minor asymmetric fold	ATD_LINEAR_TYPE
131	strike and dip of inclined inclusion	ATD_PLANAR_TYPE
132	strike of vertical inclusion	ATD_PLANAR_VERT_TYPE

Coded Domain Value	Definition	Name of Domain
133	horizontal inclusion*%	ATD_PLANAR_HORIZ_TYPE
134	strike of vertical extensional fractures	ATD_PLANAR_VERT_TYPE
135	strike of vertical fault as seen in outcrop	ATD_PLANAR_VERT_TYPE
136	<NO FEATURE AT PRESENT>	
137	dip of fault as seen in outcrop*	ATD_FLT_PLANAR_NOSTRIKE_TYPE
138	trend of horizontal intersection of cleavage and cleavage	ATD_LINEAR_HORIZ_TYPE
139	bearing and plunge of inclined sinistral fold	ATD_LINEAR_TYPE
140	bearing and plunge of inclined dextral fold	ATD_LINEAR_TYPE
141	<NO FEATURE AT PRESENT>, <NOW 20>	
142	strike of dike, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
143	bearing and plunge of inclined axis of columnar joints	ATD_LINEAR_TYPE
144	bearing and plunge of inclined axis of boudinage	ATD_LINEAR_TYPE
145	strike of vertical beds, tops known from sedimentary features	ATD_PLANAR_VERT_TYPE
146	strike of vertical foliation parallel to bedding, coplanar, tops known	ATD_PLANAR_TYPE
147	strike and dip of inclined shear planes	ATD_PLANAR_TYPE
148	strike of vertical shear planes	ATD_PLANAR_VERT_TYPE
149	strike and dip of inclined shear planes, strike variable	ATD_PLANAR_TYPE
150	strike of vertical shear planes, strike variable	ATD_PLANAR_VERT_TYPE
151	strike and dip of inclined foliation parallel to overturned bedding, coplanar	ATD_PLANAR_TYPE
152	no foliation apparent	ATD_OTHER_TYPE
153	strike of vertical foliation, dip variable	ATD_PLANAR_VERT_TYPE
154	strike of vertical foliation, strike variable	ATD_PLANAR_VERT_TYPE
155	strike and dip of inclined foliation, strike variable	ATD_PLANAR_TYPE
156	strike and dip of inclined foliation, dip variable	ATD_PLANAR_TYPE
157	strike of vertical cataclastic foliation	ATD_PLANAR_VERT_TYPE
158	strike of cataclastic foliation, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
159	direction of increasing grain size#	ATD_LINEAR_NOPLUNGE_TYPE
160	strike of vertical secondary foliation in plutonic rocks	ATD_PLANAR_VERT_TYPE
161	inclined cataclastic foliation with variable strike	ATD_PLANAR_TYPE
162	vertical cataclastic foliation with variable strike	ATD_PLANAR_VERT_TYPE
163	vertical dike with variable strike	ATD_PLANAR_VERT_TYPE
164	vertical contact	ATD_PLANAR_VERT_TYPE
165	top of beds known from sedimentary structures#	ATD_PLANAR_NODIP_TYPE
166	strike of foliation and bedding, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
167	dip direction of contact, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
168	trend of slickenlines or grooves, plunge amount unspecified#	ATD_LINEAR_NOPLUNGE_TYPE
169	strike of shear planes, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
170	strike of shear planes, strike variable, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE

Coded Domain Value	Definition	Name of Domain
171	strike of overturned beds, tops known from sedimentary structures, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
172	horizontal dike	ATD_PLANAR_HORIZ_TYPE
173	foliation present but widely variable	ATD_OTHER_TYPE
174	fault dip direction, dip amount unspecified#	ATD_FLT_PLANAR_NODIP_TYPE
175	strike of variable foliation, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
176	strike and dip of inclined foliation, dip steep but uncertain#	ATD_PLANAR_NODIP_TYPE
177	strike and dip of inclined ductile foliation	ATD_PLANAR_TYPE
178	strike of vertical ductile foliation	ATD_PLANAR_VERT_TYPE
179	strike and dip of inclined ductile foliation, dip steep but uncertain#	ATD_PLANAR_NODIP_TYPE
180	strike of vertical ductile foliation, dip variable	ATD_PLANAR_VERT_TYPE
181	strike and dip of inclined ductile foliation, strike variable	ATD_PLANAR_TYPE
182	strike and dip of inclined ductile foliation, dip variable	ATD_PLANAR_TYPE
183	strike and dip of inclined ductile foliation, strike and dip variable	ATD_PLANAR_TYPE
184	strike of ductile foliation, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
185	strike of inclined foliation, strike variable and dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
186	cleavage present but widely variable	ATD_OTHER_TYPE
187	strike and dip of overturned inclined schistosity	ATD_PLANAR_TYPE
188	strike and dip of inclined crenulated schistosity	ATD_PLANAR_TYPE
189	strike of vertical layering parallel to foliation	ATD_PLANAR_TYPE
190	trend of minor fold axis, plunge amount unspecified#	ATD_LINEAR_NOPLUNGE_TYPE
191	strike and dip of inclined cataclastic foliation with dip	ATD_PLANAR_TYPE
192	fold plunge amount	ATD_FLD_LINEAR_TYPE
193	trend of sedimentary structure	ATD_LINEAR_NOPLUNGE_TYPE
194	strike of foliation or trend of lineation, dip or plunge unknown	ATD_PLANAR_NODIP_TYPE
195	trend of glacial movement	ATD_LINEAR_NOPLUNGE_TYPE
196	trend and plunge of inclined overturned minor anticline	ATD_LINEAR_TYPE
197	trend and plunge of inclined overturned minor syncline	ATD_LINEAR_TYPE
198	trend and plunge of inclined overturned minor monocline	ATD_LINEAR_TYPE
199	strike of vertical beds, strike variable	ATD_PLANAR_VERT_TYPE
200	trend of minor anticline	ATD_LINEAR_NOPLUNGE_TYPE
201	trend of minor syncline	ATD_LINEAR_NOPLUNGE_TYPE
202	direction of dip, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
203	apparent dip of beds, dip direction indicated	ATD_PLANAR_TYPE
204	strike and dip of inclined kink plane	ATD_PLANAR_TYPE
205	strike of inclined kink plane, dip amount	ATD_PLANAR_NODIP_TYPE

Coded Domain Value	Definition	Name of Domain
	unspecified#	
206	trend of crenulation, plunge amount unspecified	ATD_LINEAR_NOPLUNGE_TYPE
207	strike of inclined schistosity, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
208	strike of minor fault, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
209	strike and dip of minor fault	ATD_PLANAR_TYPE
210	trend and plunge of schisto elongation	ATD_LINEAR_TYPE
211	strike and dip of inclined foliation or cleavage	ATD_PLANAR_TYPE
212	strike of vertical crumpled bedding	ATD_PLANAR_VERT_TYPE
213	strike and dip of inclined graded bedding	ATD_PLANAR_TYPE
214	strike and dip of inclined contact	ATD_PLANAR_TYPE
215	strike and dip of inclined tectonic fabric	ATD_PLANAR_TYPE
216	trend and plunge of inclined intersection of Sn and Sn + 1	ATD_LINEAR_TYPE
217	trend and plunge of inclined intersection of Sn + 1 and Sn + 2	ATD_LINEAR_TYPE
218	strike of inclined axial plane of fold, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
219	trend of inclined fold axis, plunge amount unspecified	ATD_LINEAR_NOPLUNGE_TYPE
220	direction of dip of limbs and plunge	ATD_FLD_LINEAR_NOPLUNGE_TYPE
221	dip of vein, dip direction indicated	ATD_LINEAR_TYPE
222	dip of dike, dip direction indicated	ATD_LINEAR_TYPE
223	trend of intersection of bedding and cleavage, plunge amount unspecified	ATD_LINEAR_NOPLUNGE_TYPE
224	strike and dip of inclined mylonitic foliation	ATD_PLANAR_TYPE
225	approximately horizontal shear planes	ATD_PLANAR_HORIZ_TYPE
226	strike and dip of bedding, estimated from aerial photographs	ATD_PLANAR_TYPE
227	horizontal slickenside	ATD_PLANAR_HORIZ_TYPE
228	trend of horizontal slickenline	ATD_LINEAR_HORIZ_TYPE
229	strike and dip of volcanic flows	ATD_PLANAR_TYPE
230	approximate strike and dip of volcanic flows	ATD_PLANAR_TYPE
231	minor shear fault, right-lateral, showing dip	ATD_PLANAR_TYPE
232	minor shear fault, right-lateral, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
233	minor shear fault, left-lateral, showing dip	ATD_PLANAR_TYPE
234	minor shear fault, left-lateral, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
235	trend of antiform	ATD_FLD_LINEAR_NOPLUNGE_TYPE
236	trend of synform	ATD_FLD_LINEAR_NOPLUNGE_TYPE
237	trend of overturned antiform	ATD_FLD_LINEAR_NOPLUNGE_TYPE
238	trend of overturned synform	ATD_FLD_LINEAR_NOPLUNGE_TYPE
239	approximate strike and dip of inclined crinkled or deformed foliation	ATD_PLANAR_TYPE
240	approximate strike of vertical foliation crinkled or deformed	ATD_PLANAR_VERT_TYPE
241	approximate strike and dip of inclined crenulated or warped bedding	ATD_PLANAR_TYPE

Coded Domain Value	Definition	Name of Domain
242	approximate strike of vertical crenulated or warped bedding	ATD_PLANAR_VERT_TYPE
243	strike of vertical bedding in phacoids in shear zones	ATD_PLANAR_VERT_TYPE
244	approximate strike and direction of dip of crenulated or warped bedding	ATD_PLANAR_NODIP_TYPE
245	direction and dip of limbs	ATD_FLD_LINEAR_NOPLUNGE_TYPE
246	trend of horizontal minor antiform	ATD_FLD_LINEAR_HORIZ_TYPE
247	trend of horizontal minor synform	ATD_FLD_LINEAR_HORIZ_TYPE
248	strike and dip of inclined cleavage and/or schistosity	ATD_PLANAR_TYPE
249	strike of vertical cleavage and/or schistosity	ATD_PLANAR_VERT_TYPE
250	trend of stones in glacial till	ATD_LINEAR_NOPLUNGE_TYPE
251	trend of oblique fault slip	ATD_FLT_LINEAR_NOPLUNGE_TYPE
252	minor shear fault, right-lateral, vertical	ATD_PLANAR_VERT_TYPE
253	minor shear fault, left-lateral, vertical	ATD_PLANAR_VERT_TYPE
254	axial trace of bedding surface	ATD_LINEAR_NOPLUNGE_TYPE
255	strike of ripple marks	ATD_PLANAR_NODIP_TYPE
256	strike of vertical igneous fabric	ATD_PLANAR_VERT_TYPE
257	direction of dip, dip amount specified	ATD_PLANAR_TYPE
258	trend and plunge of inclined overturned antiform	ATD_FLD_LINEAR_TYPE
259	strike and dip of inclined contorted bedding/layering	ATD_PLANAR_TYPE
260	strike and dip of inclined igneous flow foliation	ATD_PLANAR_TYPE
261	strike of vertical igneous flow foliation	ATD_PLANAR_VERT_TYPE
262	direction of flow	ATD_LINEAR_NOPLUNGE_TYPE
263	strike and dip of inclined main schistosity, foliation or cleavage	ATD_PLANAR_TYPE
264	strike of vertical bedding and cleavage	ATD_PLANAR_VERT_TYPE
265	trend and plunge associated with shear bands	ATD_LINEAR_TYPE
266	strike of bedding, estimated from aerial photographs, dip amount unspecified	ATD_PLANAR_NODIP_TYPE
267	strike and dip of inclined foliation or schistosity	ATD_PLANAR_TYPE
268	strike of vertical foliation or schistosity	ATD_PLANAR_VERT_TYPE
269	horizontal foliation or schistosity	ATD_PLANAR_HORIZ_TYPE
270	strike and dip of inclined crenulation cleavage	ATD_PLANAR_TYPE
271	horizontal mylonitic foliation	ATD_PLANAR_HORIZ_TYPE
272	strike of vertical mylonitic foliation	ATD_PLANAR_VERT_TYPE
273	trend and plunge of inclined mineral lineation	ATD_LINEAR_TYPE
274	trend of horizontal vein	ATD_LINEAR_HORIZ_TYPE
275	trend and plunge of cross-cutting relationship	ATD_LINEAR_TYPE
276	trend of horizontal cross-cutting relationship	ATD_LINEAR_HORIZ_TYPE
277	strike and dip of inclined eutaxitic structure	ATD_PLANAR_TYPE
278	strike of vertical eutaxitic structure	ATD_PLANAR_VERT_TYPE
279	strike and dip of inclined fracture cleavage	ATD_PLANAR_TYPE
280	strike of vertical fracture	ATD_PLANAR_VERT_TYPE
281	trend and plunge of inclined hinge line	ATD_LINEAR_TYPE
282	strike of vertical kink plane	ATD_PLANAR_VERT_TYPE
283	strike and dip of inclined spaced cleavage	ATD_PLANAR_TYPE
284	strike and dip of inclined dike, pegmatite or vein	ATD_PLANAR_TYPE
285	strike and dip of overturned inclined layering	ATD_PLANAR_TYPE
286	trend and plunge of inclined crenulation axis	ATD_LINEAR_TYPE

