

**Geological Survey of Canada Bedrock Data Model and  
tools: design and user guide documentation including  
ArcGIS™ add-ins**

**Part 1: Design Documentation**

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**GEOLOGICAL SURVEY OF CANADA  
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# 1 GEODATABASE DESIGN

The GSC's Bedrock *Geodatabase* presented here is the result of the final implementation of the conceptual data model. This physical implementation meets the requirements identified at the outset and reflects the capabilities and limitations of the ArcGIS™ platform, while taking users' needs into account.

As mentioned in the introduction, the Bedrock *Geodatabase* is designed to manage all data generated by a geological mapping project at the GSC. It is based on a modular approach, which facilitates data management while supporting communication with external systems. Figure 1 illustrates the four major modules as well as the functional links between these various modules and external systems.

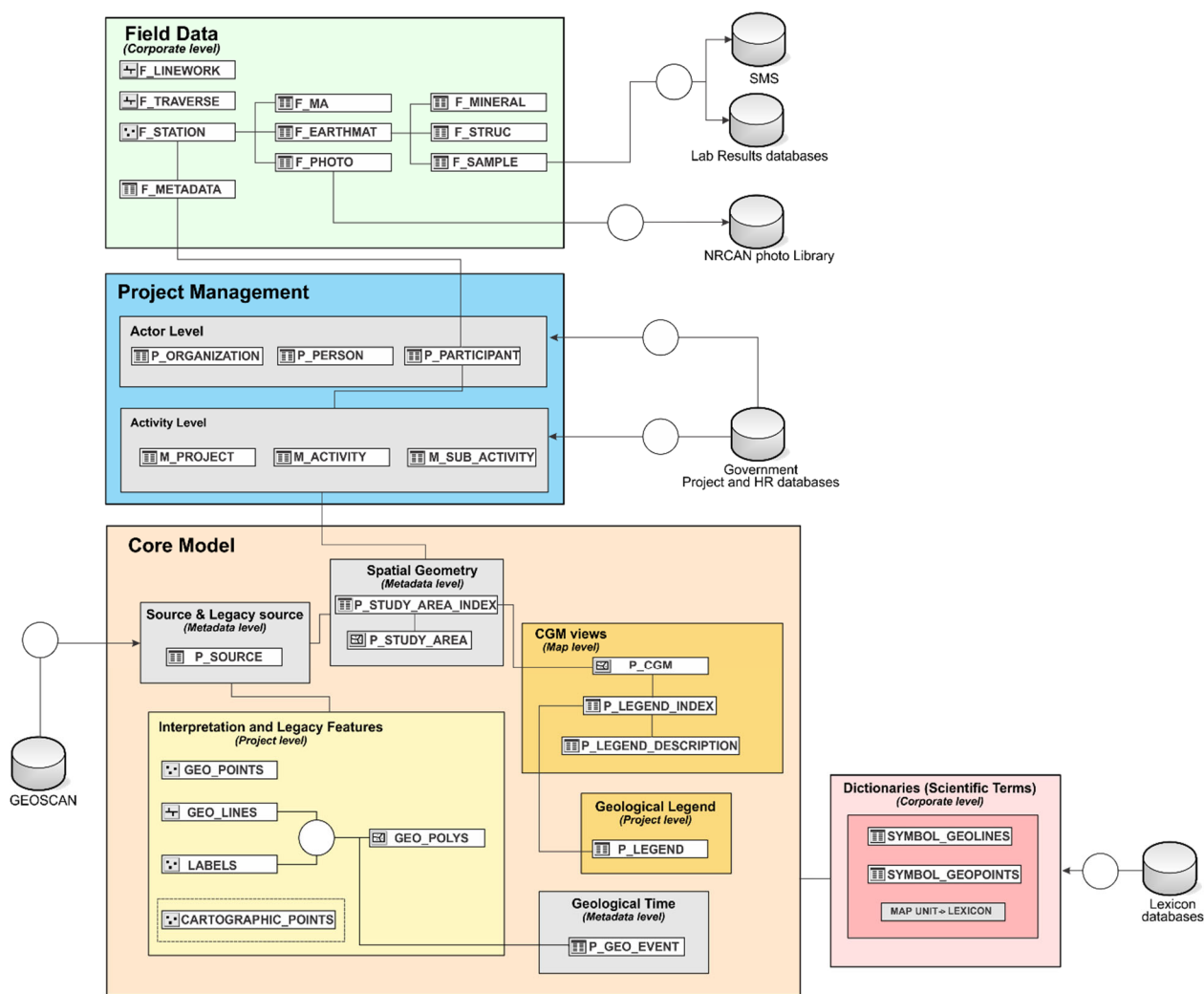
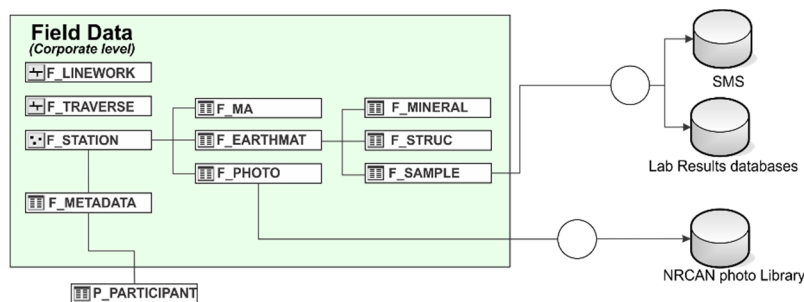


Figure 1: Simplified schema of GSC's Bedrock Geodatabase model

The *Geodatabase* design will evolve over time, in response to the needs of users, and to advances in technology.

## 1.1 FIELD DATA MODULE

Field Data 

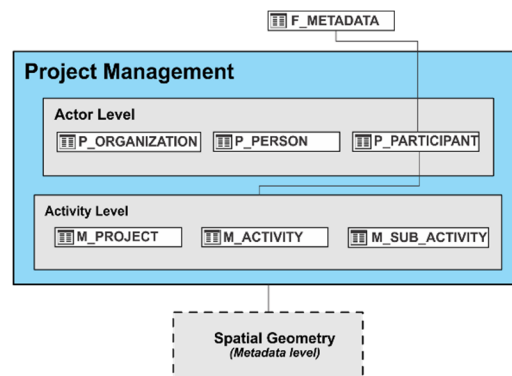


**Figure 2: Field data module**

The modular nature of the model is clearly shown here, with a single functional link to the other modules, centred on the ***F\_METADATA*** and ***P\_PARTICIPANT*** metadata tables. The model can therefore be quickly adapted to any change in the data acquisition system.

## 1.2 PROJECT MANAGEMENT MODULE

As mentioned in the introduction, one of the requirements of the model concerns the management of all aspects of the governance of a geological mapping project. The **Project Management** module (Figure 3) provides this management functionality for the project-related activities and sub-activities, as well as for the participating individuals. More specifically, the **Actors level** sub-module makes it possible to manage the relevant participant-related information, while the **Activity level** sub-module preserves the relationships between a project, its main activities and its sub-activities. The link between this module and the **Core Module** is provided by the **Spatial Geometry** metadata sub-module, whose sole function is to store the geometry (i.e. spatial extent) of the feature of the area covered by a project or its activities. This aspect is covered in detail in Section 2.2.6.



**Figure 3: Project Management module**



Some of the data recorded in the various tables of this module serve a two-fold function as both data and metadata. For example, the information recorded in the **P\_PARTICIPANTS** and **M\_SUB\_ACTIVITY** tables can become metadata for the elements of interpretation of **GEO\_LINES** or **GEO\_POINTS**. Other examples and explanations will follow in section 3.

### 1.3 DICTIONARIES MODULE

The use of dictionaries is essential to ensure the standardization of the scientific terms used and to maintain the integrity of the data recorded in the database. The terminology recorded in the tables **SYMBOL\_GEOLINES** and **SYMBOL\_GEOPOINTS** (Figure 4) is the vocabulary proposed by the GSC's Bedrock Legend Committee.

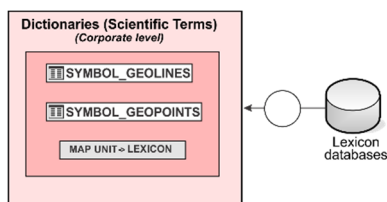


Figure 4: Dictionaries module

See section 2.4 for more detail on these tables.

### 1.4 CORE MODULE

The **Core** module includes all the basic functionalities required to create, edit and store geological interpretations or compilations, as well as a series of tables enabling this information to be structured in a format compatible with the creation of legends (Figure 5). The components of this module are also responsible for managing and generating all CGM maps within a project.

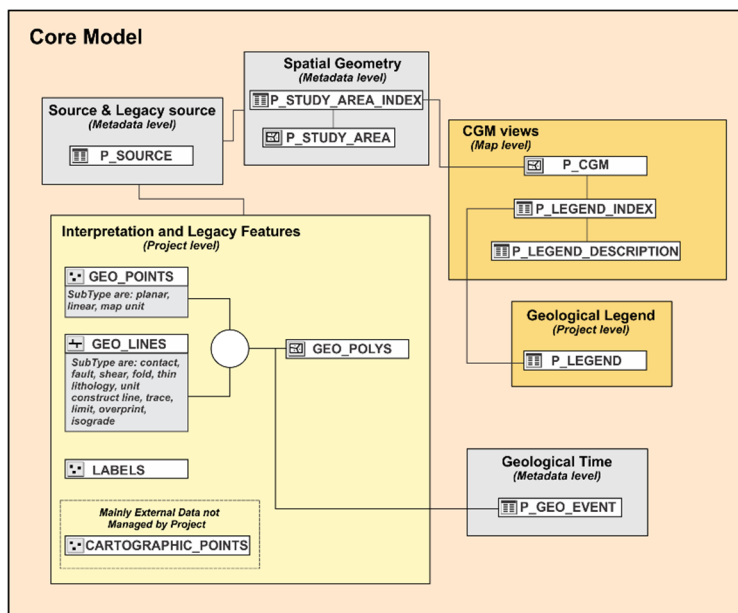


Figure 5: Core module

The **Interpretation and Legacy Feature** sub-module contains the **GEO\_LINES** and **LABELS** *Feature Classes* which are used to create the geological polygons (i.e. map units) recorded in **GEO\_POLYS**. Unlike certain other models, the approach used here relies on the combined digitization of lines and points (labels) during geological interpretation or compilation, rather than on the direct digitization of polygons. The entire geological interpretation is then recorded in **GEO\_LINES** and **LABELS** and the polygons resulting from this interpretation can be easily created or recreated if necessary.

The **GEO\_POINTS** *Feature Class* contains all the structural point data of a project as well as map units that are too small to be represented as polygons. The structural information acquired in the field using the GanFeld system are automatically transferred from the **F\_STRUC** table of attributes to **GEO\_POINTS**, while the data from compilation work are recorded directly into **GEO\_POINTS**.

The information recorded in **CARTOGRAPHIC\_POINTS** concerns external datasets, not managed by the model, but which are indispensable to the user during the process of geological interpretation (e.g. drilling data or geochronological ages for the interpretation of a geological contact, fault, etc.).

The **P\_LEGEND** table of the **Geological Legend** sub-module contains all the common and reusable legend items for each of the CGM maps of a project, while the tables of the **CGM views** sub-module are used to manage the description of each of these legend items. An example is provided in Section 2.3.6.

## 2 GEODATABASE DESCRIPTION

The following sections provide a brief explanation of the *Geodatabase* followed by complete descriptions of all elements of the model. Figure 6 provides an overview of the tree structure of the database in the ArcCatalog™ environment. This structure includes a series of *Feature Classes*, *Tables* and *Relationship Classes*, as well as two *Feature Datasets* called **FIELD\_OBS** and **GEO**. The **FIELD\_OBS** *Feature Dataset* contains all the elements downloaded from the GanFeld system, while **GEO** contains the four *Feature Classes* that are used to create and manage the geological interpretation. Two different *Feature Datasets* are used because the field observation data is often in a different projection than the interpreted/published information.

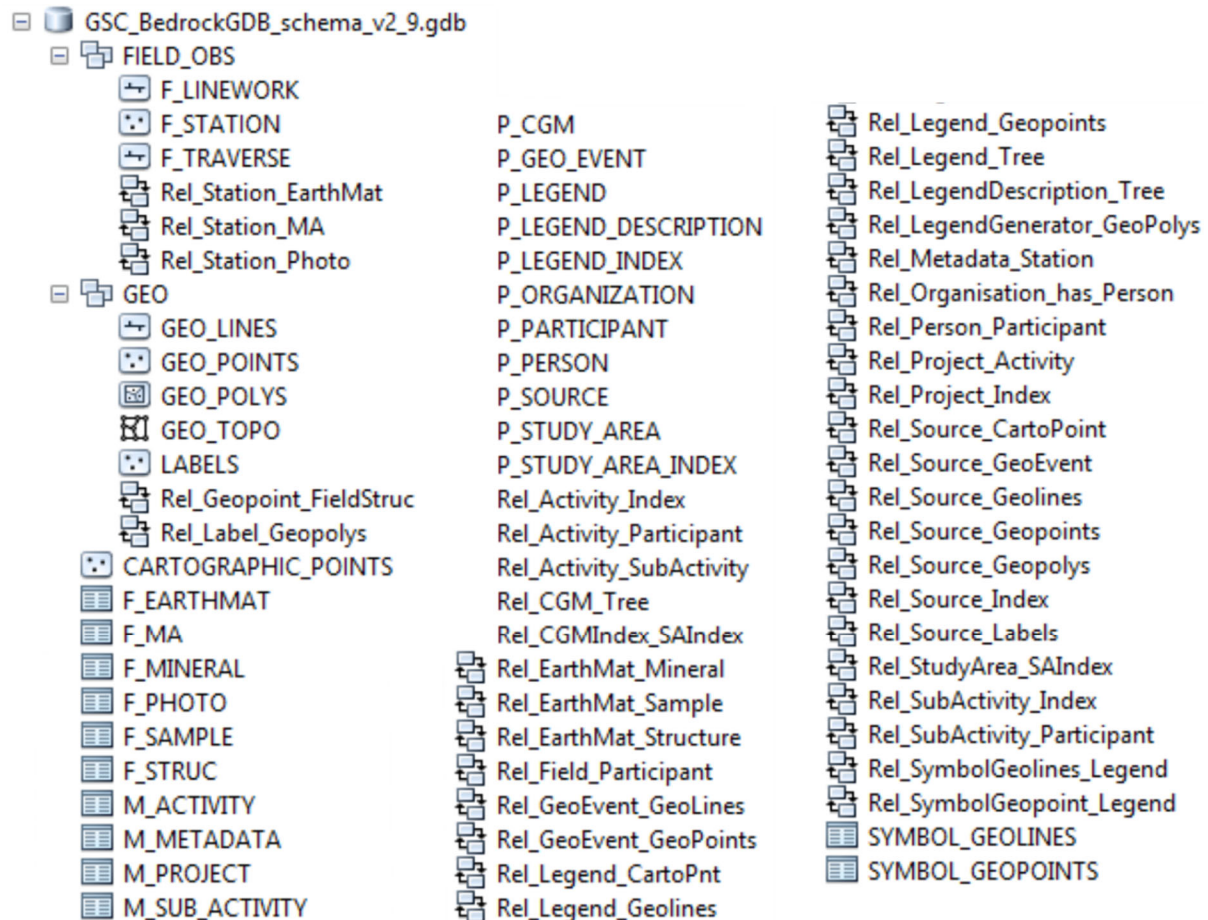


Figure 6: ArcCatalog view of GSC's Bedrock Geodatabase version 2.9

In order to facilitate the understanding and the navigation through all the elements of the model, we will provide a description of each module, as well as explanations on the links between each module.