Coded Domain Value	Definition	Name of Domain
287	trend and plunge of inclined lineament element	ATD_LINEAR_TYPE
288	trend and plunge of inclined intersection lineation	ATD_LINEAR_TYPE
289	horizontal joints	ATD_PLANAR_HORIZ_TYPE
290	trend and plunge of drag fold	ATD_FLD_LINEAR_TYPE
291	strike of vertical crenulation cleavage	ATD_PLANAR_VERT_TYPE
292	dip direction and dip of anticlinal fold limb	ATD_FLD_LINEAR_TYPE
293	dip direction of gently dipping beds	ATD_LINEAR_NOPLUNGE_TYPE#
294	approximate strike of crumpled or undulated beds, dip amount unspecified	ATD_PLANAR_NODIP_TYPE#
295	strike of vertical fault zone	ATD_FLT_PLANAR_VERT_TYPE
296	NO FEATURE AT PRESENT>, <NOW 21>	
297	vertical axis of m/w fold	ATD_LINEAR_VERT_TYPE
298	<NO FEATURE AT PRESENT>, <NOW 146>	
299	<NO FEATURE AT PRESENT>, <NOW 151>	
300	average trend of crossbedding	ATD_LINEAR_NO_PLUNGE_TYPE
301	strike of inclined contorted foliation, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
302	strike of inclined foliation or schistosity, dip amount unspecified#	ATD_PLANAR_NODIP_TYPE
303	dip direction of vein, dip amount unspecified	ATD_LINEAR_NO_PLUNGE_TYPE
304	direction of apparent dip of beds, dip unspecified	ATD_PLANAR_NODIP_TYPE
305	strike dip of inclined locally folded or deformed beds	ATD_PLANAR_TYPE
306	strike and dip of basalt flow or sedimentary bedding	ATD_PLANAR_TYPE
307	estimated strike and dip of basalt flow	ATD_PLANAR_TYPE
308	dip direction of crossbedding	ATD_LINEAR_NOPLUNGE
309	vertical minor fold axis	ATD_LINEAR_VERT_TYPE
310	strike and dip of folded axial surface of minor fold	ATD_PLANAR_TYPE
311	strike and dip of inclined gneissosity	ATD_PLANAR_TYPE
312	strike of vertical gneissosity	ATD_PLANAR_VERT_TYPE
313	strike and dip of inclined overturned graded bedding	ATD_PLANAR_TYPE
314	trend and plunge of rods or object lineations	ATD_LINEAR_TYPE
315	strike and dip of inclined sill	ATD_PLANAR_TYPE
316	trend of vertical intersection lineation	ATD_LINEAR_VERT_TYPE
317	strike and dip of inclined bedding and volcanic flows	ATD_PLANAR_TYPE
318	strike and dip of inclined volcanic breccia and volcanic flows	ATD_PLANAR_TYPE
319	strike and dip of inclined bed and dike	ATD_PLANAR_TYPE
320	horizontal bed and dike	ATD_PLANAR_HORIZ_TYPE
321	horizontal mineral lineation	ATD_LINEAR_HORIZ_TYPE

Attitude types with non-applicable strike/trend value are denoted with an asterisk (*), (see ST field description below). Attitude types with non-applicable dip/plunge value are denoted with a number or pound sign (#), (see DP field description below). Attitude types with a non-applicable rotation value (see AM_ROT field descriptions below) are denoted with a percent sign (%).

FSUBTYPE (Feature Subtype) Subtype to group related attitude measurements and observation points based on their type (planar, linear, symbol, other measurement), strike (unconstrained or no strike), dip (unconstrained, vertical, horizontal or no strike), and/or if a fault or fold observation that is associated

with a fault or fold line. These latter subtypes, those associated with a fault or fold line, should be “snapped” to the associated line feature. A subtype value in parentheses represents a subtype value in data model v. 1.2. Fault, fold and other map symbology is now in the Faults, Folds and Other Map Symbology (SYM) feature class (see Faults, Folds and Other Map Symbology (SYM) feature class).

Subtype Value	Definition	Associated Domain for FTYPE (Feature Type)
0	Planar Measurement	ATD_PLANAR_TYPE
1	Planar Measurement – Vertical	ATD_PLANAR_VERT_TYPE
2	Planar Measurement – Horizontal	ATD_PLANAR_HORIZ_TYPE
3	Planar Measurement – No Dip	ATD_PLANAR_NODIP_TYPE
4	Planar Measurement – No Strike	ATD_PLANAR_NOSTRIKE_TYPE
5	Linear Measurement	ATD_LINEAR_TYPE
6	Linear Measurement – Vertical	ATD_LINEAR_VERT_TYPE
7	Linear Measurement – Horizontal	ATD_LINEAR_HORIZ_TYPE
8	Linear Measurement – No Plunge	ATD_LINEAR_NOPLUNGE_TYPE
9 (12)	Other Observation	ATD_OTHER_TYPE
10 (13)	Fault Planar Measurement	ATD_FLT_PLANAR_TYPE
11 (14)	Fault Planar Measurement – Vertical	ATD_FLT_PLANAR_VERT_TYPE
12 (15)	Fault Planar Measurement – No Strike	ATD_FLT_PLANAR_NOSTRIKE_TYPE
13 (16)	Fault Planar Measurement – No Dip	ATD_FLT_PLANAR_NODIP_TYPE
14 (17)	Fault Linear Measurement	ATD_FLT_LINEAR_TYPE
15 (18)	Fault Linear Measurement – Vertical	ATD_FLT_LINEAR_VERT_TYPE
16	Fold Linear Measurement	ATD_FLD_LINEAR_TYPE
17	Fold Linear Measurement – No Plunge	ATD_FLD_LINEAR_NOPLUNGE_TYPE
18	Fold Linear Measurement – Horizontal	ATD_FLD_LINEAR_HORIZ_TYPE
19	Fault Linear Measurement – No Plunge	ATD_FLT_LINEAR_NOPLUNGE_TYPE

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of a geologic attitude or observation locality. Refer to the source geologic map legend for feature positional accuracy

Coded Domain Value	Definition
1	known or certain (default value)
2	approximate

ST (Strike/Trend) The azimuth value for strike (planar measurements) or trend (linear measurements). The value ranges from 0° (north) clockwise to 359° (STRIKE_ROTATION domain). For strike measurements, the azimuth value is determined using the right-rule method, dip direction 90° clockwise from the strike azimuth. For attitude types with non-applicable strike/trend value, horizontal attitude observations or fault and fold point symbology, denoted in the FTYPE Coded Value list with an asterisk (*) (see FTYPE field description above) and assigned a value of 999 (ATD_NA_STRIKE domain).

DP (Dip/Plunge) The dip (planar measurements) or plunge (linear measurements) value associated with the attitude observation. The value ranges from 0° to 90°, and includes 99 for non-applicable attitude types. The ATD_DP domain contains values from 1° to 89° and applies to all inclined attitude observations, excluding those observations that are vertical, horizontal or have a non-applicable dip. The ATD_VERT domain contains a value of 90° for vertical attitudes; the ATD_HORIZ domain contains a value of 0° for horizontal attitudes; and the ATD_NA_DP domain contains a value of 99 for attitude types with a non-applicable dip/plunge. Attitude types with non-applicable dip/plunge values, including fault

and fold point symbology, and non-determined or undeterminable attitude types are denoted in the FTYPE Coded Value list with a pound sign (#), (see FTYPE field description above). If a range of dip or plunge measurements is present on the source map, enter the average of the value range, rounding fractions up.

NOTES (Notes) Text notes on locality.

AM_ROT (ArcMap Rotation) A value that represents the rotation of an attitude or observation point feature symbol in ArcMap so that the feature symbol corresponds to the source map's representation of that feature. The rotation value is dependent on the attitude type (see FTYPE field description above), the ArcMap symbology, the default or non-rotated symbol orientation, the rotation rule (i.e. either 'geographic' or 'arithmetic' in ArcMap), and the orientation of the feature. As the rotation value for geologic Attitude Observation points with strike/trend values is equal to a 'geographic' rule rotation (0° is north with clockwise rotation to 359°) this rule is 'preferred' in displaying symbology in ArcMap. The value ranges from 0° (non-rotated or north) to 359° (STRIKE_ROTATION domain). Attitude types with a non-applicable rotation value are assigned a rotation value of 0 (non-rotated), and are denoted in the FTYPE Coded Value list with a percent sign (%), (see FTYPE field description above). For attitude types with an applicable rotation value, the value can either be determined from a strike/trend azimuth value if known or determinable and applicable, by measuring the feature's attitude or orientation directly from the source map, or by entering a rotation value so that the feature's symbol representation rotates to correspond with the source map's image representation of that feature. (see ST field description above, and Special Feature Class Rules below).

LBL (Label) Text label for feature. For geologic Attitude Observation points with applicable dip/plunge values ranging from 1° to 89° degrees, see DP field description above) the field is calculated to the dip/plunge (DP) value. For attitude types with a non-applicable dip/plunge value, or a horizontal (0°) or vertical (90°) dip/plunge value, a <NULL VALUE> is assigned.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

DOMAINS: The following domains exist for the ST, DP, and AM_ROT fields (see field descriptions above).

Domain Name (Values)	Domain Type	Applicable Attribute Field(s)	Associated Subtypes; Abbreviated Name (subtype number)
ATD_DP (1–89)	Range	DP	Planar Meas. (0), Planar Meas. No Strike (4), Linear Meas. (5), Fault Planar Meas. (10), Fault Planar No Strike (12), Fault Linear (14) and Fold Linear (16)
ATD_HORIZ (0)	Coded	DP	Planar Meas. Horiz. (2) and Linear Meas. Horiz. (7)
ATD_NA_DP (99)	Coded		Planar Meas. No Dip (3), Linear Meas.

Domain Name (Values)	Domain Type	Applicable Attribute Field(s)	Associated Subtypes; Abbreviated Name (subtype number)
		DP	No Plunge (8), Other Meas. (9) and Fault Planar No Dip (13)
ATD_NA_ST (999)	Coded	ST	Planar Meas. Horiz. (2), Planar Meas. No Strike (4), Linear Meas. Vert. (6), Other Meas. (9), Fault Planar No Strike (12) and Fault Linear Vert. (15)
ROTATION (0–359)	Range	AM_ROT	All subtypes except Planar Meas. Horiz. (2) and NA Strike subtypes (4 and 12)
STRIKE_ROTATION (0–359)	Range	ST	All subtypes except Planar Meas. Horiz. (2), NA Strike subtypes (4 and 12), Linear Meas. Vert. (11) and Fault Linear Vert. (15)
ATD_VERT (90)	Coded	DP	Planar Meas. Vert. (1), Linear Meas. Vert. (6), Fault Planar Vert. (11) and Fault Linear Vert. (15)

Note: Domains for FTYPE (see field description above) are listed with subtypes under the FSUBTYPE field (see field description above).

SUBTYPES: Sixteen subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Point Must Be Covered By Line	ATD – All ATD_FLT subtypes	FLT – All
Point Must Be Covered By Line	ATD_FLD_LINEAR_TYPE	FLD

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_ATD_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: ATD
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the FTYPE field (see field description above) to represent and sort (as per domain order) attitude and fault measurement observations localities present in the data layer. If needed, the POS field (see field description above) may be utilized as well (feature type domain value, as per domain order, then position domain value, as per domain order). Feature

symbolization rotation (if applicable) uses the AM_ROT field (see field description above) using the ‘geographic’ rule for rotation (0° is north with clockwise rotation to 359°).

Feature symbology is partially derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Geologic Attitude Observation Locality (ATD) Point Placement: For most attitude point types, placement of a digitized point is at the center of the point’s graphical symbol. Refer to the source map legend and/or the source map publisher’s cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.
- 2.) Multiple Attitude Observations at a Locality: Attitude observations observed/measured at the same locality (e.g. strike and dip of foliation and trend and plunge of lineation) are each captured as individual points. The points are also required to “snap” to one another ensuring the same locality for each observation.
- 3.) Feature Symbol Rotation and Strike/Trend Azimuth Values: A rotation value is used to correctly orient attitude feature symbols in ArcMap, as mentioned in the AM_ROT field descriptions presented above. For many geologic Attitude Observation points, a directional component or azimuth, either strike or trend, measured at the locality, is conveyed in the graphical orientation of that feature on the source map, and is therefore directly related to a value that rotates the orientation of that feature’s symbol. Thus, it is possible to determine the ST value from a rotation field(s), and vice versa.
- 4.) Fault Measurements “Snapping”: Fault measurements (ATD_FLT subtypes; FSUBTYPE (subtype) values 9–15) are required to “snap” to the fault line where the observation was measured (fault observations).