### 2.1 FIELD DATA MODULE

The **Field Data** module contains all the field observation data acquired using the GanFeld system, version 2017. A complete description of these *Feature Classes* and *Tables* is available in an internal document entitled Field Data Model V1.0 (Cocking, 2013). The intention is not to repeat an exhaustive description of these elements here, but to

provide users with the relevant information to understand the structure of the **Field Data** module. The reader will also find additional information on attributes that have a functional link with other modules.

### 2.1.1.1 F\_TRAVERSE FEATURE CLASS

**F\_TRAVERSE** is a line *Feature Class* containing the traces of the geological traverses recorded in the GanFeld application.

Table 1: Field properties and description for **F\_TRAVERSE**

Field	DataType	Length	AliasName	Description	IsNullable
TRAVERSEID	String	25	TraverseID	Unique identifier for the traverse	FALSE
TRAVERSENO	Short Integer		TraverseNo	Sequential traverse number (e.g. 1, 2, 3, etc.)	FALSE
VISITDATE	Date		Visit Date	Date of traverse (numerical mm/dd/yy)	FALSE
PARTNER	String	50	Partner	Traverse partner	TRUE
NOTES	String	254	Notes	Remarks or notes on the traverse	TRUE



For all "**F\_**" tables, the **IsNullable** field shows the value defined by the data schema designers. In some cases, the values have been modify at the implementation stage in order to facilitate data entry.

### 2.1.1.2 F\_LINEWORK FEATURE CLASS

This line *Feature Class* contains the elements of geological interpretation recorded by the GanFeld application. These linear elements generally represent contacts, faults or folds derived from the preliminary interpretation made by the geologist directly in the field.

Table 2: Field properties and description for **F\_LINEWORK**

Field	DataType	Length	AliasName	Description	IsNullable
LINEWORKID	String	25	LineworkID	Unique identifier for the line work	FALSE
LINEWORKNO	Short Integer		LineworkNo	Sequential number for line work (e.g. 1, 2, 3, etc.)	FALSE
LINETYPE	String	50	Line Type	Type of feature represented by the line (contact, fault, fold, etc.)	FALSE
LINEDetail	String	50	Line Detail	The details of the line (examples: thrust, dextral, anticline)	TRUE
CONFIDENCE	String	25	Confidence	Confidence in the position of the line	TRUE
NOTES	String	254	Notes	Notes or remarks about line	TRUE

### 2.1.3 F\_STATION FEATURE CLASS

**F\_STATION** is a point *Feature Class* which identifies and describes a geographic location for which geological observations are made. It contains the geographic coordinates as well as a series of attributes which describe the type and quality of the observation locality.

Table 3: Field properties and descriptions for **F\_STATION**

Field	DataType	Length	AliasName	Description	IsNullable
STATIONID	String	25	StationID	Unique identification of an outcrop or point where observations are made (format: 2 digit "year", 2 or 3 letter "officer code", three digit station #; e.g. 2017ABC-123)	FALSE
STATIONNO	LongInteger	4	StationNo	Sequential number of the station, used for administrative purposes (e.g. 1, 2, 3, etc.)	FALSE
TRAVNO	Short Integer		TraverseNo	Traverse number (1, 2, 3, etc.)	TRUE
VISITDATE	Date		Visit Date	Date of traverse (numerical; mm/dd/yy)	FALSE
VISITTIME	String	50	Visit Time	Time of day for station observation (hh:mm:ss AM/PM)	FALSE
LATITUDE	Double		Latitude	Latitude in decimal degrees	FALSE
LONGITUDE	Double		Longitude	Longitude in decimal degrees	FALSE
EASTING	Double		Easting	UTM Easting (2 decimal places - cm precision)	FALSE
NORTHING	Double		Northing	UTM Northing (2 decimal places - cm precision)	FALSE
DATUMZONE	String	25	Datum Zone	UTM longitudinal zone (9, 10, 11, etc.)	FALSE
ELEVATION	Float		Elevation	Elevation in metres	TRUE
ELEVMETHOD	String	15	Elevation Method	Method of elevation capture	TRUE
ENTRYTYPE	String	7	Entry Type	Method of location entry (built-in GPS, manual coordinate entry, screen tap)	TRUE
PDOP	Float		PDOP	Position Dilution of Precision (e.g. position error factor)	TRUE
SATSUSED	Short Integer		Sat Used	Number of satellites used for GPS position fix	TRUE
OBSTYPE	String	25	Observation Type	Nature of station (visited outcrop, photograph only, etc.)	TRUE
OCQUALITY	String	25	Outcrop Qual	Quality of outcrop	TRUE
PHYSENV	String	25	Physical Environment	Physical environment of the station (ridgeline, shoreline, etc.)	TRUE
OCSIZE	String	50	Outcrop Size	Outcrop size estimate	TRUE
NOTES	String	254	Notes	Notes or remarks about the station	TRUE
SLSNOTES	String	254	SLS Notes	Notes or remarks about what was seen between this station and the last	TRUE
AIRPHOTO	String	50	Airphoto No	Air photo number	TRUE
METAID	String	30	MetaID	For internal use only. Added by the GanFeld Data Management Tools to maintain a unique Station code. Composed of the [YearofFieldwork] [OfficerCode] [ProjectCode].	FALSE
REPORT_LINK	String	254	Report Link	Link to an XML document which is a summary of the field observation of a <b>STATIONID</b>	TRUE
DISPLAYPUB	Short Integer		Display In Publication	To be shown on (map) publication	TRUE

The **MetaID** and **Report Link** attributes were added to the original GanFeld structure to accommodate new processes. **MetaID** provides a link between the geological observation stations and the **Project Management** module, while the information stored in **Report Link** makes it possible to activate the hyperlink that provides access to a summary of the geological observations, in the form of an XML document (e.i. GanFeld reports).

## 2.1.4 F\_EARTHMAT TABLE

The **F\_EARTHMAT** table contains the lithological observations made at each station of **F\_STATION**. A “one-to-many” type relationship (*Relationship Class*) named **Rel\_Station\_EarthMat** exists between the two. In other words, a station can have one or more earth materials.

Table 4: Field properties and description for **F\_EARTHMAT**

Field	DataType	Length	AliasName	Description	IsNullable
STATIONID	String	25	STATIONID	Unique identification of an outcrop or point where Earth Material observations are made	FALSE
EARTHMATLT	String	5	EARTHMATLT	Sequential letter for Earth Material at a station	FALSE
EARTHMATNO	Short Integer		EARTHMATNO	Sequential number for Earth Material at a station (e.g. 1, 2, 3, etc.)	FALSE
EARTHMATID	String	25	EARTHMATID	Earth material unique identifier	FALSE
LITHGROUP	String	50	LITHGROUP	General rock grouping (for GanFeld functionality)	FALSE
LITHTYPE	String	50	LITHTYPE	Subdivision of the general rock grouping (for GanFeld functionality)	FALSE
LITHDETAIL	String	50	LITHDETAIL	Detailed rock name. This field stores the functional rock name of an Earth Material	FALSE
MAPUNIT	String	50	MAPUNIT	Map unit to which the described Earth Material belongs	TRUE
OCCURAS	String	50	OCCURAS	Nature of the occurrence of the Earth Material (e.g. pluton, dyke, etc.)	TRUE
MODSTRUC	String	254	MODSTRUC	Qualifiers relating to primary structures of the Earth Material	TRUE
MODTEXTURE	String	254	MODTEXTURE	Qualifiers relating to textural properties of the Earth Material	TRUE
MODCOMP	String	254	MODCOMP	Qualifiers relating to the composition of the Earth Material	TRUE
GRCRYSIZE	String	254	GRCRYSIZE	Earth Material grain size	TRUE
DEFFABRIC	String	254	DEFFABRIC	Deformational fabrics of the Earth Material	TRUE
BEDTHICK	String	254	BEDTHICK	Bedding thickness	TRUE
MINERAL	String	254	MINERAL	List of minerals observed in the Earth Material with respective mode (i.e. %)	TRUE
MINNOTE	String	254	MINNOTE	Notes on minerals observed	TRUE
COLOURF	String	50	COLOURF	Earth Material fresh colour	TRUE
COLOURW	String	50	COLOURW	Earth Material weathered colour	TRUE
COLOURIND	Short Integer		COLOURIND	Earth Material colour index value from 0 to 100	TRUE
MAGSUSCEPT	Double		MAGSUSCEPT	Magnetic susceptibility value of the Earth Material (in SI units)	TRUE
FOSSILS	String	254	FOSSILS	List of fossils observed in the Earth Material	TRUE
FOSSILNOTE	String	254	FOSSILNOTE	Notes on the fossils observed	TRUE
CONTACT	String	254	CONTACT	Further notes or remarks about the contacts	TRUE
CONTACTUP	String	50	CONTACTUP	Nature of upper contact	TRUE
CONTACTLOW	String	50	CONTACTLOW	Nature of lower contact	TRUE
INTERP	String	254	INTERP	Interpretation of the genetic origin or protolith of the Earth Material	TRUE
INTERPCONF	String	10	INTERPCONF	Level of confidence with the Earth Material interpretation	TRUE

### 2.1.5 F\_MINERAL TABLE

The **F\_MINERAL** table has a “one-to-many” type relationship (*Relationship Class*) with the **F\_EARTHMAT** table (*Rel\_EarthMat\_Mineral*). In other words, an earth material can have one or more minerals. This table contains all the attributes necessary to record the observations related to the form of the mineral, its mode of occurrence, size and colour.

Table 5: Field properties and description for **F\_MINERAL**

Field	DataType	Length	AliasName	Description	IsNullable
STATIONID	String	25	STATIONID	Unique identification of an outcrop or point where mineral observations are made	FALSE
EARTHMATID	String	25	EARTHMATID	Unique identifier of the Earth Material in which a mineral is described	FALSE
MINERALID	String	25	MINERALID	Unique identifier of a mineral within the observed Earth Material	FALSE
MINERALNO	Short Integer		MINERALNO	Sequential number of a mineral within the observed Earth Material (e.g. 1, 2, 3, etc.)	FALSE
MINERAL	String	25	MINERAL	Name of the mineral being described	FALSE
FORM	String	25	FORM	Form of the mineral (e.g. euhedral, anhedral, subhedral)	TRUE
HABIT	String	25	HABIT	Habit of the mineral (e.g. acicular, columnar, equant, fibrous)	TRUE
OCCURRENCE	String	25	OCCURRENCE	Nature of the occurrence of the mineral within the Earth Material (e.g. accessory, constituent, clot, phenocryst, porphyroblast)	TRUE
COLOUR	String	25	COLOUR	Colour of the mineral	TRUE
SIZEMINMM	Short Integer		SIZEMINMM	Minimum size of the mineral in mm	TRUE
SIZEMAXMM	Short Integer		SIZEMAXMM	Maximum size of the mineral in mm	TRUE
MODE	Short Integer		MODE	Proportion of rock unit comprised by the mineral (value range 0-100)	FALSE
NOTES	String	254	NOTES	Further explanatory notes on the mineral	TRUE

### 2.1.6 F\_SAMPLE TABLE

This table contains a list of all the samples collected in the field for each of the lithologies being described. It therefore has a “one-to-many” type relationship (*Relationship Class*) with the **F\_EARTHMAT** table (**Rel\_EarthMat\_Mineral**). In other words, an earth material can have one or more samples.