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GEOLOGIC OBSERVATION LOCALITIES

Feature class consists of stratigraphic section, measured section, geologic photographic and other observation-type localities.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Geologic Observation Localities (GOL)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 12

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
POS	Short Integer	No	Coded	0	—	—
SENS	Short Integer	No	Coded	0	—	—
LOC_ID	Text	No	—	—	—	40
NOTES	Text	No	—	—	—	254
AM_ROT	Short Integer	No	Range	0	—	—
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Coded value (GOL_TYPE domain) used to indicate the type of geologic observation locality. Refer to the source geologic map legend for graphical representation of geologic observation locality.

Coded Value	Definition
1	stratigraphic section locality
2	geologic photograph locality
3	type section locality
4	observation locality
5	contact exposed and/or accurately located locality
6	observed small-scale fault or shear zone
7	observed sedimentary parting
8	measured section locality
9	typical exposure
10	observed mylonite locality

Coded Value	Definition
11	hydrologic observation locality
12	stratified slope deposit
13	sense of offset change on scissor fault
14	highly deformed rock
15	dike width
16	joint measurement station
17	observed float
18	spot elevation
19	observed bed/layer
20	field verification locality
21	outcrop locality <i>** also in GPF, need to check</i>
22	location of evidence for maximum stage of flood event
23	stream loss zone
24	trench site
25	pebble-count locality

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of geologic observation locality. Refer to the source geologic map legend for feature positional accuracy.

Coded Value	Definition
1	known or certain (default value)
2	approximate

SENS (Sensitivity) Coded value (SENS domain) that designates if a geologic observation locality is considered a sensitive feature or a non-sensitive feature. A feature is assumed “non-sensitive” (SENS = 0) unless otherwise denoted. Feature type (FTYPE) values that are typically or always considered ‘sensitive’ for data distribution purposes are denoted with a (*) in the Feature Type (FTYPE) domain listing.

Coded Value	Definition
0	non-sensitive feature (default value)
1	sensitive feature

LOC_ID (Locality ID) Locality identification (ID) number indicated on source map (e.g. 1). “NA” is assigned if not available.

NOTES (Notes) Text notes on locality.

AM_ROT (ArcMap Rotation) A value that represents the rotation of a geologic observation locality symbol in ArcMap so that the feature’s symbol corresponds to the source map’s representation of that feature. The rotation value is dependent on the feature type (see FTYPE field description above), the ArcMap symbology, the default or non-rotated symbol orientation, the rotation rule (i.e. either ‘geographic’ or ‘arithmetic’ in ArcMap), and the orientation of the feature. The rotation value ranges from 0° (non-rotated or north) to 359° (ROTATION domain). For geologic observation localities a rotation value can either be determined by measuring the symbol’s attitude or orientation directly from the source map, or by entering a rotation value so that the feature’s symbol representation rotates to

correspond with the source map's image representation of that feature (see Special Feature Class Rules below).

LBL (Label) Text label for locality. Often this will be the locality ID (LOC_ID field, see field description above) should one exist. For features with no applicable value the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

SUBTYPES: None presently exist for this feature class.

TOPOLOGICAL RULES: None presently exist for this feature class.

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_GOL_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: GOL
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the FTYPE field (see field description above) to represent and sort (as per domain order) geologic observation localities present in the data layer. If needed, the POS (see field description above) field may be utilized as well (feature type domain value, as per domain order, then position domain value, as per domain order). Symbolization rotation (if applicable) uses the AM_ROT field (see field description above) using the 'geographic' rule for rotation (0° is north with clockwise rotation to 359°).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) **Geologic Observation Locality (GOL) Point Placement:** For most geologic observation locality points, placement of a digitized point is at the center of the point's graphical symbol on the source map. Refer to the source map legend and/or the source map publisher's cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.

- 2.) Geologic Observation Localities with Associated Azimuth or General Direction: For geologic observations that have directional component, an azimuth (e.g. 0–360°) should exist in the AM_ROT field (see field description above). The general direction (e.g. north–northwest or east–southeast) associated with a locality should also be indicated in the NOTES field (see field description above). An example of a geologic observation locality with a directional component is a geologic photograph localities (FTYPE = 2; see FTYPE field description above) which often has an associated azimuth and general direction that indicates the view direction of the photograph.

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GEOLOGIC MEASUREMENT LOCALITIES

Feature class consists of unit thickness and fault displacement measurement as well as feature count and elevation “point” localities.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Geologic Measurement Localities (GML)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 16

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	–	–	–	–	–
SHAPE*	Geometry	Yes	–	–	–	–
FUID	Long Integer	No	–	0	–	–
FTYPE	Short Integer	No	Coded	0	–	–
FSUBTYPE ⁽³⁾	Short Integer	No	Subtype	0	–	–
POS	Short Integer	No	Coded	0	–	–
SENS	Short Integer	No	Coded	0	–	–
FVALUE	Double	No	–	8	3	–
UNITS	Short Integer	No	Coded	0	–	–
GLG_SYM ⁽²⁾	Text	No	–	–	–	40
SRC_SYM	Text	No	–	–	–	40
SORT_NO	Double	No	–	0	0	8
NOTES	Text	No	–	–	–	254
LBL	Text	Yes	–	–	–	60
SYM	Text	No	–	–	–	60
GMAP_ID ⁽¹⁾	Long Integer	No	–	0	–	–

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) Relationship class foreign key field to UNIT table (see Relationship Classes below).

(3) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Two coded value domains, associated with two subtypes (see FSUBTYPE field), are used to indicate the type of measurement locality. Refer to the source geologic map legend for graphical representation of measurement localities.

Coded Domain Value	Definition	Name of Domain
1	coal bed thickness	GML_MUT_TYPE
2	volcanic ash bed/layer thickness	GML_MUT_TYPE
3	ore body thickness	GML_MUT_TYPE
4	fault displacement amount	GML_FLT_TYPE
5	pebble count	GML_COUNT_TYPE
6	unit thickness	GML_MUT_TYPE
7	elevation of terrace	GML_ELEV_TYPE
8	elevation of meltwater spillway	GML_ELEV_TYPE
9	elevation of surface	GML_ELEV_TYPE
10	fold flexure offset	GML_FLD_TYPE
11	depth to unit	GML_DEPTH_TYPE

FSUBTYPE (Feature Subtype) Subtype to group measurement localities associated with a geologic unit (e.g. coal bed thickness), and those measurement localities that are not associated with a geologic unit (e.g. fault displacement amounts).

Subtype Value	Definition	Associated Domain for FTYPE (Feature Type)
0	Measurement Unit Thickness Locality (associated with a geologic unit; default value)	GML_MUT_TYPE
1	Fault Measurement Locality	GML_FLT_TYPE
2	Measurement Count Locality	GML_COUNT_TYPE
3	Elevation Locality	GML_ELEV_TYPE
4	Fold Measurement Locality	GML_FLD_TYPE
5	Depth to Unit Locality	GML_DEPTH_TYPE

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of the geologic measurement locality. Refer to the source geologic map legend for feature positional accuracy.

Coded Domain Value	Definition
1	known or certain (default value)
2	approximate

SENS (Sensitivity) Coded value (SENS domain) that designates if a geologic measurement locality is considered a sensitive feature or a non-sensitive feature. A feature is assumed “non-sensitive” (SENS = 0) unless otherwise denoted. Feature type (FTYPE) values that are typically or always considered

‘sensitive’ for data distribution purposes are denoted with a (*) in the Feature Type (FTYPE) domain listing.

Coded Domain Value	Definition
0	non-sensitive feature (default value)
1	sensitive feature

FVALUE (Feature Value) Measurement value.

UNITS (Units) Coded value (GML_UNITS domain) that denotes the units of measure associated with a measurement value (see FVALUE field description above).

Coded Domain Value	Definition
0	NA
1	meters
2	feet
3	numeric count

GLG_SYM (Unit Symbol) Age-lithology symbol/code of the geologic unit associated with the measured unit thickness locality (FSUBTYPE = 0). The symbol/code is usually identical to the SRC_SYM (Source Unit Symbol) age-lithology symbol/code (see SRC_SYM field description below). The field is used as a foreign key field in a many-to-one relationship with the Geologic Unit Information (UNIT) table (see the Geologic Unit Information (UNIT) table definition, and this feature class’s Relationship Classes text below).

SRC_SYM (Source Unit Symbol) Source map age-lithology symbol/code of the geologic unit associated with the measured unit thickness locality (FSUBTYPE = 0). The symbol/code is usually identical to the GLG_SYM age-lithology symbol/code (see GLG_SYM field description above).

SORT_NO (Sort Number) Number used to age-sort geologic map units, typically from youngest (low) to oldest (high). Values assigned to each geologic unit are dependent on the geologic units that comprise the compiled NPS Unit geologic map. Subdivisions of geologic units are often denoted by assigning the same integer component of a decimal number to each division of the geologic unit and using the decimal fraction to differentiate the subdivisions.

NOTES (Note) Text notes on locality. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for locality. Often this will be an associated measurement value (i.e., FVALUE filed; see field description above) should one exist. For features with no applicable value the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see

the Source Map Information (MAP) table definition and this feature class's Relationship Classes text below).

DOMAINS: The following domains exist for the GLG_SYM, SRC_SYM and UNITS fields (see field description above).

Domain Name (Values)	Domain Type	Applicable Attribute Field(s)	Associated Subtypes
NA_VALUE (NA)	Coded	GLG_SYM, SRC_SYM	Fault Measurement Locality, Measurement Count Locality Elevation Locality
GML_UNITS (0–3)	Coded	UNITS	Measurement Count Locality Elevation Locality

Note: Domains for FTYPE (see field description above) are listed with subtypes under the FSUBTYPE field (see field description above).

SUBTYPES: Four subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Point Must Be Covered By Line	GML – Fault Measurement Locality	FLT – All

RELATIONSHIP CLASSES:

Relationship Class Name: UNIT_GML_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT
Primary Key Field: GLG_SYM
Destination Class Table: GML
Foreign Key Field: GLG_SYM

Relationship Class Name: MAP_GML_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: GML
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the FTYPE field (see field description above) to represent and sort (as per domain order) geologic measurement localities present in the data layer. If

needed, the POS field (see field description above) may be utilized as well (feature type domain value, as per domain order, then position domain value, as per domain order). If warranted, the SYM (alias Symbology; a text field with a default field length of 60) can be utilized to symbolize features.

Feature symbology is partially derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Geologic Measurement Locality (GML) Point Placement: For most measurement localities, placement of a digitized point is at the center of the localities graphical symbol on the source map. Refer to the source map legend and/or the source map publisher's cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.

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GEOLOGIC SAMPLE LOCALITIES

Feature class consists of geologic age–date and sample localities.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Geologic Sample Localities (GSL)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 16

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	–	–	–	–	–
SHAPE*	Geometry	Yes	–	–	–	–
FUID	Long Integer	No	–	0	–	–
FTYPE	Short Integer	No	Coded	0	–	–
FSUBTYPE ⁽³⁾	Short Integer	No	Subtype	0	–	–
POS	Short Integer	No	Coded	0	–	–
SENS	Short Integer	No	Coded	0	–	–
SAM_NO	Text	No	–	–	–	40
SAM_AGE	Text	No	–	–	–	40
GLG_SYM ⁽²⁾	Text	No	–	–	–	40
SRC_SYM	Text	No	–	–	–	40
SORT_NO	Double	No	–	0	0	8
NOTES	Text	No	–	–	–	254
LBL	Text	Yes	–	–	–	60
SYM	Text	No	–	–	–	60
GMAP_ID ⁽¹⁾	Long Integer	No	–	0	–	–

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

- (1) Relationship class foreign key field to MAP table (see Relationship Classes below).
- (2) Relationship class foreign key field to UNIT table (see Relationship Classes below).
- (3) Denotes a Subtype field..

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Coded value domains, associated with two subtypes (see FSUBTYPE field description below), are used to indicate the type of measurement locality. Refer to the source geologic map legend for graphical representation of geological sample localities.