Table 6: Field properties and description for F\_SAMPLE

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
STATIONID	String	25	STATIONID	Unique identification of an outcrop or point where samples are collected	FALSE	n/a
EARTHMATID	String	25	EARTHMATID	Unique identifier of the Earth Material in which a sample is collected	FALSE	n/a
SAMPLEID	String	25	SAMPLEID	Unique identifier of a collected sample	FALSE	n/a
SAMPLENO	Short Integer	2	SAMPLENO	Sequential number of a collected sample within an Earth Material (e.g. 1, 2, 3)	FALSE	n/a
SAMPLETYPE	String	25	SAMPLETYPE	Sample type (e.g. hand, oriented; chip sample; core, etc.)	FALSE	n/a
PURPOSE	String	254	Purpose	Purpose(s) regarding why the sample is collected	FALSE	n/a
FORMAT	String	25	Format	Measurement format for oriented samples (e.g. RHR (right-hand rule), DDD (dip direction, dip), TRND-PLNG (trend and plunge))	TRUE	n/a
AZIMUTH	Short Integer	2	AZIMUTH	Strike, dip direction or trend measurement of oriented samples (in degrees)	TRUE	n/a
DIPPLUNGE	Short Integer	2	DIPPLUNGE	Dip or plunge measurement of oriented samples (in degrees)	TRUE	n/a
SURFACE	String	10	SURFACE	Indication of whether the upper or lower surface of the oriented sample was marked in the field	TRUE	n/a
NOTES	String	254	NOTES	Remarks about the sample	TRUE	n/a
SMID	LongInteger		SMID	Unique identifier granted by SMS	TRUE	n/a
CURATIONID	String	25	CurationID	Curation number granted by SMS	TRUE	n/a



### 2.1.7 F\_STRUC TABLE

The **F\_STRUC** table also has a “one-to-many” type relationship (*Relationship Class*) with the **F\_EARTHMAT** table (*Rel\_EarthMat\_Structure*). In other words, an earth material can have one or more structures. It contains all the structural data measured for each of the lithologies being described. The design of the **F\_STRUC** table makes it possible to record both planar and linear structural measurements.

Table 7: Field properties and description for **F\_STRUC**

Field	DataType	Length	AliasName	Description	IsNullable
STATIONID	String	25	STATIONID	Unique identification of an outcrop or point where structural measurements are collected	FALSE
EARTHMATID	String	25	EARTHMATID	Unique identifier of the Earth Material in which a structural measurement is collected	FALSE
STRUCID	String	25	STRUCID	Unique identifier of a planar or linear structural measurement	FALSE
STRUCNO	Short Integer		STRUCNO	Sequential number of a collected structural measurement within an Earth Material (e.g. 1, 2, 3, etc.)	FALSE
STRUCCLASS	String	10	STRUCCLASS	Class of structural feature (linear or planar)	FALSE
STRUCTYPE	String	30	STRUCTYPE	Subdivision of the structural feature (for GanFeld functionality)	FALSE
DETAIL	String	50	DETAIL	Detailed structural measurement name (e.g. bedding, fault plane, fracture, joint, cleavage, schistosity)	FALSE
METHOD	String	50	METHOD	Method of acquisition (e.g. measured at station, estimated at station, calculated from data)	FALSE
FORMAT	String	25	Format	Measurement format (e.g. strike/dip, trend/plunge, etc.)	FALSE
ATTITUDE	String	50	Attitude	Attitude of planar feature (e.g. upright, overturned, etc.)	TRUE
YOUNGING	String	50	YOUNGING	Confidence in attitude of primary layering as assessed from evidence for younging direction (e.g. known, sedimentary structure; inferred, stratigraphic order; assumed, no evidence)	TRUE
GENERATION	String	50	Generation	Generation phase	TRUE
STRAIN	String	50	STRAIN	Strain intensity (e.g. no strain, weak, moderate, intense)	TRUE
FLATTENING	String	50	FLATTENING	Relative intensity of planar (S) fabric over linear (L) fabric (e.g. L tectonite, L>S, L=S, L<S, S tectonite)	TRUE
RELATED	String	50	RELATED	Unique identifier for related planar or linear measurement	TRUE
FABRIC	String	254	FABRIC	Fabric defining elements within the observed Earth Material (e.g. muscovite (schistosity), flattened or stretched quartz (mylonitic foliation), crenulations (cleavage))	TRUE
SENSE	String	254	SENSE	Sense of movement indicated by the feature (e.g. sinistral, down to northeast)	TRUE
AZIMUTH	Short Integer		AZIMUTH	Strike, dip direction or trend of measurement [Range=0-360]	FALSE
DIPPLUNGE	Short Integer		DIPPLUNGE	Dip value of the planar feature or plunge value of the linear feature in degrees. [Range=0-90]	FALSE
SYMANG	Short Integer		SYMANG	Rotational angle for plotting symbol	TRUE
NOTES	String	254	NOTES	Notes relating to the measurement	TRUE

### 2.1.8 F\_PHOTO TABLE

The **F\_PHOTO** table is used to save the information collected while taking photographs, for each of the stations being described. It therefore has a “one-to-many” type relationship (*Relationship Class*) with the **F\_STATION** *Feature Class (rel\_Station\_Photo)*. In other words, a station can have one or more photographs.

Table 8: Field properties and description for F\_PHOTO

Field	DataType	Length	AliasName	Description	IsNullable
STATIONID	String	25	STATIONID	Unique identification of an outcrop or point where the photograph are taken	FALSE
PHOTOID	String	25	PHOTOID	Unique identifier of the photograph	FALSE
PHOTONO	Short Integer		PHOTONO	Sequential photo number for the station (e.g. 1, 2, 3, etc.)	FALSE
CATEGORY	String	50	CATEGORY	General subject matter of the photograph (e.g. outcrop, structure, landscape, wildlife)	FALSE
FILENO	Short Integer		FILENO	Sequential number or frame of the photo as assigned by the users camera (e.g. 1, 2, 3, etc.)	TRUE
FILENAME	String	25	FILENAME	File name assigned by the camera (e.g. DSC_087, IMG_088, etc.)	TRUE
DIRECTION	Short Integer		DIRECTION	Direction (value in degrees) toward which the photograph was taken	TRUE
CAPTION	String	254	CAPTION	Short description of the photograph	TRUE
PHOTO_LINK	String	254	PHOTO_LINK	Relative path location of the photograph	TRUE

### 2.1.9 F\_MA TABLE

This table includes elements relevant to the identification of mineralization and/or alteration for each of the stations being described. It therefore has a “one-to-many” type relationship (*Relationship Class*) with the **F\_STATION** *Feature Class (rel\_Station\_MA)*. In other words, a station can have one or more mineralization and/or alterations.

Table 9: Field properties and description for F\_MA

Field	DataType	Length	AliasName	Description	IsNullable
STATIONID	String	25	STATIONID	Unique identification of an outcrop or point where alteration or mineralization occurs	FALSE
MAID	String	25	MAID	Unique identifier for the occurrence of alteration or mineralization	FALSE
MANO	Short Integer		MANO	Sequential number for alteration/mineralization occurrence(s) at a station (e.g. 1, 2, 3, etc.)	FALSE
MA	String	15	MA	Type of feature (alteration or mineralization)	FALSE
UNIT	String	15	UNIT	Rock type or unit in which the alteration or mineralization occurs	TRUE
MINERAL	String	100	MINERAL	Name of the alteration mineral or economic mineral	TRUE
MODE	Short Integer		MODE	Proportion (%) of the rock unit comprised by the mineral (range is 0-100)	TRUE
DISTRIBUTE	String	100	DISTRIBUTE	Nature of the distribution of the alteration mineral or economic mineral (e.g. pervasive, replacement, etc.)	TRUE
NOTES	String	254	NOTES	Further explanatory notes on the alteration or mineralization	TRUE

## 2.2 PROJECT MANAGEMENT MODULE

This module contains the minimum data required to manage the elements essential to the governance of a geological mapping project.

### 2.2.1 M\_PROJECT TABLE

The **M\_PROJECT** table contains the essential project-related data. Although the design of the model permits multi-project management, the current version of the implementation process can only manage one project per database. The **M\_PROJECT** table should therefore contain only one record.

The **ProjectID** attribute is the primary key of this table. The **Project Name** and **Nom Projet** attributes provide the bilingual functionality required by the North American Profile of ISO Standard 19115 (NAP). The **Project Abbreviation** makes it possible to define an abbreviated project name that can be used as an annotation in the ArcMAP™ environment.

Table 10: Field properties and description for **M\_PROJECT**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
PROJECTID	Short Integer		ProjectID	Auto-generated unique identification number	FALSE	n/a
PROJECTNAME	String	255	Project Name	Name of the project (e.g. GEM2 - Hudson-Ungava)	FALSE	n/a
PROJECTNOM	String	255	Nom Projet	Nom du Projet	FALSE	n/a
PROJECTCODE	String	50	Project Code	Internal GSC project code (e.g. MGM2013)	TRUE	n/a
PROJECTABBREV	String	25	Project Abbreviation	Project abbreviation name (e.g. HUDSON-UNGAVA)	FALSE	n/a
STARTDATE	Date		Start Date	Start date of the project	FALSE	n/a
ENDDATE	Date		End Date	End date of the project	TRUE	n/a
REMARKS	String	255	Remarks	Clarifying comments regarding the project	TRUE	n/a
WEBLINK	String	50	Web Link	Link key to the corporate system for more metadata	TRUE	n/a



For all "**M\_**" and "**P\_**" tables, the **IsNullable** field shows the value defined by the data schema designers. In some cases, the values have been modified at the implementation stage in order to facilitate data entry.

### 2.2.2 M\_ACTIVITY AND M\_SUB\_ACTIVITY TABLES

These two tables follow the organizational structure of the Geological Survey of Canada for the "Geoscience for Energy and Mineral" program (i.e. GEM program). The GEM program has multiple projects, each composed of main activities and sub-activities. The structure of these tables is very similar to the structure of **M\_PROJECT** and it is recommended that the primary keys be defined according to the following rules:

- **Main\_ActivityID** should use the **Project Code** value, followed by a dash and a numerical suffix (e.g. MGM2013-1, MGM2013-2, etc.)
- **Sub\_ActivityID** should use the **Main\_ActivityID** value, followed by an alphabetical suffix (e.g. MGM2013-1A, MGM2013-1B, MGM2013-2A, etc.)

The **Abbreviation** attribute present in both tables also makes it possible to assign an abbreviated name for an activity or sub-activity, while the secondary keys **ProjectID** in **M\_ACTIVITY** and **Main\_ActivityID** in **M\_SUB\_ACTIVITY** make it possible to associate each of the sub-activities with a main activity and then with a project.

**Table 11: Field properties and description for M\_ACTIVITY**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
M_ACTIVITYID	String	25	Main_ActivityID	Main Activity code used as primary key; best practice would be to use the ProjectID code + incremented numbers (e.g. MGM2013-1, MGM2013-2, etc.)	FALSE	n/a
M_ACTIVITYNAME	String	255	Main_Activity Name	Name of the activity (e.g. Core Zone Integrated Geoscience, Romanet Horts - IOCG, etc.)	FALSE	n/a
ABBREVIATION	String	25	Abbreviation	Abbreviation name that will be used as label in ArcMAP (e.g. CORE ZONE, ROMANET-IOCG, etc.)	FALSE	n/a
STARTDATE	Date		Start Date	Start date of the activity	FALSE	n/a
ENDDATE	Date		End Date	End date of the activity	TRUE	n/a
DESCRIPTION	String	255	Description	Short description of the activity	TRUE	n/a
PROJECTID	Short Integer		ProjectID	Foreign key to <b>M_PROJECT</b> table	FALSE	n/a

The model proposes to treat CGM maps as a particular case of sub-activity. Although it shares the same properties as all the other sub-activities, the workflow of the model is modified for this sub-activity. In order to ensure that this particular type of sub-activity is clearly recognized, the model imposes a **Sub\_Activity\_Name** with the prefix **Build\_CGM\_**.

**Table 12: Field properties and description for M\_SUB\_ACTIVITY**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
S_ACTIVITYID	String	25	Sub_ActivityID	Sub-Activity code used as primary key; best practice would be to use the M_ActivityID code + incremented letters (e.g. MGM2013-1A, MGM2013-1B, MGM2013-2A, etc.)	FALSE	n/a
S_ACTIVITYNAME	String	255	Sub_Activity Name	Name of the activity (e.g. Field work 2013, <b>Build_CGMMap_1</b> , Schefferville aeromag survey, etc.)	FALSE	n/a
ABBREVIATION	String	25	Abbreviation	Abbreviation name that will be used as label in ArcMAP (e.g. FW2013, CGMMap_1, SCHEFFER_MAG, etc.)	FALSE	n/a
STARTDATE	Date		Start Date	Start date of the activity	FALSE	n/a
ENDDATE	Date		End Date	End date of the activity	TRUE	n/a
DESCRIPTION	String	255	Description	Short description of the activity	TRUE	n/a
M_ACTIVITYID	String	25	Main_ActivityID	Foreign key to <b>M_ACTIVITY</b> table	FALSE	n/a

### 2.2.3 P\_PERSON AND P\_ORGANIZATION TABLES

The structure of these two tables accurately reproduces the minimum basic information required by the model to manage the participants in a project. **P\_PERSON** makes it possible to manage the information related to the person, while **P\_ORGANIZATION** links the contact information of the organization to which the person belongs.

Table 13: Field properties and description for **P\_PERSON**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
PERSONID	Long Integer		PersonID	Auto-generated unique identification number	FALSE	n/a
FNAME	String	50	First Name	Person first name	FALSE	n/a
MNAME	String	25	Mid Name	Person middle name	TRUE	n/a
LNAME	String	50	Last Name	Person last name	FALSE	n/a
ALIAS	String	8	Alias	For NRCAN employees, Alias = username (e.g. pbrouill)	TRUE	n/a
ABBREVNNAME	String	50	Name Abbreviation	Abbreviation name (e.g. Brouillette, P.)	FALSE	n/a
PHONE	String	25	Phone	Phone number (format: Area Code-Phone No-Ext)	TRUE	n/a
EMAIL	String	50	Email	Email address	TRUE	n/a
ORGID	String	25	OrganizationID	Foreign key to <b>P_ORGANIZATION</b> table	TRUE	n/a

The **PersonID** attribute of the **P\_PERSON** table constitutes the primary key that is controlled and managed by the application. For the attribute **Alias**, it is suggested that the employee “pseudonym” be used for Natural Resources Canada personnel (i.e. Alias Name, username) (e.g. pbrouill). In **Name\_Abbreviation**, it is suggested that the standard format for bibliographic reference should be used (e.g. Brouillette, P.). The secondary key **OrgID** makes it possible to link the person to their organization.

Table 14: Field properties and description for **P\_ORGANIZATION**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
ORGID	String	25	OrganizationID	Auto-generated unique identification number	FALSE	n/a
ORGNAME	String	255	Organization Name	Name of the organization	FALSE	n/a
ORGABBREV	String	50	Organization Abbreviation	Abbreviated organization name (e.g. GSC-Q)	TRUE	n/a
ORGADD	String	255	Organization Address	Business address of the organization	FALSE	n/a
ORGPHONE	String	25	Organization Phone	Business phone number of the organization (format: Area Code-Phone No-Ext)	FALSE	n/a
ORGEMAIL	String	50	Organization Email	Business email address of the organization	TRUE	n/a
ORGWWW	String	50	Organization WEB	Business WEB address of the organization	TRUE	n/a

### 2.2.4 P\_PARTICIPANT TABLE

The concept of “Participant” ensures the functional link between the **Project Level** and **Actors Level** of the metadata module. The **P\_PARTICIPANT** table is used to manage the link between a person and an activity, or sub-activity, by means of a role. This concept therefore authorizes a person to participate in more than one role in an activity or sub-activity.

**ParticipantID** is the primary key of this table and is a sequential auto-generated number. To ensure the integrity of the database when creating a record, the model imposes a list of values for the **Participant\_Role** attribute. This list is implemented in a *Domain Value* called **ActivityRole\_DID**.

Table 15: Field properties and description for **P\_PARTICIPANT**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
PARTICIPANTID	String	15	ParticipantID	Auto-generated unique identification number	FALSE	n/a
PERSONID	Long Integer		PersonID	Foreign key to table <b>P_PERSON</b>	FALSE	n/a
M_ACTIVITYID	String	25	M_ActivityID	Foreign key to table <b>M_ACTIVITY</b>	TRUE	n/a
S_ACTIVITYID	String	25	S_ActivityID	Foreign key to table <b>M_SUB_ACTIVITY</b>	TRUE	n/a
PARTROLE	String	50	Participant Role	Role of the person in each specific activity (e.g. bedrock mapper, GIS specialist, etc.)	TRUE	ActivityRole_DID
ROLEDESC	String	255	Role Description	Brief description of the role of the participant	TRUE	n/a
GEOLCODE	String	10	Geologist Code	GSC Officer code (usually a combination of the project leader Officer Code with the first letter of the participant last name)	TRUE	n/a
STARTDATE	String	10	Start Date	Participant start date for a specific activity (format: yyyy-mm-dd)	TRUE	n/a
ENDDATE	String	10	End Date	Participant end date for a specific activity (format: yyyy-mm-dd)	TRUE	n/a
REMARKS	String	255	Remarks	Clarifying comments regarding the participant	TRUE	n/a
METAID	String	30	MetalID	Used as foreign key to <b>F_STATION</b>	TRUE	n/a

## 2.2.5 P\_SOURCE TABLE

This table is one of the essential elements of the model because it makes it possible to associate a source with all the spatial objects of the database. This table has a unique identifier stored in **SourceID** and the values are auto-generated by the application.

Table 16: Field properties and description for **P\_SOURCE**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
SOURCEID	String	15	SourceID	Auto-generated unique identification number	FALSE	n/a
SOURCENAME	String	255	Source Name	Abbreviated publication reference for the original data source (e.g. Gordon, T; Okulitch, A.V., 1977, Open File 442)	TRUE	n/a
DOI	String	25	DOI	Unique Digital Object Identifier (e.g. doi:10.4095/290088)	TRUE	n/a
ABBREVIATION	String	50	Abbreviation	Abbreviation name that can be used as label in ArcMAP (e.g. OF442)	FALSE	n/a
FILEPATH	String	200	File Path	Complete path of the input dataset	TRUE	n/a
EXTENDED_SOURCE	String	2000	Extended Source	Bibliographical record and authors or any other information related to source	TRUE	n/a
REMARKS	String	1000	Remarks	Clarifying comments regarding the sources	TRUE	n/a

The **P\_SOURCE** table makes it possible to manage the minimum information required to identify a source (**SourceName**), record its local physical location if necessary (**File\_Path**) and locate its presence on the web (**DOI**).

## 2.2.6 P\_STUDY\_AREA AND P\_CGM FEATURES

The **P\_STUDY\_AREA** polygon *Feature Class* makes it possible to record the geometry of the metadata that may have a spatial reference, such as the area covered by a project, activity, sub-activity or source.

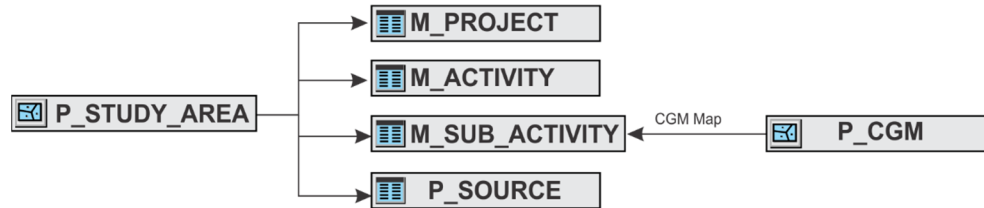


Figure 7: Subset of the Data Model illustrating relationships between **P\_STUDY\_AREA**, **P\_CGM** and their associated attribute tables

In the case of a sub-activity associated with the preparation of CGM maps, the footprint of these maps is managed by the **P\_CGM** *Feature Class* (Figure 7). This geometry, commonly named “*Neatline*”, delimits the spatial extent (bounding box coordinates) of a CGM map.

For these two *Feature Classes*, data entry for the **Abbreviation** and **Table\_RelatedID** attributes is entirely controlled by the application. The **Abbreviation** attribute is assigned the values recorded in the fields of the same name of the **M\_PROJECT**, **M\_ACTIVITY**, **M\_SUB\_ACTIVITY** or **P\_SOURCE** tables, while **Table\_RelatedID** is the secondary key pointing to the **P\_STUDY\_AREA\_INDEX** table.

Table 17: Field properties and description for **P\_STUDY\_AREA**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
TABLE_RELATEDID	String	25	Table RelatedID	Foreign key used to link each polygon from the <b>P_Study_Area</b> Feature Class to their attribute tables through the <b>P_Study_Area_Index</b> table	TRUE	n/a
EAST_EXTENT_COORD	Double		East extent coordinate	The eastern-most coordinate of the limit of the study area	TRUE	n/a
WEST_EXTENT_COORD	Double		West extent coordinate	The western-most coordinate of the limit of the study area	TRUE	n/a
NORTH_EXTENT_COORD	Double		North extent coordinate	The northern-most coordinate of the limit of the study area	TRUE	n/a
SOUTH_EXTENT_COORD	Double		South extent coordinate	The southern-most coordinate of the limit of the study area	TRUE	n/a
ABBREVIATION	String	25	Abbreviation	Label text used for display in ArcMap. This field is entirely controlled by the data entry interface and values are from the <b>ABBREVIATION</b> field of the <b>M_ACTIVITY</b> , <b>M_SUB_ACTIVITY</b> and <b>P_SOURCE</b> tables, as well as the <b>PROJECTABBR</b> field of the <b>M_PROJECT</b> table	FALSE	n/a
REMARKS	String	255	Remarks	Clarifying comments regarding the study area	TRUE	n/a

As mentioned above, the **P\_CGM** *Feature Class* is a particular case of Study Area essentially dedicated to CGM maps. For this reason, and for implementation considerations, this *Feature Class* contains additional attributes that serve to manage a dataset required for formatting CGM maps. Therefore, the **CGM\_MapID**, **Map\_Name**, **Abstract**, **Résumé** and **Descriptives\_Notes** attributes contain some of the information necessary to create the surround of a CGM map.

Table 18: Field properties and description for *P\_CGM*

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
CGM_MAPID	String	25	CGM_MapID	Unique identifier of a CGM map (e.g. CGM044).- if the CGM map number is not available, the author can use a temporary ID like the NTS sheet number (e.g. 47A06) or a short intuitive term (e.g. PenrhynGroup_east)	FALSE	n/a
TABLE_RELATEDID	String	25	Table RelatedID	Foreign key used to link each polygon from the <i>P_CGM</i> Feature Class to the <i>M_SUB_ACTIVITY</i> table through the <i>P_STUDY_AREA_INDEX</i> table	TRUE	n/a
MAPNAME	String	255	Map Name	Map name as it will appear on the lower right corner of the CGM paper map	FALSE	n/a
ABSTRACT	String	2147483647	Abstract	Text of the abstract as it will appear on the paper map (English version)	TRUE	n/a
RESUME	String	2147483647	Résumé	Text of the abstract as it will appear on the paper map (French version)	TRUE	n/a
DESCNOTE	String	2147483647	Descriptive Notes	Descriptive notes as they will appear on the paper map	TRUE	n/a
EAST_EXTENT_COORD	Double		East extent coordinate	The eastern-most coordinate of the CGM map	TRUE	n/a
WEST_EXTENT_COORD	Double		West extent coordinate	The western-most coordinate of the CGM map	TRUE	n/a
NORTH_EXTENT_COORD	Double		North extent coordinate	The northern-most coordinate of the CGM map	TRUE	n/a
SOUTH_EXTENT_COORD	Double		South extent coordinate	The southern-most coordinate of the CGM map	TRUE	n/a
REMARKS	String	255	Remarks	Clarifying comments regarding the study area	TRUE	n/a

## 2.2.7 P\_STUDY\_AREA\_INDEX TABLE

*P\_STUDY\_AREA\_INDEX* is the index table which maintains the link between the geometry of the *P\_STUDY\_AREA* or *P\_CGM* Feature Classes and a record in the *M\_PROJECT*, *M\_ACTIVITY*, *M\_SUB\_ACTIVITY* or *P\_SOURCE* tables (Figure 8).

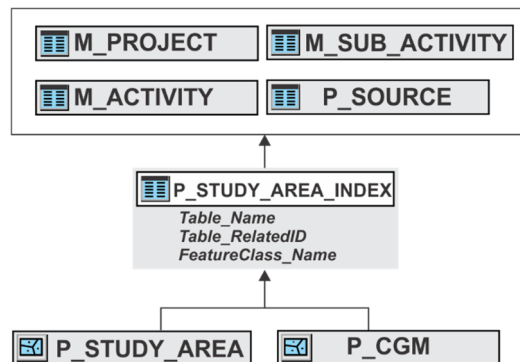


Figure 8: Subset of the Data Model illustrating the role of the *P\_STUDY\_AREA\_INDEX* index table



Management of the content of **P\_STUDY\_AREA\_INDEX** is controlled entirely by the application. Users must not attempt to edit its content, at the risk of altering the functional integrity of the table and, in turn the database.

Table 19: Field properties and description for **P\_STUDY\_AREA\_INDEX**

Field	Data Type	Length	Alias Name	Description	Is Nullable	Domain Name
TABLERNAME	String	25	Table Name	Name of the table for which a StudyArea Index is created	TRUE	n/a
TABLE_RELATEDID	String	25	Table RelatedID	Key field used to link each polygon from either the <b>P_STUDY_AREA</b> or the <b>P_CGM</b> Feature Class to their specific attribute table	TRUE	n/a
FC_NAME	String	15	FeatureClass Name	Name of the Feature Class for which a StudyArea Index is created	TRUE	n/a

The example illustrated in Figure 9 facilitates understanding the elements of the model presented in this section as well as Sections 2.2.6.

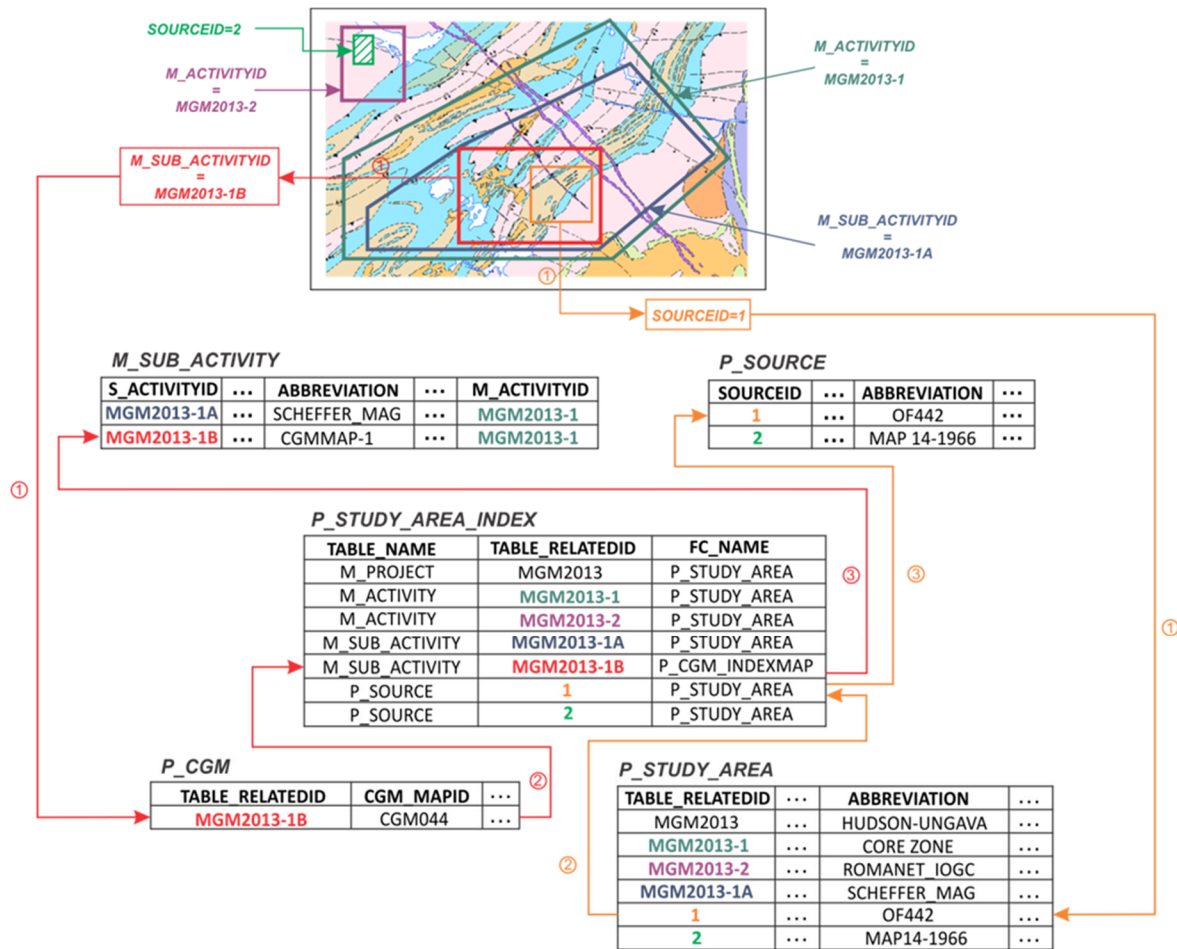


Figure 9: Example showing the relationships between the **P\_STUDY\_AREA\_INDEX** table, the **P\_STUDY\_AREA** and **P\_CGM\_MAPINDEX** Feature Classes, and their associated tables

The two scenarios described here show how the **P\_STUDY\_AREA\_INDEX** index table ensures the link between **P\_STUDY\_AREA**, **P\_CGM** and the associated attribute Tables.