Coded Domain Value	Definition	Name of Domain
1	radiometric age–date locality	GSL_AGE–DATE
2	paleontological age–date locality (*)	GSL_AGE–DATE
3	mineralogical/chemical sample	GSL_NON–AGE–DATE
4	rock strength test sample	GSL_NON–AGE–DATE
5	assay sample	GSL_NON–AGE–DATE
6	special interest sample (e.g. petrological, cataclasite, mylonite)	GSL_NON–AGE–DATE
7	gemstone sample	GSL_NON–AGE–DATE
8	mine drainage sample	GSL_NON–AGE–DATE
9	repository sample	GSL_NON–AGE–DATE
10	fossil locality (*)	GSL_NON–AGE–DATE
11	thermal remanent magnetization (TRM) age–date locality	GSL_AGE–DATE
12	sample locality	GSL_SAMPLE
13	U–Pb age–date locality	GSL_AGE–DATE
14	K–Ar age–date locality	GSL_AGE–DATE
15	net neutralization potential locality	GSL_SAMPLE
16	paleomagnetism sample locality	GSL_AGE–DATE
17	Ar–Ar age–date locality	GSL_AGE–DATE
18	Rb–Sr age–date locality	GSL_AGE–DATE
19	radiocarbon age–date locality	GSL_AGE–DATE
20	fission track age–date locality	GSL_AGE–DATE
21	Pb–alpha age–date locality	GSL_AGE–DATE
22	SHRIMP age–date locality	GSL_AGE–DATE
23	Thermal Ionization Mass Spectrometry (TIMS) age–date locality	GSL_AGE–DATE
24	U–Th age–date locality	GSL_AGE–DATE
25	auger sample locality	GSL_SAMPLE
26	grain–size analysis locality	GSL_SAMPLE
27	infrared stimulated luminescence age–date locality	GSL_AGE–DATE
28	optically stimulated luminescence age–date locality	GSL_AGE–DATE
29	accelerator mass spectrometer age–date locality	GSL_AGE–DATE

(*) denotes a FTYPE (Feature Type) domain value that is ‘sensitive’, and therefore the feature’s SENS (Sensitivity) field domain value needs to be 1 (sensitive locality)

FSUBTYPE (Feature Subtype) Subtype to group age–date sample localities, and non–age–date sample localities.

Subtype Value	Definition	Associated Domain for FTYPE (Feature Type)
0	Non Age–Date Sample Locality (default value)	GSL_NON-AGE-DATE
1	Age–Date Sample Locality	GSL_AGE-DATE
2	General Sample Locality	GSL_SAMPLE

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of a geological sample locality. Refer to the source geologic map legend for feature positional accuracy.

Coded Domain Value	Definition
1	known or certain (default value)
2	approximate

SENS (Sensitivity) Coded value (SENS domain) that designates if a geologic sample locality is considered a sensitive feature or a non–sensitive feature. A feature is assumed “non–sensitive” (SENS = 0) unless otherwise determined. Feature type (FTYPE) values that are typically or always considered ‘sensitive’ for data distribution purposes are denoted with a (*) in the Feature Type (FTYPE) domain listing.

Coded Domain Value	Definition
0	non–sensitive feature (default value)
1	sensitive feature

SAM_NO (Sample Number) Sample number indicated on source map (e.g. W–4305). “NA” is assigned if not available.

AGE (Sample Age) Age of geologic age–date sample (FSUBTYPE = 1; see FSUBTYPE field description above). As an example, 11000+–100 yr B.P. “NA” assigned if a non–age–date sample.

GLG_SYM (Unit Symbol) Age–lithology symbol/code of the geologic unit the sample was produced from. The symbol/code is usually identical to the SRC_SYM (Source Unit Symbol) age–lithology symbol/code (see SRC_SYM field description below). The field is used as a foreign key field in a many–to–one relationship with the Geologic Unit Information (UNIT) table (see the Geologic Unit Information (UNIT) table definition, and this feature class’s Relationship Classes text below).

SRC_SYM (Source Unit Symbol) Source map age–lithology symbol/code of the geologic unit the sample was produced from. The symbol/code is usually identical to the GLG_SYM age–lithology symbol/code (see GLG_SYM field description above).

SORT_NO (Sort Number) Number used to sort geologic map units, typically from youngest (low) to oldest (high). Values assigned to each geologic unit are dependent on the geologic units that comprise the

compiled NPS Unit geologic map. Subdivisions of geologic units are often denoted by assigning the same integer component of a decimal number to each division of the geologic unit and using the decimal fraction to differentiate the subdivisions.

NOTES (Notes) Text notes on locality. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for feature. Often this will be sample number (SAM_NO field, see field description above) should one exist. For features with no applicable value the field should be left blank, or with a <NULL VALUE>.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

DOMAINS: The following domains exist for sample age-date values (SAM_AGE field; see field description above).

Domain Name (Value)	Domain Type	Applicable Attribute Field(s)	Associated Subtypes
NA_VALUE (NA)	Coded	GSL_AGE	Non-Age-Date Sample Locality

Note: Domains for FTYPE (see field description above) are listed with subtypes under the FSUBTYPE field (see field description above).

SUBTYPES: Two subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES: None presently exist for this feature class.

RELATIONSHIP CLASSES:

Relationship Class Name: UNIT_GSL_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT
Primary Key Field: GLG_SYM
Destination Class Table: GSL
Foreign Key Field: GLG_SYM

Relationship Class Name: MAP_GSL_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: GSL
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the FTYPE field (see field description above) to represent and sort (as per domain order) geologic sample localities present in the data layer. If needed, the POS field (see field description above) may be utilized as well (feature type domain value, as per domain order, then position domain value, as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Geologic Sample Locality (GSL) Point Placement: For most geological sample localities, placement of a digitized point is at the center of the point's graphical symbol on the source map. Refer to the source map legend and/or the source map publisher's cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.
- 2.) Geologic sample localities coincident with other geologic point features: A sample locality point that is coincidental with a geologic point feature (e.g. well, mine adit, geologic point unit) has a point captured in the Geologic Sample Locality (GSL) feature class, as well as in the other relevant feature class (e.g. Mine Point Features (MIN) or Geologic Point Units (GPT)).

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GEOLOGIC and OTHER GEOLOGY-RELATED POINT FEATURES

Feature class type definition consists of other geologic features mapped as points. See the feature class name/alias (abbreviation) list below for additional information on what geologic features are represented by this feature class type definition.

TYPE: Multiple Feature Class Definition (6 Geologic Feature Classes defined)

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Alteration and Metamorphic Feature Points (AMP), Glacial Feature Points (GFP), Geologic Point Features (GPF), Hazard Point Features (HGP), Mine Point Features (MIN) and Volcanic Point Features (VPF)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 11

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
POS	Short Integer	No	Coded	0	—	—
SENS ⁽²⁾	Short Integer	No	Coded	0	—	—
NOTES	Text	No	—	—	—	254
AM_ROT	Short Integer	No	Range	0	—	—
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(2) The Sensitivity (SENS) field is only applicable with the Mine Point Features (MIN) feature class and certain features in the Geologic Point Features (GPF) and Volcanic Point Features (VPF) feature classes. The field is only present in the feature classes just mentioned.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for points. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Coded value domains used to indicate the type of point geologic feature. Refer to the source geologic map legend for graphical representation of point geologic feature. Feature types that are typically considered 'sensitive' for distribution purposes are denoted with a (*) in the feature type domain listings (see the SENS (Sensitivity) field description below).

Alteration and Metamorphic Feature Points (AMP; AMP_TYPE domain)

Coded Domain Value	Definition
1	metamorphic breccia

Glacial Feature Points (GFP; GFP_TYPE domain)

Coded Domain Value	Definition
1	glacial erratic
2	glacial erratic with pedestal
3	glacially shaped and striated stone
4	direction of ice movement
5	crest of drumlin
6	drumlin
7	drumlin with direction of glacial/ice movement indicated
8	direction of glacial stream flow
9	pingo
10	u-shaped pass
11	till knob
12	crescentic feature

Geologic Point Features (GPF; GPF_TYPE domain)

Coded Domain Value	Definition
1	cave (*)
2	hollow (*)
3	<<NOT IN USE>>
4	tunnel (*)
5	natural arch (*)
6	natural bridge (*)
7	rock/boulder
8	natural window (*)
9	cairn
10	collapse structure
11	breccia pipe
12	coal outcrop
13	clinker rock locality
14	mineralization locality
15	mima mound
16	individual spring
17	location of earthquake-induced liquefaction features
18	breccia
19	orbicular structure
20	rock outcrop
21	bog
22	sag pond
23	fossil stump(s) (*)
24	tor(s)
25	exposed gravel or conglomerate interbedded with ash-flow tuff
26	dinosaur trackway (*)
27	glaciomarine delta
28	petrified tree (*)

(*) denotes a Feature Type (FTYPE) domain value that is 'sensitive', and therefore the feature's Sensitivity (SENS) field domain value needs to be 1 (sensitive feature).

Hazard Point Features (HZP; HZP_TYPE domain)

Coded Domain Value	Definition
1	small mass movement
2	sinkhole (*)
3	collapse structure/feature
4	seep of flammable gas
5	direction of mass movement
6	landslide
7	debris flow
8	rockfall
9	rockslide
10	debris slide
11	debris spread
12	earth flow
13	earth slide
14	rock flow
15	soil slide
16	debris slide and flow
17	debris blowout
18	rockslide and flow
19	rockslide and fall
20	debris subsidence
21	debris and rockslide
22	debris and earth slide
23	debris and rock, slide and fall
24	debris and rock, slide and flow
25	direction of inferred activity
26	direction of movement of landslide, mudflows and debris flows

Mine Point Features (MIN; MIN_TYPE)

Coded Domain Value (*)	Definition
1	prospect
2	adit
3	shaft
4	mine
5	open pit mine
6	gravel pit
7	borrow pit
8	mine related structure (e.g. mill, cable tower, water tank etc.)
9	caved adit
10	caved shaft
11	quarry

Coded Domain Value (*)	Definition
12	well
13	oil well
14	oil and gas well
15	gas well
16	water-injection well
17	gas-injection well
18	dry hole
19	test hole
20	drill hole
21	auger hole
22	core hole
23	mine dump
24	tipple
25	gas field
26	monitoring/test site
27	observation well
28	thermal and air injection well
29	water well
30	water disposal well
31	water supply well
32	gas storage well
33	pit
34	sand pit
35	calyx hole
36	borehole
37	oil field
38	oil and gas field
39	sand and gravel pit
40	mineral occurrence
41	clay pit
42	blast furnace
43	sand or gravel pit
44	embankment
45	explosives cache
46	glory hole
47	historic mining artifact site
48	historic mining equipment
49	highwall structure
50	impoundment
51	incline (shaft or cut)
52	miscellaneous mine-related
53	mining tunnel
54	open stope
55	ore pile
56	subsidence feature
57	surface mine
58	tailings
59	trench
60	vent raise opening

Coded Domain Value (*)	Definition
61	waste rock
62	shut-in oil well
63	shut-in gas well
64	gravel, sand, clay or borrow pit
65	dry hole with show of oil
66	placer mine
67	oil or gas well
68	prospect or mine

(*) All Mine Point Feature (MIN) Feature Type Feature Type (FTYPE) domain values are 'sensitive', and therefore the Sensitivity (SENS) field domain value needs to be 1 (sensitive feature).

Volcanic Point Features (VPF; VPF_TYPE domain)

Coded Domain Value	Definition
1	cave of volcanic origin (*)
2	hollow of volcanic origin (*)
3	skylight (*)
4	tunnel of volcanic origin (*)
5	cone
6	spatter cone
7	rootless vent (*)
8	natural bridge of volcanic origin (*)
9	natural arch of volcanic origin (*)
10	natural window of volcanic origin (*)
11	lava tree (*)
12	tree mold (*)
13	vent (*)
14	general location of vent source
15	tepee circle(s) (*)
16	thermal spring (*)
17	fumarole (*)
18	plug
19	outcrop of vitric tuff or cinders
20	volcanic breccias
21	push-ups
22	squeeze-up
23	tumulus
24	dome
25	stratovolcano
26	volcano

(*) denotes a Feature Type (FTYPE) domain value that is 'sensitive', and therefore the feature's Sensitivity (SENS) field domain value needs to be 1 (sensitive feature).

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of a point feature. Refer to the source geologic map legend for feature positional accuracy.

Coded Domain Value	Definition
1	known or certain (default value)
2	approximate

SENS (Sensitivity) Coded value (POINT_SENS domain) that designates if a point feature is considered a sensitive locality or a non-sensitive locality. A locality is assumed “non-sensitive” (SENS = 0) unless otherwise determined. Feature type (FTYPE) values that are typically or always considered ‘sensitive’ for data distribution purposes are denoted with a (*) in the Feature Type (FTYPE) domain listing.

Coded Domain Value	Definition
0	non-sensitive locality (default value)
1	sensitive locality

NOTES (Note) Text notes on feature. Calculate to “NA” if there is no pertinent information to be added to this field.