1. The first scenario is shown in red by a sequence of arrows numbered from ① to ③. It illustrates the functional link between the geographic position (i.e. Neatline) of a CGM geological map, its record in the **P\_CGM Feature Class**, and its redirection to the **M\_SUB\_ACTIVITY** attribute table.
2. In the same way, the second scenario, indicated with orange arrows, shows the functional link between the geographic position of a source document, its record in the **P\_STUDY\_AREA Feature Class**, and its redirection to the **P\_SOURCE** attribute table.

## 2.2.8 P\_GEO\_EVENT TABLE

The table **P\_GEO\_EVENT** contains age related information linked to the geological events represented by map units, geolines, etc. For each event the user can assign age, specified either numerically or using a named era from the International Commission on Stratigraphy.

Table 20: Field properties and description for **P\_GEO\_EVENT**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
GEOEVENT_ID	Long Integer		Event ID	Auto-generated unique identification number	FALSE	n/a
GEOEVENT_NAME	String	254	Event Name	Name given to the geological event	TRUE	n/a
AGEMIN_PREFIX	String	50	Minimum Age Prefix	Prefix added to AGEMIN_TIMESCALE in order to further specify the age	TRUE	AgePrefix_DID
AGEMIN_TIMESCALE	String	50	Minimum Age Time Scale	Minimum age of a geological event represented by the name of a geological time scale in which the age terms are defined	TRUE	AgeDesignator_DID
AGEMIN_VALUE	Double		Minimum Age Value (Ma)	Younger boundary of interval for age of the geological event	TRUE	n/a
AGEMIN_CERTAINTY	Double		Minimum Age Value Certainty (Ma)	Value of the range of uncertainty for <b>AGEMIN_VALUE</b>	TRUE	n/a
AGEMAX_PREFIX	String	50	Maximum Age Prefix	Prefix added to <b>AGEMIN_TIMESCALE</b> in order to further specify the age	TRUE	AgePrefix_DID
AGEMAX_TIMESCALE	String	50	Maximum Age Time Scale	Maximum age of a geological event represented by the name of a geological time scale in which the age terms are defined	TRUE	AgeDesignator_DID
AGEMAX_VALUE	Double		Maximum Age Value (Ma)	Older boundary of interval for age of the geological event	TRUE	n/a
AGEMAX_CERTAINTY	Double		Maximum Age Value Certainty (Ma)	Value of the range of uncertainty for <b>AGEMAX_VALUE</b>	TRUE	n/a
SOURCEID	String	15	Source ID	Foreign key to <b>P_SOURCE</b>	TRUE	SourceRef_PID

## 2.3 CORE MODULE

This section describes in detail the *Feature Classes* and the *Tables* comprising the core of the model. A brief explanation is provided for each of the mandatory fields and examples are provided to illustrate the more complex concepts.

### 2.3.1 GEO\_LINES FEATURE CLASS

The **GEO\_LINES Feature Class** is one of the central components of the **Core module** because it contains all linear elements supporting the interpretation of a geological mapping project. **GEO\_LINES** is composed of eleven *Subtypes (Geoline Type)* (see ANNEX A), each representing a type of line required to create a geological interpretation. When combined with the values of the **GeoLine Qualifier**, **Confidence**, **Attitude** and **Generation** fields, these *Subtypes* define a set of more than 10,000 line types, all individually represented by a unique **GEOLINEID**.

The **GEO\_LINES Feature Class** also contains the attributes required to interpret the movement of certain linear geological concepts (**Fault Movement**, **HangWall Direction**, **Fold Trend**) as well as attributes that serve to assign a name (**Geological Name**) to the linear elements.

The automated process of creating geological polygons is essentially controlled by the value assigned in the **Is Boundary** attribute. The “Yes” or “No” value of this attribute determines the selection of the linear elements that are used to create the polygons. For example, a normal fault limiting contact between two different geological units must have the value “Yes” in the **Is Boundary** attribute. In the current version of the model, the **contact**, **unit construct line**, **isograd** and **overprint Subtypes** have the **Is Boundary** attribute set to “Yes” by default.

**GEO\_LINES** has five attributes to manage mandatory metadata. For each line feature, the application will automatically enter the data for **CreatorID**, **EditorID** as well as for **Create Date**, **Edit Date** and **SourceID**.

Table 21: Field properties and description for **GEO\_LINES**

FieldName	DataType	Length	AliasName	Description	IsNullable	Domain Name
GEOLINEID	String	12	GeoLineID	Calculated field obtained by concatenating the CODES associated with the following fields: <b>GeoLine Type</b> , <b>GeoLine Qualifier</b> , <b>Confidence</b> , <b>Attitude</b> and <b>Generation</b>	TRUE	n/a
GEOLINETYPE	Long Integer		GeoLine Type	Type of GeoLine (e.g. fault)	FALSE	n/a
QUALIFIER	String	4	GeoLine Qualifier	Qualifier of a GeoLine (e.g. thrust)	FALSE	Controlled by the Subtype (see Annexe A)
CONFIDENCE	String	2	Confidence	Certainty in the position of the Feature	FALSE	Controlled by the Subtype (see Annexe A)
ATTITUDE	String	2	Attitude	Position of the fault, shear or fold	FALSE	Controlled by the Subtype (see Annexe A)
GENERATION	String	2	Generation	The phase of generation	FALSE	Controlled by the Subtype (see Annexe A)
NAME	String	255	Geological Name	Name of the geological feature (e.g. Cadillac Fault, Mackenzie Dykes, etc.)	TRUE	n/a

FieldName	DataType	Length	AliasName	Description	IsNullable	Domain Name
MOVEMENT	String	2	Fault Movement	Description of fault movement where the hanging wall cannot be established (e.g. generic, steep dip faults)	TRUE	Controlled by the Subtype (see Annexe A)
HWALLDIR	String	2	HangWall Direction	Direction of the side of the fault on which the hanging wall occurs (for faults where a hanging wall can be identified (e.g. normal, reverse, thrust))	TRUE	Controlled by the Subtype (see Annexe A)
FOLDTREND	String	2	Fold Trend	Approximate direction of plunge (e.g. trend) of the fold axis	TRUE	Controlled by the Subtype (see Annexe A)
FOLDPLUNGE	String	25	Fold Plunge	Approximate magnitude of plunge of the fold axis	TRUE	n/a
ARROWDIR	String	2	Arrow Direction	Direction in which the arrows for the limbs point for overturned and monocline symbols, or direction of short arrow (steep limb) for asymmetrical fold symbols	TRUE	Controlled by the Subtype (see Annexe A)
ISBOUNDARY	String	2	Is Boundary	Identifies a line segment shared by more than one subtype (default is set to YES for SubTypes Contact, Unit Construct Line, Overprint and Isograd)	FALSE	Boundary_DID
CREATORID	String	25	CreatorID	Name of the user who created the line. Abbreviated creator name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	FALSE	Participant_PID
EDITORID	String	25	EditorID	Name of the user who edited the line. Abbreviated editor name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
CREATEDATE	Date		Create Date	Date and time the line was created	FALSE	n/a
EDITDATE	Date		Edit Date	Date and time the line was last edited	TRUE	n/a
GSC_SYMBOL	String	12	GSC SYMBOL	GSC symbol value as defined by the GSC's Legend Committee	TRUE	n/a
SOURCEID	String	15	SourceID	Foreign key to <b>P_SOURCE</b>	TRUE	SourceRef_PID
GEOEVENT_ID	Long Integer		Event ID	Foreign key to <b>P_GEO_EVENT</b>	TRUE	n/a
ORIGCODE	String	50	Origcode	Original code of the GEOLINE (original code assigned to a GEOLINE, from previous version, external database, etc.)	TRUE	n/a
REMARKS	String	255	Line Remarks	Clarifying comments from the <b>CREATORID</b>	TRUE	n/a
EDITREMARKS	String	255	Editing Remarks	Clarifying comments from the <b>EDITORID</b>	TRUE	n/a
DISPLAYPUB	Short Integer		Display In Publication	To be shown on (map) publication	TRUE	n/a

### 2.3.2 LABELS FEATURE CLASS

The **LABELS Feature Class** also constitutes a central component of the **Core module**. Used in conjunction with the **GEO\_LINES Feature Class**, **LABELS** participates in the automated creation of geological polygons.

The data recorded in the **Label** attribute generally correspond to a *map unit* code and these values are used to generate the **MapUnit\_PID** domain value. The application provides users with a simple procedure to modify this value at any time. At the risk of altering the integrity of the database, users should never attempt to manually modify this value by directly editing the Feature Class.

Just like for the **GEO\_LINES Feature Class**, a series of attributes manage mandatory metadata which are automatically entered when the object is created.

Table 22: Field properties and description for **LABELS**

FieldName	DataType	Length	AliasName	Description	IsNullable	Domain Name
LABELID	String	10	Label	Common use for <b>LABELID</b> is the code (annotation) used for a lithological unit (i.e. Map Unit)	FALSE	MapUnit_PID
SOURCEID	String	15	SourceID	Reference of original data source. (foreign key to <b>P_SOURCE</b> table)	TRUE	SourceRef_PID
GEOEVENT_ID	Long Integer		Event ID	Foreign key to <b>P_GEO_EVENT</b>	TRUE	n/a
REMARKS	String	255	Remarks	Comment field available for further explanation of the Label	TRUE	n/a
CREATORID	String	25	CreatorID	Name of the user who created the label. Abbreviated creator name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
CREATEDATE	Date		Create Date	Date and time the label was created	TRUE	n/a
EDITORID	String	25	EditorID	Name of the user who edited the label. Abbreviated editor name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
EDITDATE	Date		Edit Date	Date and time the label was last edited	TRUE	n/a

### 2.3.3 GEO\_POLYS FEATURE CLASS

The **GEO\_POLYS Feature Class** contains the geological polygons (i.e. *map unit polygons* or *map unit*) resulting from the interpretation recorded in the **GEO\_LINES** and **LABELS Feature Classes**. The creation of data in this **Feature Class** is entirely controlled by the application developed in ArcMAP™, and users should never create or edit the polygons that are stored in it. As mentioned earlier, the polygons generated by the geological interpretation can easily be created or recreated at any time. All objects recorded in **GEO\_POLYS** should be considered temporary until the interpretation has been finalized.

All the attributes of this Feature Class are assigned the same values as those belonging to the **LABELS Feature Class** with the exception of **Remarks**. The latter can be edited by the user following the creation of the polygons.

Table 23: Field properties and description for *GEO\_POLY*

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
LABELID	String	10	Label	Common use for <b>LABELID</b> is the code (annotation) used for a lithological unit (i.e. Map Unit)	FALSE	MapUnit_PID
SOURCEID	String	15	SourceID	Reference of original data source	TRUE	SourceRef_PID
REMARKS	String	255	Remarks	Comment field available for further explanation of the described geological polygon	TRUE	n/a
CREATORID	String	25	CreatorID	Name of the user who created the polygon. Abbreviated creator name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	n/a
CREATEDATE	Date		Create Date	Date and time the polygon was created	TRUE	n/a
EDITORID	String	25	EditorID	Name of the user who edited the polygon. Abbreviated editor name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	n/a
EDITDATE	Date		Edit Date	Date and time the polygon was last edited	TRUE	n/a

### 2.3.4 GEO\_POINTS FEATURE CLASS

The **GEO\_POINTS** *Feature Class* contains all the structural point data as well as map units that are too small to be represented as polygons. The structural information that was acquired in the field using the GanFeld system and stored in the **F\_STRUC** attribute table of the **Field Data** module can be transferred automatically to **GEO\_POINTS**. The structural data from compilation work (imported or digitized *in situ*) can also be imported or recorded automatically in **GEO\_POINTS**.

**GEO\_POINTS** is characterized by three *Subtypes* (**GeoPoint\_Type**), that have the value of either *Planar*, *Linear* or *Map Unit* (the latter has not been fully implemented in this version of the model). When combined with the values of the **GeoPoint Subset**, **Attitude**, **Generation**, **Younging** and **Method** fields, these *Subtypes* define a set of more than 9,000 types of points, all individually represented by a unique **GEOPOINTID**.

The **GEO\_POINTS** *Feature Class* also contains the attributes **Azimuth** and **DipPlunge** as well as the **F\_StrucID** attribute which is used to link the structural elements to their original **F\_STRUC** table. The **Display From** and **Display To** attributes are used to manage the visualization of data based on a range of scales.

Table 24: Field properties and description for *GEO\_POINTS*

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
GEOPOINTID	String	13	GeopointID	Calculated field obtained by concatenating the CODES associated with GeoPoints SubTypes (GeoPoint Type, GeoPoint Subset, Attitude, Generation, Younging and Method)	TRUE	n/a
GEOPOINTTYPE	Long Integer		GeoPoint Type	Valid GeoPoint Type includes planar, linear and map unit	TRUE	n/a
GEOPOINTSUBSET	String	4	GeoPoint Subset	GeoPoint. Subset values are controlled by domain values Subset_Planar_SID and Subset_Linear_SID. (e.g. bedding, axial plane, anticline, etc.)	TRUE	Controlled by the Subtype (see Annexe A)

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
STRUCATTITUDE	String	2	Attitude	Attitude of the structural measurement (e.g. upright, overturned < 180, vertical, etc.)	TRUE	Controlled by the Subtype (see Annexe A)
STRUCGENERATION	String	2	Generation	Phase of generation (ex. primary, first, second, etc.)	TRUE	Controlled by the Subtype (see Annexe A)
STRUCYOUNGING	String	2	Younging	Confidence in attitude of primary layering as assessed from evidence for younging direction (e.g. known, stratigraphic order)	TRUE	Controlled by the Subtype (see Annexe A)
STRUCMETHOD	String	2	Method	Method of acquisition (e.g. measured at station, estimated remotely, etc.)	TRUE	Controlled by the Subtype (see Annexe A)
RELATEDSTRUC	String	15	Related Structure	Unique identifier for related planar or linear measurements (e.g. <b>StrucID</b> value from <b>F_STRUC</b> table)	TRUE	n/a
AZIMUTH	Short Integer		Azimuth	Right-hand rule strike value of structural feature (from 1 to 360)	TRUE	n/a
DIPPLUNGE	Short Integer		DipPlunge	Dip/plunge value of the structural feature in degrees (from 0 to 90)	TRUE	n/a
DIPDESC	String	30	Dip Description	To capture non-numerical dip values for dedicated symbols	TRUE	Dip_Desc_SID
SENSE_EVID	String	50	Sense Evidence	Evidence of sense of motion from kinematic indicators	TRUE	Sense_Evid_SID
STRAIN	String	2	Strain	Strain intensity associated with the fabric measurements	TRUE	Controlled by the Subtype (see Annexe A)
FLATTENING	String	2	Flattening	Relative intensity of planar (S) fabric over linear (L) fabric	TRUE	Controlled by the Subtype (see Annexe A)
F_STRUCID	String	25	F_StrucID	Foreign key to <b>F_STRUC</b> table	TRUE	n/a
GSC_SYMBOL	String	15	GSC Symbol	GSC symbol value as defined by the GSC's Legend Committee	TRUE	n/a
CREATORID	String	25	CreatorID	Name of the user who created the point. Abbreviated creator name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
CREATEDATE	Date		Create Date	Date and time the point was created	TRUE	n/a
EDITORID	String	25	EditorID	Name of the user who edited the point. Abbreviated editor name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
EDITDATE	Date		Edit Date	Date and time the point was last edited	TRUE	n/a
SOURCEID	String	15	SourceID	Reference of the original data source (foreign key to <b>P_SOURCE</b> )	TRUE	SourceRef_PID
ORIGCODE	String	50	Original Code	Original code of the GEOPOINT (original code assigned to a GEOPOINT, from previous version, external database, etc.)	TRUE	n/a
REMARKS	String	255	Remarks	Clarifying comments regarding the GEOPOINT	TRUE	n/a
EDITREMARKS	String	255	Editing Remarks	Clarifying comments from the EDITOR	TRUE	n/a
DISPLAY_FROM	String	20	Display from	Minimum scale at which point objects must be displayed	TRUE	Scale_PID

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
DISPLAY_TO	String	20	Display To	Maximum scale at which point objects must be displayed	TRUE	Scale_PID
DISPLAYPUB	Short Integer		Display In Publication	To be shown on (map) publication	TRUE	BooleanTruth_PID

### 2.3.5 CARTOGRAPHIC\_POINTS FEATURE CLASS

**CARTOGRAPHIC\_POINTS** is intended to store the spatial geometries of external source datasets like geochronology, legacy field data, drill holes, etc. Attributes of this *Feature\_Class* hold information essentially related to the spatial representation. Any tabular information related to the **Cartographic\_Points** is managed within an auto generated table, and linked with field **PointID**.

Thus, the purpose of this *Feature\_Class* is to display datasets that are not managed by the GSC's Bedrock Data Model but are needed for the geological compilation/interpretation processes.

Table 25: Field properties and description for **CARTOGRAPHIC\_POINT**

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
LEGENDITEMID	String	36	Legend Item ID	Auto-generated unique identifier. Foreign key to <b>P_LEGEND</b> table	FALSE	n/a
POINTID	String	36	Point Identification	Auto-generated unique identifier	FALSE	n/a
THEME	String	50	Cartographic Theme	Current version of the model implements seven themes but the application allows adding new themes	TRUE	CartoTheme_PID
SYMBOL	String	12	GSC Symbol	GSC symbol value as defined by the GSC's Legend Committee	TRUE	n/a
SYM_ANGLE	Short Integer		Azimuth	The right-hand rule value of the cartographic point symbol (from 1 to 360)	TRUE	n/a
DISPLAY_FROM	String	20	Display from	Minimum scale at which point objects must be displayed	TRUE	Scale_PID
DISPLAY_TO	String	20	Display To	Maximum scale at which point objects must be displayed	TRUE	Scale_PID
EASTING	Double		Easting	UTM Easting (to 2 decimal places - cm precision)	TRUE	n/a
NORTHING	Double		Northing	UTM Northing (to 2 decimal places - cm precision)	TRUE	n/a
LATITUDE	Double		Latitude	Latitude in decimal degrees	TRUE	n/a
LONGITUDE	Double		Longitude	Longitude in decimal degrees	TRUE	n/a
ALTITUDE	Double		Altitude	Elevation in metres	TRUE	n/a
DATUMZONE	String	25	Datum Zone	UTM longitudinal zone	TRUE	n/a
REMARKS	String	255	Remarks	Clarifying comments regarding the Cartographic Point	TRUE	n/a
CREATORID	String	25	CreatorID	Name of the user who created the point. Abbreviated creator name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
CREATEDATE	Date		Create Date	Date and time the point was created	TRUE	n/a



EDITORID	String	25	EditorID	Name of the user who edited the point. Abbreviated editor name: for NRCAN employees, Editor_ID = Alias name (e.g. pbrouill)	TRUE	Participant_PID
EDITDATE	Date		Edit Date	Date and time the point was last edited	TRUE	n/a
SOURCEID	String	15	Source ID	Foreign key to <b>P_SOURCE</b>	TRUE	SourceRef_PID
DISPLAYPUB	Short Integer		Display In Publication	To be shown on (map) publication	TRUE	n/a

### 2.3.6 P\_LEGEND, P\_LEGEND\_DESCRIPTION AND P\_LEGEND\_INDEX TABLES

The **P\_LEGEND** and **P\_LEGEND\_INDEX** tables, in combination with the **P\_CGM Feature Class**, make it possible to manage multiple CGM map legends within a single *Geodatabase* (Figure 10). With the addition of the **P\_LEGEND\_DESCRIPTION** table, different descriptions for the same legend item can be maintained on more than one CGM map.



Figure 10: Subset of the Data Model illustrating the role played by the table **P\_LEGEND\_INDEX**.

More simply, the **P\_LEGEND\_INDEX** table makes it possible to link a record in **P\_LEGEND** with one or more CGM maps from **P\_CGM**, and associate that record with a description in **P\_LEGEND\_DESCRIPTION**.

The **P\_LEGEND** table should be considered “The Authoritative Legend” for the whole project because it contains all items needed to create a geological map legend, independent of which CGM map they appear on. The **Symbol Type** attribute is essential for the creation of a geological legend because it is used to identify the type of legend item (line, header, marker point, etc.). The **Symbol**, **Indent** and **Legend Order** attributes make it possible to symbolize and position each of the legend items correctly relative to one another according to a hierarchical geological time sequence. The **Map Unit** and **Annotation** attributes are also used by cartographers to correctly symbolize the legend and map annotations. Finally, the **Legend ItemID** is the unique identifier of a legend item (i.e. primary key), and its value is controlled entirely by the application.

Table 26: Field properties and description for *P\_LEGEND*

Field	DataType	Length	AliasName	Description	IsNullable	Domain Name
LEGENDITEMID	String	36	Legend ItemID	Unique Legend Item identifier. Values stored in this field represent a legend item whether it's a Label name, a GeoPoint type or a GeoLine type: values stored are either <b>LabelID</b> , <b>GeoLineID</b> , <b>GeoPointID</b> or <b>headerID</b> but the interface displays the Description for all items	TRUE	n/a
LEGEND_ITEMTYPE	String	50	Legend Item Type	Legend item theme (e.g. Geoline, Geopoint. Headers, etc.)	TRUE	LegendItemTheme_PID
GSC_DISPLAY_NAME	String	254	Display Name	Editable legend item name that is displayed in ArcMap environment (e.g. Table of Content, Feature Templates, etc.)	TRUE	n/a
GSC_SYMBOL	String	15	Symbol	GSC symbol value as defined by the GSC's Legend Committee	TRUE	n/a
SYM_TYPE	String	2	Symbol Type	Type of symbol (e.g. fill, Line 1, Line 2, Header 1, Marker Point, etc.)	FALSE	LegendSymbolType_DID
INDENT	Short Integer		Indent	Number from 0 to 6 indicating the amount of indent for the legend item	TRUE	n/a
NAME	String	254	Geological Name	Geological Name of the legend item (e.g. Victoria Island formation, etc.)	TRUE	n/a
MAPUNIT	String	254	Map Unit	Coded value of the map unit as it appears on the map. e.g. the MAPUNIT of the Silurian Allen Bay Formation (Sa) is: (FNT name = "GSCGeology" size = "8")^A/(FNT)	TRUE	n/a
ANNOTATION	String	254	Annotation	Coded value of the map unit as it appears on the legend of the map. e.g. the MAPUNIT of the Silurian Allen Bay Formation (Sa) is: ^A	TRUE	n/a
GEOLRANK	String	25	Geological Rank	Geological rank (terms are from the CGI Simple Lithology Categories, v.201211)	TRUE	RankTerm_DID
LEGEND_ORD	Single	4	Legend_Order	Item order in the legend	TRUE	n/a

The ***P\_LEGEND\_DESCRIPTION*** table maintains the description of all the legend items for all the CGM maps.

Table 27: Field properties and description for *P\_LEGEND\_DESCRIPTION*

Field	DataType	Length	AliasName	Description	IsNullable
LEGDESCRIPTIONID	Double		Legend DescriptionID	Auto-generated unique identifier	TRUE
DESCRIPTION	String	2000	Description	Complete description of a legend item as it appears on the legend of a specific CGM Map.	TRUE

The ***P\_LEGEND\_INDEX*** table is controlled by the application and users must refrain from editing its content. This table contains only three attributes, each referring to the primary key of the related items, namely, ***P\_LEGEND*** (***Legend ItemID***), ***P\_LEGEND\_DESCRIPTION*** (***Legend DescriptionID***) and ***P\_CGM*** (***CGM MapID***).

Table 28: Field properties and description for *P\_LEGEND\_INDEX*

Field	DataType	Length	AliasName	Description	IsNullable
LEGDESCRIPTIONID	Double		Legend DescriptionID	Foreign key to <i>P_LEGEND_DESCRIPTION</i>	TRUE
CGM_MAPID	String	25	CGM_MapID	Primary key of <i>P_CGM</i> Feature Class	TRUE
LEGENDITEMID	String	36	Legend ItemID	Foreign key to <i>P_LEGEND</i>	TRUE

The example in Figure 11 provides context to help users better understand the functional link between CGM geological maps, the geological units that comprise them and the textual description of each of these units.

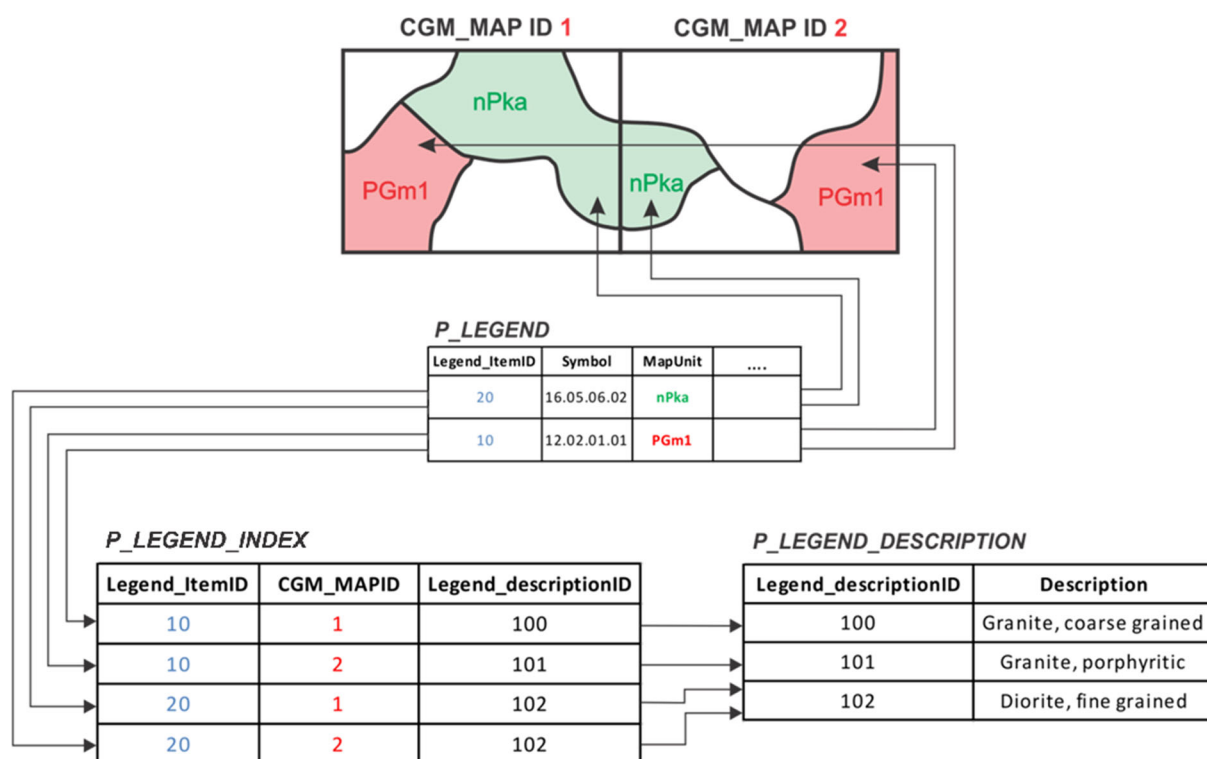


Figure 11: Example showing the relationships between the CGM maps and the tables managing their respective map unit's description

It should be noted that the application developed in ArcMAP™ controls the sequence of data entry in these tables. The process is user-transparent and strictly follows the data flow presented in this example.