AM_ROT (ArcMap Rotation) A value that represents the rotation of a point symbol in ArcMap so that the feature’s symbol corresponds to the source map’s representation of that feature. The rotation value is dependent on the feature type (see FTYPE field description above), the ArcMap symbology, the default or non-rotated symbol orientation, the rotation rule (i.e. either ‘geographic’ or ‘arithmetic’ in ArcMap), and the orientation of the feature. The rotation value ranges from 0⁰ (non-rotated or north) to 359⁰ (ROTATION domain). For points a rotation value can either be determined by measuring the symbol’s attitude or orientation directly from the source map, or by entering a rotation value so that the feature’s symbol representation rotates to correspond with the source map’s image representation of that feature (see Special Feature Class Rules below).

LBL (Label) Text label for feature. For features with appropriate labeling text (e.g. Lehman Cave or Jasper Mine) this text should populate this field. In some cases the type of feature (i.e., FTYPE field; see field description above) may serve as a label (e.g., Test Hole or Mine; note that the case sensitivity was changed to Title Case for labeling). For features with no desirable label text the field should be left blank with a <NULL> value.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: None presently exist for this feature class type definition.

TOPOLOGICAL RULES: None presently exist for this feature class type definition.

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_FC_Abbrev_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: FC_Abbrev
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the FTYPE field (see field descriptions above) to represent and sort (as per domain order) features present in the data layer. If needed, the POS field (see field description above) may be utilized as well (feature type domain value, as per domain order, then position domain value, as per domain order). Feature symbolization rotation (if applicable) uses the AM_ROT field (see field description above) using the 'geographic' rule for rotation (0^0 is north with clockwise rotation to 359^0).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Point Feature Placement: For most point features, placement of a digitized point is at the center of the point's graphical symbol on the source map. Refer to the source map legend and/or the source map publisher's cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.
- 2.) Point Feature Symbol Rotation: For mine point features that have directional component, an azimuth (e.g. $0-360^0$) should exist in the AM_ROT field (see field description above) to correctly rotate the feature's symbol to the correct orientation. Mine adits (MIN FTYPE = 2; see FTYPE field description above) are typically the only mine point features that have a directional component associated with the feature's symbol. A drumlin with direction of glacial/ice movement indicated (GFP FTYPE = 7; see FTYPE field description above) should have their symbol rotated to point in the direction of glacial or ice movement as indicated on the source map.

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SEISMIC LOCALITIES

Feature class consists of surface and subsurface seismic observation data localities.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Seismic Localities (SMC)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 12

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
POS	Short Integer	No	Coded	0	—	—
MAG	Float	No	—	4	2	—
DEPTH	Double	No	—	8	3	—
UNITS	Short Integer	No	Coded	0	—	—
NOTES	Text	No	—	—	—	254
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Coded value (SMC_TYPE domain) used to indicate the type of seismic data locality. Refer to the source geologic map legend for graphical representation of seismic localities.

Coded		
Domain Value	Definition	
1	earthquake epicenter	
2	earthquake hypocenter	
3	earthquake monument	

POS (Position) Coded value (POINT_POS domain) that designates the positional accuracy of the seismic data locality. Refer to the source geologic map legend for feature positional accuracy.

Coded		
Domain Value	Definition	
1	known or certain (default value)	
2	approximate	

MAG (Magnitude) Magnitude of the seismic event as measured by the Richter Scale (Magnitude Local or ML). Assign a value of “99.99” if not available.

DEPTH (Depth) Depth of seismic event. Assign a value of “99999.999” if not applicable or available.

UNITS (Units) Coded value (SMC_UNITS domain) that denotes the units of measure associated with the depth of the seismic event (see DEPTH field description above).

Coded	
Domain Value	Definition
0	NA
1	meters
2	feet
3	kilometers
4	miles

NOTE (Notes) Text notes on locality. Calculate to “NA” if there is no pertinent information to be added to this field.

LBL (Label) Text label for locality. For features with appropriate labeling text (e.g. 5.7 ML) this text should populate this field. For features with no desirable label text the field should be left blank with a <NULL> value.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

SUBTYPES: None presently exist for this feature class.

TOPOLOGICAL RULES: None presently exist for this feature class.

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_SMC_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: SMC
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Feature symbolization utilizes the FTYPE field (see field description above) to represent and sort (as per domain order) seismic data point localities present in the data layer. If needed, the POS field (see field descriptions above) may be utilized as well (feature type domain value, as per domain order, then position domain value, as per domain order).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Seismic Locality Point Placement: For most seismic localities, placement of a digitized point is at the center of the localities graphical symbol on the source map. Refer to the source map legend and/or the source map publisher's cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.

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MAP SYMBOLOGY

Feature class consists of fault, fold and other map symbology.

TYPE: Single Feature Class Definition

FEATURE CLASS NAME/ALIAS (ABBREVIATION): Fault, Fold and Other Map Symbology (SYM)

SPATIAL TYPE: Point Feature Class

NUMBER OF ATTRIBUTE FIELDS: 10

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
SHAPE*	Geometry	Yes	—	—	—	—
FUID	Long Integer	No	—	0	—	—
FTYPE	Short Integer	No	Coded	0	—	—
FSUBTYPE	Short Integer	No	Subtype	0	—	—
NOTES	Text	No	—	—	—	254
AM_ROT	Short Integer	No	Range	0	—	—
LBL	Text	Yes	—	—	—	60
SYM	Text	No	—	—	—	60
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—

* Standard ESRI geodatabase feature class attribute field (see ESRI ArcGIS software).

(1) Relationship class foreign key field to MAP table (see Relationship Classes below).

(3) Denotes a Subtype field.

ATTRIBUTE FIELD DESCRIPTIONS:

FUID (Unique Feature ID) Unique sequential identification number for each point. The field values range from 1 to n, where n is the number of features/points in the feature class.

FTYPE (Feature Type) Coded value (SYM_TYPE domain) used to indicate the type of fault, fold and other map symbol. Refer to the source geologic map legend for graphical representation of fault, fold and other map symbology. The value in parentheses represents the domain value in data model v. 1.2 in the Geologic Attitude Observation Localities (ATD) feature class.

Coded Domain Value	Definition	Name of Domain
1 (42)	fold plunge arrow head	SYM_FLD_TYPE
2 (48)	fault up 'U' indicator	SYM_FLT_TYPE
3 (49)	fault down 'D' indicator	SYM_FLT_TYPE
4 (50)	fault down-side (bar and ball) indicator	SYM_FLT_TYPE
5 (57)	monocline symbol	SYM_FLD_TYPE
6 (58)	anticline symbol	SYM_FLD_TYPE
7 (59)	syncline symbol	SYM_FLD_TYPE
8 (60)	overturned anticline symbol	SYM_FLD_TYPE
9 (61)	overturned syncline symbol	SYM_FLD_TYPE
10 (62)	monocline, anticlinal bend symbol	SYM_FLD_TYPE
11 (63)	monocline, synclinal bend symbol	SYM_FLD_TYPE
12 (64)	antiform symbol	SYM_FLD_TYPE
13 (65)	synform symbol	SYM_FLD_TYPE
14 (66)	overturned antiform symbol	SYM_FLD_TYPE
15 (67)	overturned synform symbol	SYM_FLD_TYPE
16 (68)	monocline, maximum inflection of dip	SYM_FLD_TYPE
17 (74)	asymmetrical anticline symbol	SYM_FLD_TYPE
18 (75)	asymmetrical syncline symbol	SYM_FLD_TYPE
19 (79)	fault block movement direction arrows (right-lateral)	SYM_FLT_TYPE
20 (80)	fault block movement direction arrows (left-lateral)	SYM_FLT_TYPE
21 (81)	dome symbol	SYM_FLD_TYPE
22 (82)	basin symbol	SYM_FLD_TYPE
23 (93)	'Y' (younger) age-relationship of contiguous geologic units	SYM_OTHER_TYPE
24 (94)	'O' (older) age-relationship of contiguous geologic units	SYM_OTHER_TYPE
25 (114)	antiformal syncline symbol	SYM_FLD_TYPE
26 (115)	synformal anticline symbol	SYM_FLD_TYPE
27 (136)	cleavage trough symbol	SYM_FLD_TYPE
28	uncertainty '?' indicator	SYM_OTHER_TYPE
29	tightly folded antiforms and synforms	SYM_FLD_TYPE
30	direction of coal-bearing area	SYM_OTHER_TYPE
31	graben label	SYM_OTHER_TYPE
32	fault zone label	SYM_OTHER_TYPE
33	fold area label	SYM_OTHER_TYPE
34	metamorphic zone label	SYM_OTHER_TYPE

FSUBTYPE (Feature Subtype) Subtype to group fault, fold and other map symbols exist. The subtype value in parentheses represents the subtype value in data model v. 1.2 in the Geologic Attitude Observation Localities (ATD) feature class.

Subtype Value	Definition	Associated Domain for FTYPE (Feature Type)
0 (9)	Fault Symbol	SYM_FLT_TYPE
1 (10)	Fold Symbol	SYM_FLD_TYPE
2 (11)	Other Symbol	SYM_OTHER_TYPE

NOTES (Notes) Text notes on the feature. Calculate to “NA” if there is no pertinent information to be added to this field.

AM_ROT (ArcMap Rotation) A value that represents the rotation of a fault, fold and other map symbol feature in ArcMap so that the feature’s symbol corresponds to the source map’s representation of that feature. The rotation value is dependent on the feature type (see FTYPE field description above), the ArcMap symbology, the default or non-rotated symbol orientation, the rotation rule (i.e. either ‘geographic’ or ‘arithmetic’ in ArcMap), and the orientation of the feature. The rotation value ranges from 0⁰ (non-rotated or north) to 359⁰ (ROTATION domain). For fault, fold and other map symbol feature types a rotation value can either be determined by measuring the symbol’s attitude or orientation directly from the source map, or by entering a rotation value so that the feature’s symbol representation rotates to correspond with the source map’s image representation of that feature (see Special Feature Class Rules below).

LBL (Label) Text label for feature. For features with no desirable label text the field should be left blank with a <NULL> value.

SYM (Symbology) Symbology reference number used to symbolize feature (see Symbolization section below).

GMAP_ID (Source Map) Unique integer value assigned to the source map in the MAP table. The field is a foreign key field in a many-to-one relationship with the Source Map Information (MAP) table (see the Source Map Information (MAP) table definition and this feature class’s Relationship Classes text below).

DOMAINS: The following domains exist for rotation values (AM_ROT).

Domain Name (Values)	Domain Type	Applicable Attribute Field(s)	Associated Subtypes
ROTATION (0–359)	Range	AM_ROT	All subtypes

Note: Domains for the FTYPE field (see field description above) are listed with subtypes under the FSUBTYPE field (see field description above).

SUBTYPES: Three subtypes, stored in the FSUBTYPE field (see field description above), presently exist for this feature class.

TOPOLOGICAL RULES:

Topology Rule	Origin (Feature Class – Subtype)	Destination (Feature Class – Subtype)
Point Must Be Covered By Line	SYM/Fault Symbols*	FLT – All
Point Must Be Covered By Line	SYM/Fold Symbols**	FLD – All

* Fault up ‘U’ indicator symbols (FTYPE value = 2), fault down ‘D’ symbols (FTYPE value = 3) are marked as ‘exceptions’ as these symbols typically are not on the associated fault line (see FTYPE field description above).

**Dome symbols (FTYPE value = 21) and Basin symbols (FTYPE value = 22) are marked as ‘exceptions’ as these symbols typically are not on a fold line (see FTYPE field description above).

RELATIONSHIP CLASSES:

Relationship Class Name: MAP_SYM_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: SYM
Foreign Key Field: GMAP_ID

SYMBOLIZATION: Symbolization utilizes the FTYPE field (see field description above) to represent and sort (as per domain order) map point symbology. Symbolization rotation (if applicable) uses the AM_ROT (see field description above) field using the ‘geographic’ rule for rotation (0° is north with clockwise rotation to 359°).

Feature symbology is primarily derived from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers (Federal Geographic Data Committee, 2006), and is listed in Appendix A.

SPECIAL FEATURE CLASS RULES:

- 1.) Fault, Fold and Other Symbol Placement: For most symbols, placement of a digitized point is at the center of the point’s graphical symbol. Refer to the source map legend and/or the source map publisher’s cartographic standards (e.g., FGDC Cartographic Standards) if feature placement is not clear or questioned.
- 2.) Fault, Fold and Other Symbol Rotation Values: A rotation value is used to correctly orient symbols in ArcMap, as mentioned in the AM_ROT field (see field description above).
- 3.) Fault and Fold Symbology “Snapping”: Fault and Fold symbols are required to “snap” to the symbols related fault or fold line.

ANCILLARY TABLES

Additional data on geologic unit information and source map information are presented in two tables.

GEOLOGIC UNIT INFORMATION TABLE

Additional information pertaining to the geologic and/or other map units present in a GRI digital geologic-GIS data.

TYPE: Single Table Definition

TABLE NAME (ABBREVIATION): Geologic Unit Information Table (UNIT)

RELATIONSHIP TYPE: Simple (all)

CARDINALITY: One-to-Many (all)

PRIMARY KEY: GLG_SYM

FOREIGN KEY: GLG_SYM (all)

NUMBER OF FIELDS: 12

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
GUNIT_ID	Long Integer	No	—	0	—	—
GLG_SYM ⁽¹⁾	Text	No	—	—	—	40
GLG_NAME	Text	No	—	—	—	200
HIERARCHY	Text	Yes	—	—	—	254
SORT_NO	Double	No	—	0	0	8
AGE_TEXT	Text	No	—	—	—	200
AGE_PERIOD	Text	No	—	—	—	200
AGE_MIN	Text	No	—	—	—	200
AGE_MAX	Text	No	—	—	—	200
MJ_LITH	Text	No	Coded	0	—	100
NOTES	Text	No	—	—	—	254

* Standard ESRI geodatabase table attribute field (see ESRI ArcGIS software).

(1) Relationship class primary key field (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

GUNIT_ID (Unit ID) Unique integer value assigned geologic unit in the UNIT table.

GLG_SYM (Unit Symbol) Age–lithology symbol/code of geologic unit. The field is the primary key used to relate the Geologic Unit Information Table (UNIT) to the Geologic Unit feature class (GLG) table and other themes with a GLG_SYM field that possess abbreviated descriptive unit lithology data.

GLG_NAME (Unit Name) Name of the geologic unit.

HIERARCHY (Unit Hierarchy) Hierarchical order and/or grouping of the unit, if any. Listed from highest hierarchy to lowest hierarchy, separated by semi-colons (e.g., “Tonto Group; Bright Angel Shale” or “Granite Gorge Metamorphic Suite; Vishnu Schist”). Any unit hierarchy or organization/grouping should be listed, even if informal (e.g., “Anthropogenic Features” or “Caesar Till; Lattaville Moraine”).

SORT_NO (Sort Number) Number used to age-sort geologic map units, generally from youngest (low) to oldest (high). Values assigned to each geologic unit are dependent on the geologic units that comprise the compiled NPS Unit geologic map. Subdivisions of geologic units are often denoted by assigning the same integer component of a decimal number to each division of the geologic unit and using the decimal fraction to differentiate the subdivisions. A value of 0 is typically assigned to water areas.

AGE_TEXT (Age Text) Geologic time period text of geologic unit (e.g. Cretaceous). Any “?” associated with an age, if present, is kept.

AGE_PERIOD (Period Age) Period(s) or epoch(s) of Geologic Time of geologic unit (e.g. Cretaceous, Eocene). Time adjective (i.e. late, Early, lower), if any, is omitted. Any “?” associated with an age, if present, is kept.

AGE_MIN (Minimum Age) Minimum or youngest period or epoch of Geologic Time of geologic unit (e.g. Cretaceous). Time adjectives (i.e. late, Early, lower), if present, are kept. Any “?” associated with an age, if present, is kept.

AGE_MAX (Maximum Age) Maximum or oldest period or epoch of Geologic Time of geologic unit (e.g. Eocene). Time adjectives (i.e. late, Early, lower), if present, are kept. Any “?” associated with an age, if present, is kept.

MJ_LITH (Major Lithology) Coded value (MJ_LITH domain) that indicates the major lithologic type (i.e. unconsolidated, sedimentary etc.) of the geologic unit.

Coded Domain Value	Definition
igneous extrusive	igneous extrusive (volcanic)
igneous intrusive	igneous intrusive (plutonic)
igneous extrusive and intrusive	igneous extrusive (volcanic) and intrusive (plutonic)
igneous and metamorphic	igneous and metamorphic
igneous and sedimentary	igneous and sedimentary
metamorphic	metamorphic
metasedimentary	metamorphic and sedimentary (metasedimentary)
not applicable	not applicable (i.e., no data, not applicable, ice or water)
sedimentary	sedimentary
sedimentary and volcanic	sedimentary and igneous extrusive (volcanic)
unconsolidated	unconsolidated
sedimentary and unconsolidated	sedimentary and unconsolidated

NOTES (Notes) Notes related to the geologic unit. Calculate to “NA” if there is no pertinent information to be added to this field. If a unit is present in cross section only enter the following text, “unit present in cross section only”.

RELATIONSHIP CLASSES: Relationship class presently exist between the Geologic Unit Information (UNIT) table and the following feature classes listed in the Data Dictionary: Geologic Units (GLG), all Area Geologic Unit feature classes, all Geologic Line Unit feature classes; Geologic Point Units (GPT), Geologic Measurement Localities (GML) and Geologic Sample Localities (GSL)

Relationship Class Name: UNIT_FC_Abbrev_Relate

Relationship Type: Simple

Cardinality: One-to-Many

Origin Class Table: UNIT

Primary Key Field: GLG_SYM

Destination Class Table: FC_Abbrev

Foreign Key Field: GLG_SYM

Example record:

GUNIT_ID = 11076
GLG_SYM = Ct
GLG_NAME = Tapeats Sandstone
GLG_GRP = Tonto Group; Tapeats Sandstone
SORT_NO = 227
AGE_TXT = Middle and Lower(?) Cambrian
AGE_PER = Cambrian
AGE_MIN = Middle Cambrian
AGE_MAX = Lower(?) Cambrian
MJ_LITH = Sedimentary
NOTE = NA

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SOURCE MAP INFORMATION TABLE

TYPE: Single Table Definition

TABLE NAME (ABBREVIATION): Source Map Information Table (MAP)

RELATIONSHIP TYPE: Simple (all)

CARDINALITY: One-to-Many (all)

PRIMARY KEY: GMAP_ID

FOREIGN KEY: GMAP_ID (all)

NUMBER OF FIELDS: 21

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
GMAP_ID ⁽¹⁾	Long Integer	No	—	0	—	—
GMAP_AUTH	Text	No	—	—	—	200
GMAP_YEAR	Short Integer	No	—	0	—	—
GMAP_TITLE	Text	No	—	—	—	254
GMAP_ORG	Text	No	—	—	—	200
GMAP_STYPE	Text	No	—	—	—	100
GMAP_SER	Text	No	—	—	—	40
GMAP_SCALE	Long Integer	No	—	0	—	—
GMAP_NMAS_M	Float	No	—	6	3	—
GMAP_NMAS_FT	Float	No	—	6	3	—
GMAP_TYPE	Text	No	Coded	—	—	25
GMAP_USE	Text	No	—	—	—	254
GMAP_RMS	Float	No	—	6	3	—
GMAP_REF	Text	No	—	—	—	254
GMAP_PROJ	Text	No	—	—	—	100
GMAP_XMAX	Double	No	—	9	6	—
GMAP_XMIN	Double	No	—	9	6	—
GMAP_YMAX	Double	No	—	9	6	—
GMAP_YMIN	Double	No	—	9	6	—
GMAP_NOTES	Text	No	—	—	—	254

* Standard ESRI geodatabase table attribute field (see ESRI ArcGIS software)..

(1) Relationship class primary key field (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS

GMAP_ID (Source Map ID) Unique integer value assigned in the source map in the MAP table. The field is a primary key field in a one-to-many relationship with all feature classes. Field is aliased as “Source Map ID” in this table.

GMAP_AUTH (Author) Map author(s) and compiler(s). Listed has last name, first name for each map author. For digital maps, digital compiler(s) and digitizer(s) may also be cited.

GMAP_YEAR (Year) Year of map compilation or publication.

GMAP_TITLE (Title) Published or compiled map title.

GMAP_ORG (Publisher) Abbreviation of organization that compiled and/or published map.

GMAP_STYPE (Series Type) Map series type/name (e.g., Geologic Quadrangle Map). If there is no series type or the map is unpublished enter “not applicable” in the field, but omit this text from the complete citation (i.e., Reference or GMAP_REF) field.

GMAP_SER (Series Number) Map series and/or organizational identifier (e.g., GQ-1516).

GMAP_SCALE (Scale) Map scale denominator.

GMAP_NMAS_M (NMAS Meters) United States National Map Accuracy Standards (NMAS) horizontal spatial accuracy in meters. Value is calculated dependent upon map scale, and published geologic maps are expected to be equal to or less than the reported value. See U.S. Geological Survey publication <http://pubs.usgs.gov/fs/1999/0171/report.pdf> for additional information.

GMAP_NMAS_F (NMAS Feet) United States National Map Accuracy Standards (NMAS) horizontal spatial accuracy in feet. Value is calculated dependent upon map scale, and published geologic maps are expected to be equal to or more accurate than the reported value. See U.S. Geological Survey publication <http://pubs.usgs.gov/fs/1999/0171/report.pdf> for additional information.

GMAP_TYPE (Source Type) Coded domain (DATA_TYPE domain) that denotes the type or format of the source map.

<u>Coded Domain Value</u>
paper
digital data
mylar
digital data and paper
digital image
digital data and image
other

GMAP_USE (GRI Use) Brief summary of how the map was used in the production of a GRI digital geologic-GIS map or maps.

GMAP_RMS (Paper Map Accuracy) The value, in meters, of accuracy between the paper map and digitized data. This may be the RMS (root mean square) recorded when georeferencing in ArcMap or the maximum measured distance between the georeferenced map and digital data (if georeferenced map is inherited from a third-party). For digital data, the value should be set to 0.

GMAP_REF (Reference) Complete map citation in U.S. Geological Survey style; author(s), year, title, publisher, series type + series number, scale (as 1:XX,XXX scale).

GMAP_PROJ (Projection) Name or description of map projection with projection datum.

GMAP_XMAX (West Extent) Western limit (longitude) of map extent in decimal degrees.

GMAP_XMIN (East Extent) Eastern limit (longitude) of map extent in decimal degrees.

GMAP_YMAX (North Extent) Northern limit (latitude) of map extent in decimal degrees.

GMAP_XMIN (South Extent) Southern limit (latitude) of map extent in decimal degrees.

GMAP_NOTES (Notes) Notes pertaining to the source map and how the source map was used by the GRI (e.g., “source used for unit descriptions” or “only a portion of the full source map extent was used”). Calculate to “NA” if there is no pertinent information to be added to this field.

Example record for the Digital Geologic Map of Rocky Mountain National Park, Colorado source map. The 4-letter NPS (and designated park map) alpha code for Rocky Mountain National park is ROMO, and thus the table would be named romomap.

GMAP_ID = 144
GMAP_AUTH = Braddock, William A., and Cole, James C.
GMAP_YEAR = 1990
GMAP_TITLE = Geologic Map of Rocky Mountain National Park and Vicinity, Colorado
GMAP_ORG = U.S. Geological Survey
GMAP_STYPE = Miscellaneous Investigations Series Map
GMAP_SER = I-1973
GMAP_SCALE = 50000
GMAP_NMAS_M = 25.4
GMAP_NMAS_FT = 83.33
GMAP_TYPE = digital data and paper
GMAP_USE = full extent of map was used, and all geologic features digitized and attributed as per the source map
GMAP_RMS = 0
GMAP_REF = Braddock, William A., and Cole, James C., 1990, Geologic Map of Rocky Mountain National Park and Vicinity, Colorado, U.S. Geological Survey, Miscellaneous Investigations Series Map I-1973, 1:50,000 scale
GMAP_PROJ = NAD83, UTM Zone 13N
GMAP_XMAX = -105.958333
GMAP_XMIN = -105.458333
GMAP_YMAX = 40.566666
GMAP_YMIN = 40.125000
NOTES = point features captured from a scanned copy of the paper map, other features from digital vector data in CAD format from Braddock (1999)

RELATIONSHIP CLASSES: Relationship classes presently exist with all feature classes listed in the Data Dictionary.

Relationship Class Name: MAP_FC_Abbrev_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: MAP
Primary Key Field: GMAP_ID
Destination Class Table: FC_Abbrev
Foreign Key Field: GMAP_ID

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Geodatabase Designer v2 – Developed by Richie Carmichael, Environmental Systems Research Institute (ESRI) Inc., 380 New York St., Redlands, CA92373, downloadable at <http://arcscripsts.esri.com>

Geodatabase Diagrammer – Developed by Michael Zeiler, Environmental Systems Research Institute (ESRI) Inc., 380 New York St., Redlands, CA92373, downloadable at <http://arcscripsts.esri.com>

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APPENDIX A: FEATURE SYMBOLIZATION

Geologic units and features are symbolized (i.e., represented on a map) by differing colors and/or symbols dependent on the type of unit and/or feature type. A color and/or pattern is typically used to represent a geologic unit, and often a unit's color adheres to accepted practices that color or color ranges denote the age and/or the type of unit. As examples, units that are Quaternary in age are typically represented with shades of yellow, whereas igneous and volcanic rocks (often regardless of age) are depicted with reds, oranges or reddish–purples. U.S. Geological Survey, Techniques and Methods 11–B1 provides color and pattern standards and conventions for geologic maps (units).