## 2.4 DICTIONARIES MODULE

The management of the dictionaries is fully integrated in this version of the GSC Bedrock *Geodatabase* model. However, it is anticipated that these dictionaries may eventually be managed in whole or in part by external systems or databases.

Although users may not utilize these tables directly, they remain available for consultation. The vocabularies within the dictionaries follow the recommendations of the GSC Bedrock Legend Committee, 2015.

### 2.4.1 SYMBOL\_GEOLINES AND SYMBOL\_GEOPOINTS TABLES

These tables serve a two-fold function of containing both the symbology and an abbreviated descriptive text of all the line and point types of the **GEO\_LINES** and **GEO\_POINTS** *Feature Class*.

Table 29: Field properties and description for **SYMBOL\_GEOLINES**

Field	DataType	Length	AliasName	Description	IsNullable
GEOLINEID	String	255	GEOLINEID	Unique identifier for a GEOLINE	FALSE
Legend_Description	String	255	Legend_Description	Short description of the GEOLINE	FALSE
GSC_Symbol	String	255	GSC Symbol	GSC symbol value as defined by the GSC's Legend Committee	FALSE

Their structure is identical, where a brief description is associated with each **GeoLineID** or **GeoPointID**, as well as a symbol code from the GSC style set, modified from the standard Federal Geographic Data Committee (FGDC) style.

Table 30: Field properties and description for **SYMBOL\_GEOPOINTS**

Field	DataType	Length	AliasName	Description	IsNullable
GEOPOINTID	String	255	GEOPOINTID	Unique identifier for a GEOPOINTID	FALSE
Legend_Description	String	255	Legend_Description	Short description of the GEOPOINTID	FALSE
GSC_Symbol	String	255	GSC Symbol	GSC symbol value as defined by the GSC's Legend Committee	FALSE

### 3 METADATA

Metadata occupy an important place in the GSC Bedrock *Geodatabase* model. Whether they are related to project governance or to the source of an observation and/or geological interpretation, metadata appear in all modules. Their creation and use are intimately integrated into the applications that interact with the model.

Figure 12 provides an overview of the *Feature Class* and *Tables* that contain actual metadata as well as other data that can eventually be used as metadata.

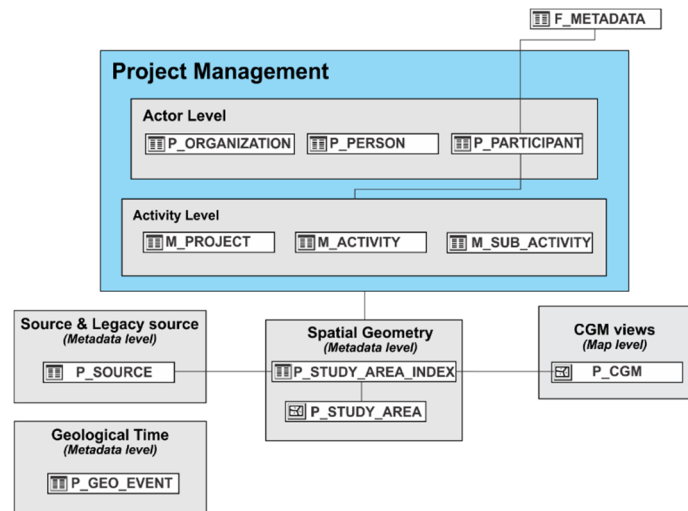


Figure 12: Subset of the Data Model showing the Feature Classes and Tables providing metadata management

For example, the records contained in the **P\_PARTICIPANT** and **P\_SOURCE** tables become **metadata** when they are used to document the geological objects in the database. Figure 13 illustrates this where a geological feature (e.g. contact) recorded in the **GEO\_LINES** Feature Class is linked to its source and the participant who interpreted and/or digitized the contact.

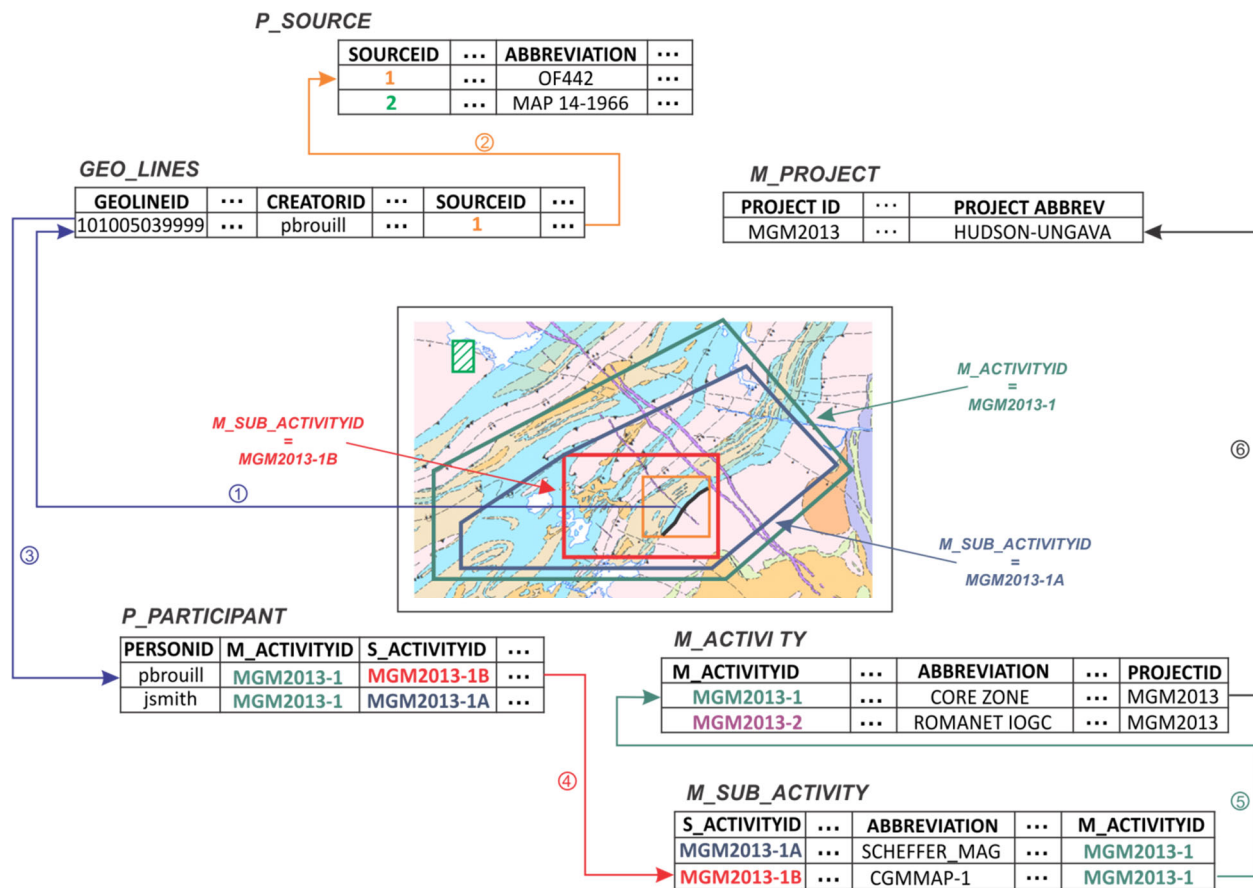


Figure 13: Example showing the relationships between spatial objects and associated metadata

The geological contact is digitized and then recorded in **GEO\_LINES** ①. This contact is functionally linked to the source map ② (**P\_SOURCE**) and to the participant ③ (**P\_PARTICIPANT**). In the same way, starting from the participant, it is possible to trace back the links up to the project (**M\_PROJECT**), through ④ the sub-activity (**M\_SUB\_ACTIVITY**), and then ⑤ the main activity (**M\_ACTIVITY**).

Here again, the applications developed in ArcMAP™ and ArcCatalog™ entirely control the management of the data flow, and when a value is entered in one of the tables in Figure 12, it immediately becomes available to be used as metadata.

The structure of the model, combined with its implementation process and with the applications developed in ArcGIS™, make it possible to completely integrate the creation and management of metadata at all steps of the data input, interpretation and dissemination process.

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## 4 ANNEXES

The following annexes describe the geological terminology used for a bedrock mapping project. They also help to understand the relationship between the subtypes, their associated domains values as well as the default values.

### ANNEX A

*Subtypes* are used in the **GEO\_LINES** and **GEO\_POINTS** *Features Classes*. The **GeolineType** and **GeopointType** fields control the value of the *Subtype*. The following table shows a list of the *Subtypes* used for the *Features Class* **GEO\_LINES** with their code and corresponding description.

SUBTYPE FIELD	CODE	DESCRIPTION
GEOLINETYPE	10	contact
GEOLINETYPE	11	fault
GEOLINETYPE	12	shear
GEOLINETYPE	14	fold
GEOLINETYPE	15	thin lithology
GEOLINETYPE	16	unit construct line
GEOLINETYPE	17	trace
GEOLINETYPE	18	limit
GEOLINETYPE	19	overprint
GEOLINETYPE	20	isograd

As shown in Table 21 of section 2.3.1, several *Domain Values* are fully controlled by the value of the *Subtype*. The following tables show the list of *Domain Values* associated with eight fields of the **GEO\_LINES** *Feature Class*, depending on the value of each *Subtype*.

*Subtype* Code: 10

*Subtype* Name: contact

FIELD NAME	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_contact_SID	1001
CONFIDENCE	Confid_SID	01
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

*Subtype* Code: 11

*Subtype* Name: Fault

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_fault_SID	2001
CONFIDENCE	Confid_SID	01
ATTITUDE	Attitude_SID	66
GENERATION	Gen_FaultShear_SID	88
MOVEMENT	Fault_move_SID	66
HWALLDIR	Fault_direct_SID	66
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 12

Subtype Name: shear

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_shear_SID	2050
CONFIDENCE	Confid_SID	01
ATTITUDE	Attitude_SID	66
GENERATION	Gen_FaultShear_SID	88
MOVEMENT	Fault_move_SID	66
HWALLDIR	Fault_direct_SID	66
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 14

Subtype Name: fold

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_fold_SID	3001
CONFIDENCE	Confid_fold_SID	01
ATTITUDE	Attitude_SID	01
GENERATION	Gen_fold_SID	88
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	Fold_direct_SID	66
ARROWDIR	Fold_direct_SID	66

Subtype Code: 15

Subtype Name: thin lithology

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_ThinLitho_SID	4006
CONFIDENCE	Confid_SID	01
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 16

Subtype Name: unit construct line

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_construct_SID	5001
CONFIDENCE	NA_DID	99
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 17

Subtype Name: trace

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_trace_SID	5031
CONFIDENCE	Confid_SID	01
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 18

Subtype Name: limit

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_limit_SID	5056
CONFIDENCE	Confid_SID	02
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 19

Subtype Name: overprint

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_overprint_SID	6001
CONFIDENCE	Confid_SID	02
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

Subtype Code: 20

Subtype Name: isograd

FIELD	DOMAIN NAME	DEFAULT VALUE
QUALIFIER	Qualif_isograd_SID	7004
CONFIDENCE	Confid_SID	02
ATTITUDE	NA_DID	99
GENERATION	NA_DID	99
MOVEMENT	NA_DID	99
HWALLDIR	NA_DID	99
FOLDTREND	NA_DID	99
ARROWDIR	NA_DID	99

The following table shows a list of the *Subtypes* used for the **GEO\_POINTS** *Features Class* with their code and respective description.

SUBTYPE FIELD	CODE	DESCRIPTION
GEOPOINTTYPE	1	planar
GEOPOINTTYPE	2	linear
GEOPOINTTYPE	3	map unit

As shown in Table 24 of section 2.3.4, several *Domain Values* are fully controlled by the value of the *Subtype*. The following two tables show the list of *Domain Values* associated with nine fields of the *Feature Class* **GEO\_POINTS**, depending on the value of each *Subtype*.