With regards to patterns, the GRI seeks to not use patterns to represent units or features wherever possible as either patterns are not supported by certain software that we produce maps for (e.g., Google Earth), or because patterns are often difficult to accurately re–create in related GRI report graphics and map layouts.

Of note, if the number of units of a particular age and/or rock type on a map are greater than the color values or color ranges proposed to symbolize these units (i.e., there are more units on a map than distinguishable colors for the age or type) than it is sometimes necessary to symbolize some units using other colors, or by using color ramps.

For geologic features that are not units (e.g., a fault, a moraine crest, or an observation locality) these features are symbolized on a geologic map by a particular symbol and color. FGDC Digital Cartographic Standard for Geologic Map Symbolization (Federal Geographic Data Committee, 2006) lists commonly adopted map symbols for a number of geologic features, however, as noted with specific features in the following tables a considerable number of geologic features found on GRI maps are not present in this document.

Feature symbolization within this document is denoted by symbol reference numbers that have been “zero-padded” if less than 10 to better denote and sort these values. For many symbol reference numbers these were derived directly from FGDC Digital Cartographic Standard for Geologic Map Symbolization reference numbers, however, for features not present within the standard document symbol reference numbers start with the next highest value within a set of features (e.g., “bedding” attitude observation measurements are a “set of features”, with “bedding” reference numbers beginning with “6” or zero-padded to “06”. The highest reference value in the standard document is “06.46”, and thus “bedding” attitude observation measurements not found in the standard document but are in this data model document are “06.47” and higher.

In several cases it was necessary to generalize certain line feature symbology as symbology defined in the FGDC Digital Cartographic Standard for Geologic Map Symbolization document contained “symbology elements” that were deemed unnecessary for each individual segment of a connected feature. These “elements” typically are symbols captured as point symbology features in the Symbology (SYM) feature class. Some common examples of these symbology elements include fault “U” and “D”, “bar and ball”, and lateral displacement indicators, and fold type (e.g., anticline) symbols. Without a generalization to a simple line symbol every line segment of these features would display the additional but unnecessary “elements”.

As an example, all fold (FLD) lines are generalized to symbols that solely depict positional accuracy and not also fold type. A symbol to denote fold type is found in the Symbology (SYM) feature class that is associated with a fold line, but not every segment of a given fold has this symbol to represent feature type. In cases where reference numbers have been generalized both FGDC and generalized GRI symbol reference numbers are listed. Feature types not found in the FGDC Digital Cartographic Standard for Geologic Map Symbolization are denoted by a “NA” in the FGDC symbol reference number.

Also, some feature symbols listed in FGDC Digital Cartographic Standard for Geologic Map Symbolization had a 2nd and 3rd option for symbolization. These are denoted in the notes field where applicable. The GRI “default” reference number is always the 1st option, however, if warranted the 2nd and/or 3rd option may also be used.

In some cases, it may be necessary to customize a symbol to denote differences between features of the same feature type. As an example, a map may have folds colored differently to denote folds that are Proterozoic versus Phanerozoic in age, or a map may have wells that are denoted as commercial and non-commercial. In these cases, a symbol's reference number may be augmented by including additional “text” to further distinguish these features. A generally adopted practice by the GRI is to append an underscore followed by text to the end of the symbol's reference number. As an example, to further delineate a coal prospect from a non-specific prospect the text “_coal” could be added to a prospect's symbol reference number of 19.03.01 (so, “19.03.01_coal”). In these cases, the default symbology has been edited slightly or changed.

Symbol Reference Numbers By Data Model Feature Class.

Adopted symbology reference numbers for features are stored in a spreadsheet, fgdc_symbology.xlsx, with each feature class having its own tab or sheet within the spreadsheet. For geologic unit feature classes, those feature classes comprised of area geologic units (e.g., Geologic Units (GLG) or Surficial Units (SUR), these are not listed as symbology is based more upon custom color symbology, and not on standard symbolization based on a type of feature.

Symbol reference numbers populate (are stored) in the SYM (Symbology) field in all applicable (i.e., non-unit) feature classes.

APPENDIX B: ADDED ATTRIBUTE FIELDS and TABLES

If warranted, additional source map feature attribute fields and/or GIS tables may be present in a GRI digital geologic-GIS dataset. The additional information or table is often retained and communicated in the GRI digital geologic-GIS data “as is” in the source data. However, if warranted the actual attribution maybe “cleaned up” to better communicate the information and/or to remove cryptic and abbreviated information. In addition, attribute field names, aliases, data types and other attribute field parameters, as well as GIS table parameters, may be modified if warranted to conform to attribute and table parameters common to the GRI data model (e.g., implementation of a field or table alias, use of coded or ranged domains, text length limitations etc.).

Alaska Science Center (ASC) Source Datasets

GRI digital geologic-GIS maps produced from source digital data produced by the U.S. Geological Survey (USGS) Alaska Science Center (ASC) retain several source digital data attribute fields that possess additional information concerning regional unit correlation (applicable to area, linear unit features, and sample localities) and source map tracking information (applicable to all features). In addition, point features derived from Alaska Resource Data Files (ARDF) data retain considerable information pertaining to mining.

Attributed fields appended to GRI digital geologic-GIS maps produced from Alaska Science Center (ASC) and Alaska Resource Data Files (ARDF) source digital data are listed below. As with feature class attribute field information, field parameters are listed in a field definition table followed by attribute field descriptions.

ADDED ASC UNIT FEATURE CLASS FIELDS

Additional attribute fields pertaining to Alaska Science Center (ASC) regional unit correlation and source map tracking codes added to area unit feature classes (e.g., Geologic Units (GLG), Surficial Units (SUR)) and linear unit feature classes (e.g., Linear Geologic Units (GLN), Linear Dikes (DKE)).

TYPE: Added Fields Feature Class Definition

APPLICABLE FEATURE CLASSES: Applicable Unit Polygon and Unit Line Feature Classes

NUMBER OF ADDED ATTRIBUTE FIELDS: 5

ADDED ASC UNIT ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
NSA_SOURCE_CLASS	Text	No	—	—	—	20
NSACCLASS	Long Integer	No	—	0	—	—
CLASS	Long Integer	No	—	0	—	—
QCLASS	Long Integer	No	—	0	—	—
NSASUB	Long Integer	No	—	0	—	—
SOURCE	Text	No	—	—	—	8

ADDED ASC UNIT ATTRIBUTE FIELD DESCRIPTIONS:

NSA_SOURCE_CLASS (Unique Source Unit Identifier) Concatenated field that uniquely identifies Regional numeric code assigned to similar geologic units. The NSACCLASS (field), a given source map

(SOURCE field), and geologic unit (CLASS field) produce the concatenated value. Field NSA_SOURCE_CLASS is a key field used to identify area and lines features with unique attributes and unit descriptions that may have been lumped together in generalized source data. The field is a key field that relates a unit, its source and its class value to the Alaska Unit Information Table (CODEUNIT_AK) in the GRI digital geologic-GIS data.

NSAClass (USGS Regional Unit Correlation Code) Regional numeric code assigned to similar geologic units. Field NSAClass is a key field and links to field NSAClass in tables nsaage, nsakey, nsalith, nsarefs, and nsasetting in the Alaska Geology FileMaker Pro database. NSAClass is also a 1: many relationship with NSAClass in table nsaunits in the Alaska Geology FileMaker Pro database.

CLASS (USGS Unit Number linked to USGS Source Map Code) Unique numeric code assigned to a geologic unit from an original source map. Number is unique only within a given quadrangle and specific to SOURCE (field).

QCLASS (USGS Quaternary Regional Unit Correlation Code) Subdivision of attribute NSAClass (field) providing more detailed Quaternary classification. Field QCLASS is a key field for linking to field QCLASS in table nsaqkey in the Alaska Geology FileMaker Pro database.

NSASUB (USGS Regional Unit Correlation Code Underlying Unit)
Same coding as NSAClass but used to define the bedrock unit beneath surficial deposits. Not universally populated.

SOURCE (USGS Source Map Code) Unique code assigned to each source; uses the 2-letter quadrangle code and a three-digit number. By default, 001 is reserved for the topographic map or other source of hydrologic spatial data for each quadrangle. Field SOURCE is a key field and links to SOURCE in table nsarefs in the Alaska Geology FileMaker Pro database.

ADDED ASC AREA TYPE FEATURE CLASS FIELDS

Additional attribute fields pertaining to Alaska Science Center (ASC) regional unit correlation, unit modification (e.g., sericitic alteration) and source map tracking codes added to applicable area type feature classes (e.g., Alteration and Metamorphic Areas (AMA)).

TYPE: Added Field Feature Class Definition

APPLICABLE FEATURE CLASSES: Applicable Area Type Feature Classes

NUMBER OF ADDED ATTRIBUTE FIELDS: 1

ADDED ASC AREA TYPE ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
SOURCE	Text	No	–	–	–	8

ADDED ASC AREA TYPE ATTRIBUTE FIELD DESCRIPTIONS:

SOURCE (USGS Source Map Code) Unique code assigned to each source; uses the 2-letter quadrangle code and a three-digit number. By default, 001 is reserved for the topographic map or other source of

hydrologic spatial data for each quadrangle. Field SOURCE is a key field and links to SOURCE in table nsarefs in the Alaska Geology FileMaker Pro database.

ADDED ASC LINE FEATURE CLASS FIELDS

A field added to all line feature classes to retain Alaska Science Center (ASC) source map tracking codes.

TYPE: Added Field Feature Class Definition

APPLICABLE FEATURE CLASSES: All Line Feature Classes save Linear Unit Feature Classes (see the Added ASC Unit Feature Class Fields section above).

NUMBER OF ADDED ATTRIBUTE FIELDS: 1

ADDED ASC LINE FEATURE CLASS ATTRIBUTE FIELD DEFINITION:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
SOURCE	Text	No	—	—	—	8

ADDED ASC LINE FEATURE CLASS ATTRIBUTE FIELD DESCRIPTION:

SOURCE (USGS Source Map Code) Unique code assigned to each source; uses the 2-letter quadrangle code and a three-digit number. By default, 001 is reserved for the topographic map or other source of hydrologic spatial data for each quadrangle. Field SOURCE is a key field and links to SOURCE in table nsarefs in the Alaska Geology FileMaker Pro database.

ADDED ARDF MINE DATA FIELDS

Additional Alaska Resource Data Files (ARDF) attribute information pertaining to mining and commodity exploration (e.g., Mine Point Features). The (source) data is available in native format or as comma separated value (.csv) format at: <https://ardf.wr.usgs.gov>.

TYPE: Added Field Feature Class Definition

APPLICABLE FEATURE CLASSES: Applicable Mine Feature Classes

NUMBER OF ADDED ATTRIBUTE FIELDS: 11

ADDED ARDF MINE DATA ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
SITE_NAME	Text	No	—	—	—	254
SITE_TYPE	Text	No	—	—	—	50
SITE_STATUS	Text	No	—	—	—	50
COMMODITY_MAIN	Text	No	—	—	—	50
COMMODITY_OTHER	Text	No	—	—	—	50
ORE_MINERALS	Text	No	—	—	—	50
GANGUE_MINERALS	Text	No	—	—	—	254
MINERAL_AGE	Text	No	—	—	—	50
ARDF_NO	Text	No	—	—	—	50
ARDF_DATE	Text	No	—	—	—	20
SOURCE	Text	No	—	—	—	8

ADDED ARDF MINE DATA ATTRIBUTE FIELD DESCRIPTIONS:

SITE_NAME (ARDF Site Name) Also known as 'Site'. This field contains the name or names for the site as found in the literature. It may be a proper name or name of a nearby geographic feature. Site is 'Unnamed', if the site does not have a proper name, does not coincide with a geographic feature, and has never or only informally been identified with a geographic name.

SITE_TYPE (ARDF Site Type) Sites are classified as Mine, Mines, Prospect, Prospects, Occurrence, or Occurrences. In some cases, the only suggestion of a mineral deposit existing at a site is that a claim or claims have been staked there. These sites are included in ARDF if 1) the claim or claims have been identified as a site in a previous publication (may have an MRDS number); or 2) there is clear evidence that the claim or claims have had substantial work by a reputable source. However, ARDF is NOT a claim-location database.

Coded Domain Value

Definition

Mine or Mines	Mines have had past production, though it may be small or trivial.
Prospect or Prospects	Prospects have had some mapping, or geochemical or geophysical surveys, or physical excavation by industry.
Occurrence or Occurrences	Mineral occurrences include unexplored occurrences of minerals of economic interest, or areas with multiple samples having substantial values of one or more metals as determined by analysis or mineralogy. By convention, an occurrence does not become a prospect if only government workers have found or studied it.

SITE_STATUS (ARDF Site Status) The level of current activity at the site. This is the best estimate by the compiler of recent activity at the time the ARDF record was updated and is somewhat subjective. It is not a legal definition of claim validity. Activity is not restricted to excavation or other physical exploration, but may include substantial geologic mapping, geochemical sampling, or ground geophysics within the last several years. Values include: Active, Active?, Probably inactive/Inactive, and Undetermined.

COMMODITY_MAIN (ARDF Main Commodity) Also known as 'Commodities, main'. List of dominant elements or commodities of real or potential economic value in the mineral deposit. Commodities are listed alphabetically by chemical symbol; commodities such as barite, chromite, gypsum, and jade are spelled out. When described collectively, rare-earth elements = REE; platinum group elements = PGE. The chemical symbols are used for individual REE and PGE elements if they have been cited by element specifically as the commodities of interest at a site. Although arsenic is rarely a commodity of economic interest, it is commonly a pathfinder element and may be listed among the other commodities.

COMMODITY_OTHER (ARDF Other Commodity) Also known as 'Commodities, other'. These commodities are present in minor amounts as determined by analysis or mineralogy. 'Other' may include by-products from a mine. Distinguishing 'main' and 'other' may not be possible for prospects and occurrences.

ORE_MINERALS (ARDF Ore Minerals) An alphabetical list of the ore minerals at the site. By convention, the ore minerals include all the native metals, sulfides and sulfosalts, metallic oxides and metal-rich minerals of real or potential economic value. This includes pyrite and arsenopyrite if they are of economic value. The relative abundance should be described in the 'Geologic description' field. Barite, gypsum, chromite, fluorite, and the like may be listed here if they are the chief minerals of economic interest.

GANGUE MINERALS (ARDF Gangue Minerals) An alphabetical list of the non-economic minerals at the site that cannot be avoided in mining. As conventionally used, gangue minerals are silicates, carbonates, and other minerals that are intergrown with the ore minerals. The term 'gangue' mineral was originally used in the context of classic vein or replacement deposits and may not apply in discussing the mineralogy of many deposits. 'Gangue' usually does not include the minerals in the host rock, nor does it normally include alteration minerals. Minerals like barite, fluorite, and gypsum are usually included as gangue minerals if present in relatively minor amounts. The relative abundance of the gangue minerals should be described in the 'Geologic description' field. This field may be blank.

MINERAL_AGE (ARDF Mineralization Age) Also known as 'Age'. This is the age of mineralization and the evidence for the age. Maybe an age, age range or inferred age.

ARDF_NO (ARDF Site ID) Also known as 'ARDF no.'. This is a unique label assigned to each mineral deposit in the database. The form of the ARDF number is the two-letter 1:250,000 scale quadrangle code followed by a three-digit number.

ARDF_DATE (ARDF Update/Revision Date) Date when the record was compiled or updated. This is not the date of the last publication on the site. It is the date that a competent geologist reviewed the information in the record and, if necessary, added information to bring it up to date. The date indicates that the updater was satisfied that the record was complete and accurate as possible as of that date. The date is entered in the form MM/DD/YYYY.

SOURCE (USGS Source Map Code) Unique code assigned to each source; uses the 2-letter quadrangle code and a three-digit number. By default, 001 is reserved for the topographic map or other source of

hydrologic spatial data for each quadrangle. Field SOURCE is a key field and links to SOURCE in table nsarefs in the Alaska Geology FileMaker Pro database.

ADDED SAMPLE LOCALITY FIELDS

Additional attribute information pertaining to sample localities applicable to the Geologic Sample Localities (GSL) feature class. The feature class is comprised of two types of samples, radiometric ages and U-Pb ages. Radiometric age data is comprised of samples analyzed by K/Ar, 40Ar/39Ar, Rb/Sr, fission-track, and other methods, excluding U/Pb determinations. Attribute information is derived from the Radiometric database, a component of the Alaska Geology Filemaker database. U-Pb age data is comprised of samples analyzed by uranium-lead methods. Information pertaining to both sets of sample localities is also provided in the following applications and file formats: Filemaker runtime, and DBF and CSV files.

TYPE: Added Field Feature Class Definition

APPLICABLE FEATURE CLASSES: Geologic Sample Localities (GSL)

NUMBER OF ADDED ATTRIBUTE FIELDS: 10

ADDED SAMPLE LOCALITY ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
REC_NO	Long Integer	No	—	0	—	—
SAMPLE	Text	No	—	—	—	254
ROCK_TYPE	Text	No	—	—	—	254
MINERAL	Text	No	—	—	—	254
METHOD	Text	No	—	—	—	254
AGE_SAMPLE	Double	No	—	8	3	—
ERROR	Double	Yes	—	8	3	—
COMMENT	Text	No	—	—	—	800
REFERENCE	Text	No	—	—	—	254
SOURCE	Text	No	—	—	—	8

ADDED SAMPLE LOCALITY ATTRIBUTE FIELD DESCRIPTIONS:

REC_NO (Sample Record Number) Unique numeric identifier for this dataset. Values range from 1 to 6108 for radiometric age data, and from 1 to 1389 for U-Pb age data.

SAMPLE (Sample ID) Sample number/identifier.

ROCK_TYPE (Sample Rock Type) Rock type of sample dated.

MINERAL (Sample Mineral) Mineral or phase dated.

METHOD (Sample Analysis Method) Dating method used. Coded values for both radiometric age and U-Pb age data are listed.

Radiometric Age Date
Coded Domain Value

Definition

40/39	Argon-argon dating
40/39 Average	Average of multiple $^{40}\text{Ar}/^{39}\text{Ar}$ ages
40/39 High temp. frac.	$^{40}\text{Ar}/^{39}\text{Ar}$ high temperature fraction
40/39 Isochron	$^{40}\text{Ar}/^{39}\text{Ar}$ isochron age
40/39 Plateau	$^{40}\text{Ar}/^{39}\text{Ar}$ plateau age
40/39 Total Fusion	$^{40}\text{Ar}/^{39}\text{Ar}$ total fusion age
Fission-track	Fission track dating
K/Ar	Potassium-argon dating
Lu/Hf	Lutetium-hafnium dating
Pb-alpha	Lead-alpha dating
Rb/Sr	Rubidium-strontium dating
Re/Os	Rhenium-osmium dating
Sm/Nd	Samarium-neodymium dating
U-Th/He	Uranium-thorium / helium dating; uranium-helium dating

U-Pb Age Date
Coded Domain Value

Definition

ICPMS	Inductively coupled plasma-mass spectrometry
SHRIMP	Sensitive high-resolution ion microprobe
TIMS	Thermal ionization mass spectrometry
TIMS-multigrain	Thermal ionization mass spectrometry multi-grain
TIMS-singlegrain	Thermal ionization mass spectrometry single grain
U/Th	Uranium-thorium dating
U/Pb	Uranium-lead dating

AGE_SAMPLE (Sample Age) Reported/interpreted best age based on the data age in millions of years.

ERROR (Sample Age Error) Analytical error for the preferred age, if reported (age in millions of years).

COMMENT (Sample Comments) Comments about the sample or analysis. Calculate to “NA” if there is no pertinent information to be added to this field.

REFERENCE (Sample Reference) Reference citations for the age determination. Calculate to “NA” if there is no pertinent information to be added to this field.

SOURCE (USGS Source Map Code) Unique code assigned to each source; uses the 2-letter quadrangle code and a three-digit number. By default, 001 is reserved for the topographic map or other source of hydrologic spatial data for each quadrangle. Field SOURCE is a key field and links to SOURCE in table nsarefs in the Alaska Geology FileMaker Pro database.

ASC (ALASKA) UNIT INFORMATION TABLE

Additional information pertaining to the geologic and/or other map units as derived from the to Alaska Science Center (ASC) Alaska Geology FileMaker Pro database or that relates a unit to the U.S. Geological Survey Geologic Map of Alaska (SIM-3340) units.

TYPE: Single Table Definition

TABLE NAME (ABBREVIATION): Geologic Unit Information Table (UNIT_AK)

RELATIONSHIP TYPE: Simple (all)

CARDINALITY: One-to-Many (all)

PRIMARY KEY: NSA_CLASS_SOURCE (all)

FOREIGN KEY: NSA_CLASS_SOURCE (all)

NUMBER OF FIELDS: 13

ATTRIBUTE FIELD DEFINITIONS:

Field Name	Data Type	Allow Nulls	Domain	Precision	Scale	Length
OBJECT_ID*	Object ID	—	—	—	—	—
NSA_SOURCE_CLASS ⁽¹⁾	Text	No	—	—	—	20
AK_DB_UNIT_SYM	Text	No	—	—	—	20
AK_DB_UNIT_NAME	Text	No	—	—	—	200
AK_SORT_NO	Double	No	—	0	0	8
AK_DB_UNIT_AGE	Text	No	—	—	—	200
AK_DB_FOSSIL	Text	No	—	—	—	254
AK_DB_AGE_DATE	Text	No	—	—	—	254
AK_DB_ROCK_CLASS	Text	No	—	—	—	50
STATE_LABEL2	Text	No	—	—	—	10
STATE_UNITNAME	Text	No	—	—	—	200
AGE_RANGE	Text	No	—	—	—	200
SEQUENCE	Text	No	—	—	—	50

* Standard ESRI geodatabase table attribute field (see ESRI ArcGIS software).

(1) Relationship class primary key field (see Relationship Classes below).

ATTRIBUTE FIELD DESCRIPTIONS:

NSA_SOURCE_CLASS (Unique Source Unit Identifier) Concatenated field that uniquely identifies Regional numeric code assigned to similar geologic units. The NSAClass (field), a given source map (SOURCE field), and geologic unit (CLASS field) produce the concatenated value. Field NSA_SOURCE_CLASS is a key field used to identify polygons with unique attributes and unit descriptions that may have been lumped together in generalized source data.

AK_DB_UNIT_SYM (Alaska Database Unit Symbol) Unit symbol in the Alaska Geology FileMaker Pro database.

AK_DB_UNIT_NAME (Alaska Database Unit Name) Unit name in the Alaska Geology FileMaker Pro database.

AK_SORT_NO (Alaska Sort Number) Number used to age-sort geologic map units, generally from youngest (low) to oldest (high). Assigned by the GRI with integer values corresponding to the SORT_NO (field) value assigned to the unit's "grouped unit" in the GRI Geologic Unit Information Table. Decimal places, starting with .00, are then assigned to each unit within a grouped unit.

AK_DB_UNIT_AGE (Alaska Database Unit Age) Age of the unit in the Alaska Geology FileMaker Pro database.

AK_DB_FOSSIL (Alaska Database Fossil Information) Notes pertaining to fossils present in the unit in the Alaska Geology FileMaker Pro database.

AK_DB_AGE_DATE (Alaska Database Age Date Information) Notes pertaining to radiometric age-date(s) derived for the unit in the Alaska Geology FileMaker Pro database.

AK_DB_ROCK_CLASS (Alaska Database Rock Class) Rock class assigned to the unit in the Alaska Geology FileMaker Pro database.

STATE_LABEL2 (Alaska State Map Unit Label) Unit symbol on the Geologic Map of Alaska (SIM-3340).

STATE_UNITNAME (Alaska State Map Unit Name) Unit name on the Geologic Map of Alaska (SIM-3340).

AGE_RANGE (Alaska State Map Unit Age Range) Unit age on the Geologic Map of Alaska (SIM-3340).

SEQUENCE (Alaska State Map Unit Sequence) Unit sequence on the Geologic Map of Alaska (SIM-3340). A sorting code using a letter for lithologic type and then a number. Used to place the unit in age order. Matches the order given in the Description of Map Units. (Source: this dataset) A is unconsolidated units; B is sedimentary rocks; C is volcanic rocks; D is plutonic rocks, E is metamorphic rocks, and F is tectonic units or assemblages.

RELATIONSHIP CLASSES: Relationship classes presently exist between the Alaska Geologic Unit Information (UNIT_AK) table and the following feature classes listed in the Data Dictionary: Geologic Units (GLG), Surficial Units (SUR), Linear Geologic Units (GLN) and Linear Dikes (DKE).

Relationship Class Name: UNIT_FC_Abbrev_Relate
Relationship Type: Simple
Cardinality: One-to-Many
Origin Class Table: UNIT_AK
Primary Key Field: NSA_SOURCE_CLASS
Destination Class Table: FC_Abbrev
Foreign Key Field: NSA_SOURCE_CLASS