*Subtype* Code: 1

*Subtype* Name: planar

FIELD	DOMAIN NAME	DEFAULT VALUE
GEOPOINTSUBSET	Subset_Planar_SID	1001
STRUCATTITUDE	Struc_Attitude_Planar_SID	05
STRUCGENERATION	Struc_Generation_SID	88
STRUCYOUNGING	Planar_Younging_SID	07
STRUCMETHOD	Struc_Method_SID	01
DIPDESC	Dip_Desc_SID	66
SENSE_EVID	Sense_Evid_SID	66
STRAIN	Struc_Strain_SID	66
FLATTENING	Struc_Flattening_SID	66

*Subtype* Code: 2

*Subtype* Name: linear

FIELD	DOMAIN NAME	DEFAULT VALUE
GEOPOINTSUBSET	Subset_Linear_SID	2029
STRUCATTITUDE	NA_DID	99
STRUCGENERATION	Struc_Generation_SID	88
STRUCYOUNGING	NA_DID	99
STRUCMETHOD	Struc_Method_SID	01
DIPDESC	NA_DID	99
SENSE_EVID	NA_DID	99
STRAIN	Struc_Strain_SID	66
FLATTENING	Struc_Flattening_SID	66

*Subtype* Code: 3

*Subtype* Name: map unit

FIELD	DOMAIN NAME	DEFAULT VALUE
GEOPOINTSUBSET	NA_DID	99
STRUCATTITUDE	NA_DID	99
STRUCGENERATION	NA_DID	99
STRUCYOUNGING	NA_DID	99
STRUCMETHOD	NA_DID	99
DIPDESC	NA_DID	99
SENSE_EVID	NA_DID	99
STRAIN	NA_DID	99
FLATTENING	NA_DID	99

## ANNEX B

This annex contains all corporate *Domain Values* controlled by the *Subtype*. A list of codes and descriptions are presented for each of the *Domain Values*. *Domain Name*: Qualif\_Contact\_SID

Code	Description
1001	depositional
1002	depositional-conformable
1003	depositional-escarpment
1004	depositional-unconformable
1005	intrusive
1006	metamorphic
1007	sheared
1008	faulted
1010	facies change
1011	drift contact
1012	undefined

### *Domain Name*: Qualif\_Fault\_SID

Code	Description
2001	normal
2002	reverse
2003	thrust
2004	strike-slip, dextral
2005	strike-slip, sinistral
2006	oblique-slip, dextral, extensional
2007	oblique-slip, dextral, contractional
2008	oblique-slip, sinistral, extensional
2009	oblique-slip, sinistral, contractional
2012	back-thrust
2013	transverse, motion undefined
2014	generic, moderate dip
2015	generic, shallow dip
2016	generic, steep dip
2017	tear
2018	motion undefined
2019	detachment, extensional
2020	detachment, contractional
2021	transform, dextral
2022	transform, sinistral
2023	generic, downthrown

### *Domain Name*: Qualif\_Shear\_SID

Code	Description
2050	normal
2051	reverse
2052	strike-slip, dextral
2053	strike-slip, sinistral
2054	oblique-slip, dextral, extensional
2055	oblique-slip, dextral, contractional
2056	oblique-slip, sinistral, extensional
2057	oblique-slip, sinistral, contractional
2059	generic, moderate dip
2060	generic, shallow dip
2061	generic, steep dip

2062	motion undefined
2063	thrust
2064	detachment, extensional
2065	detachment, contractional
2066	transform, dextral
2067	transform, sinistral

### *Domain Name*: Qualif\_Fold\_SID

Code	Description
3001	anticline
3002	anticline, asymmetrical
3003	anticline, synformal
3004	syncline
3005	syncline, antiformal
3006	syncline, asymmetrical
3007	antiform
3008	antiform, asymmetrical
3009	antiformal sheath
3010	synform
3011	synform, asymmetrical
3012	synformal sheath
3013	monocline, anticlinal bend
3014	monocline, synclinal bend
3015	anticlinorium
3016	synclinorium
3017	neutral
3018	trough
3019	arch
3020	anticline, homeoclinic
3021	syncline, homeoclinic
3022	anticline, contraclinal
3023	syncline, contraclinal
3024	anticline, homeoclinic, synformal
3025	syncline, homeoclinic, antiformal
3026	anticline, contraclinal, synformal
3027	syncline, contraclinal, antiformal
3031	recumbent, anticlinal
3032	recumbent, synclinal

### *Domain Name*: Qualif\_ThinLitho\_SID

Code	Description
4001	dyke
4002	sill
4003	vein
4004	marker bed
4005	distinctive lithology
4006	thin stratigraphic unit
4007	discontinuous thin unit

*Domain Name: Qualif\_Construct\_SID*

Code	Description
5001	limit of mapping
5002	map neat line
5004	mapping precision change
5005	nomenclature change
5007	other, see remarks

*Domain Name: Qualif\_Trace\_SID*

Code	Description
5025	bedding form line
5026	foliation form line
5027	undefined form line
5028	joint / fracture
5029	geophysical anomaly, positive
5030	geophysical anomaly, negative
5031	structural line of section
5032	seismic survey line
5033	geophysical survey line
5034	ductile structural trend
5035	other - see remark
5036	lineament
5037	measured section
5038	cross-section

*Domain Name: Qualif\_Limit\_SID*

Code	Description
5050	outcrop extent
5051	gas field
5052	oil field
5053	extent of bitumen
5054	geothermal field
5055	mine, surface
5056	quarry
5057	edge of sinkhole
5058	lava flow margin
5059	edge of crater
5060	edge of caldera
5061	front of penetrative strain
5062	front of alteration
5063	extent of gossan or mineralization
5066	unique - see description

*Domain Name: Qualif\_Overprint\_SID*

Code	Description
6001	drift contact
6002	fault zone
6003	shear zone
6004	breccia zone
6005	alteration zone
6006	mineralization zone
6008	gossan zone
6009	porphyritic zone

*Domain Name: Qualif\_Isograd\_SID*

Code	Description
7001	actinolite in
7002	andalusite in
7003	biotite in
7004	chlorite in
7005	clinopyroxene in
7006	cordierite in
7007	diopside in
7008	forsterite in
7009	garnet in
7010	hornblende in
7011	K-feldspar in
7012	kyanite in
7013	melt in
7014	muscovite in
7015	orthopyroxene in
7016	prehnite-pumpellyite in
7017	sillimanite in
7018	staurolite in
7019	tremolite in
7020	wollastonite in
7021	zeolite in

*Domain Name: Confid\_SID*

Code	Description
01	defined
02	approximate
03	inferred
04	concealed
99	not applicable

*Domain Name: Attitude\_SID*

Code	Description
01	upright
02	overturned
03	upright, assumed from archival data
99	not applicable
66	not entered
77	unknown

*Domain Name: Generation\_SID*

Code	Description
01	first
02	second
03	third
04	fourth
10	primary
20	multi-generation
66	Not entered
88	undefined

*Domain Name: Fault\_Move\_SID*

Code	Description
01	N side down
02	NE side down
03	E side down
04	SE side down
05	S side down
06	SW side down
07	W side down
08	NW side down
66	not entered
88	undefined
99	not applicable

*Domain Name: Fault\_Direct\_SID*

Code	Description
01	N
02	NE
03	E
04	SE
05	S
06	SW
07	W
08	NW
09	inward
10	outward
66	not entered
88	undefined
99	not applicable

*Domain Name: Fold\_Direct\_SID*

Code	Description
01	N
02	NE
03	E
04	SE
05	S
06	SW
07	W
08	NW
66	not entered
88	undefined
99	not applicable

*Domain Name: Subset\_Planar\_SID*

Code	Description
1001	bedding
1002	eutaxitic layering
1003	igneous layering
1004	igneous layering, pillows
1005	flow layering
1006	compositional layering
1007	crossbed foreset
1008	contact
1009	dyke margin
1010	sill margin
1011	vein margin
1012	joint
1013	fracture
1014	fracture zone margin
1015	fault plane, unknown sense
1016	fault plane, normal
1017	fault plane, reverse
1018	fault plane, thrust
1019	fault plane, dextral
1020	fault plane, sinistral
1021	fault plane, oblique
1022	shear band, unknown sense
1023	shear band, normal
1024	shear band, reverse
1025	shear band, dextral
1026	shear band, sinistral
1027	shear zone, unknown sense
1028	shear zone, normal
1029	shear zone, reverse
1030	shear zone, dextral
1031	shear zone, sinistral
1032	shear zone, dextral-normal
1033	shear zone, dextral-reverse
1034	shear zone, sinistral-normal

Code	Description
1035	shear zone, sinistral-reverse
1036	axial plane
1037	axial plane, anticline
1038	axial plane, syncline
1039	axial plane, crenulation
1040	axial plane, kink-band
1041	axial plane, minor S fold
1042	axial plane, minor Z fold
1043	axial plane, minor U fold
1044	axial plane, transposition fold
1045	cleavage
1046	cleavage, slaty
1047	cleavage, spaced
1048	cleavage, crenulation
1049	schistosity
1050	gneissosity
1051	foliation
1052	foliation, mylonitic
1053	foliation, transposed bedding
1055	stylolitic surface
1056	fault plane, horizontal
1057	fault plane, vertical dip-slip
1058	shear band, horizontal
1059	shear band, vertical dip-slip
1060	shear zone, horizontal
1061	shear zone, vertical dip-slip
1062	fault plane, dextral extensional
1063	fault plane, dextral contractional
1064	fault plane, sinistral extensional
1065	fault plane, sinistral contractional
1999	other, see remarks

*Domain Name: Subset\_Linear\_SID*

Code	Description
2001	symmetrical ripple crest
2002	asymmetrical ripple paleoflow
2003	imbrication paleoflow
2004	flute
2005	tool mark
2006	prod mark
2007	parting lineation
2008	trough axis
2009	slump fold hinge
2010	slump fold hinge, Z
2011	slump fold hinge, S
2012	igneous flow lineation
2013	fold hinge
2014	fold hinge, soft-sediment
2015	fold hinge, anticline
2016	fold hinge, syncline
2017	fold hinge, antiform
2018	fold hinge, synform
2019	fold hinge, minor S
2020	fold hinge, S crenulation
2021	fold hinge, minor Z
2022	fold hinge, Z crenulation
2023	fold hinge, minor U
2024	fold hinge, U crenulation
2025	fold hinge, crenulation
2026	axis of sheath fold
2027	axis of sheath antiform
2028	axis of sheath synform
2029	intersection lineation
2030	intersection, cleavage-bedding
2031	intersection, cleavage-cleavage
2032	fault striae
2033	fault grooves
2034	slickensides
2035	mineral growth fibres
2036	mineral lineation
2037	stretching lineation
2038	boudinage axis
2039	rodding
2040	mullions
2041	boudins
2042	glacial striae
2043	glacial grooves
2044	flute, down plunge
2045	flute, up plunge
2999	other, see remarks

*Domain Name: Struc\_Attitude\_Planar\_SID*

Code	Description
01	inclined, upright
02	inclined, overturned < 180
03	inclined, overturned > 180
04	vertical
05	horizontal
06	inclined
07	horizontal, upright
08	horizontal, overturned
66	not entered
88	undefined

*Domain Name: Struc\_Generation\_SID*

Code	Description
01	first
02	second
03	third
04	fourth
05	fifth
10	primary
11	multi-generation
88	undefined
66	not entered

*Domain Name: Struc\_Method\_SID*

Code	Description
01	measured at station
02	estimated at station
03	estimated remotely
04	calculated from data
05	calculated from imagery
06	acquired from historical data
66	not entered

*Domain Name: Planar\_Younging\_SID*

Code	Description
01	younging known, sedimentary structure
02	younging known, igneous structure
03	younging known, stratigraphic order
04	younging inferred, stratigraphic order
05	younging inferred, bedding-cleavage
06	younging evidence unknown, historical data
07	no younging evidence
99	younging evidence not applicable
66	not entered

*Domain Name: Dip\_Desc\_SID*

Code	Description
01	gently inclined (0-30)
02	moderately inclined (31-60)
03	steeply inclined (61-90)
66	not entered
99	not applicable

*Domain Name: Sense\_Evid\_SID*

Code	Description
01	asymmetric deformable fibres
02	asymmetric extensional shear bands
03	asymmetric fold
04	asymmetric inclusion trail
05	asymmetric rigid fibres
06	back-rotated swell
07	C/S fabric
08	deflection of foliation
09	foliation fish
10	mineral fibres
11	offset of marker
12	pressure fringes
13	pressure shadows
14	quarter structures
15	quartz fabric
16	rotated porphyroblast
17	sheath folds
18	sigmoid tension gashes
19	striae or grooves
20	winged inclusion
21	winged porphyroclast
22	no sense of motion evidence
66	not entered



*Domain Name: Struc\_Strain\_SID*

Code	Description
01	no strain
02	massive
03	weak
04	moderate
05	strong
06	intense
66	not entered

*Domain Name: Struc\_Flattening\_SID*

Code	Description
01	S tectonite
03	S>L
04	S>=L
05	S=L
06	S<=L
07	S<L
09	L tectonite
66	not entered
99	not applicable



## ANNEX C

This annex contains all corporate *Domain Values* not controlled by a *Subtype*. A list of codes and descriptions are presented for each of the *Domain Values*.

### *Domain Name: ActivityRole\_DID*

Code	Description
01	Project leader
02	Project co-leader
03	Activity leader
04	Activity co-leader
05	Geologist
06	Bedrock mapper
07	Surficial mapper
08	Assistant geologist
09	Student
10	Master degree student
11	PhD degree student
12	Student supervisor
13	IM specialist
14	GIS specialist
15	Scientific colleague
16	Volunteer

### *Domain Name: AgeDesignator\_DID*

Code	Description
Ar	Archean
Cl	Calymnian
Cm	Cambrian
Cb	Carboniferous
Cn	Cenozoic
Ct	Cretaceous
Cy	Cryogenian
Dv	Devonian
Et	Ectasian
Ed	Ediacaran
Ea	Eoarchean
Ec	Eocene
Ha	Hadean
Ho	Holocene
Jr	Jurassic
Ma	Mesoarchean
Mp	Mesoproterozoic
Mz	Mesozoic

Mi	Miocene
Ms	Mississippian
Na	Neoarchean
Ng	Neogene
Np	Neoproterozoic
Og	Oligocene
Od	Ordovician
Os	Orosirian
Pa	Paleoarchean
Pc	Paleocene
Pg	Paleogene
Pp	Paleoproterozoic
Pz	Paleozoic
Pn	Pennsylvanian
Pr	Permian
Ps	Pleistocene
Pi	Pliocene
Pt	Proterozoic
Qt	Quaternary
Rh	Rhyacian
Sd	Siderian
Sl	Silurian
St	Statherian
Se	Stenian
To	Tonian
Tr	Triassic

### *Domain Name: AgePrefix\_DID*

Code	Description
early	Early
mid	Mid
late	Late

### *Domain Name: Boundary\_DID*

Code	Description
01	no
02	yes

*Domain Name: LegendSymbolType\_DID*

Code	Description
F	Fill
L	Line
L1	Line 1
L2	Line 2
L3	Line 3
L4	Line 4
L5	Line 5
H1	Header 1
H2	Header 2
H3	Header 3
M	Marker Point

*Domain Name: NA\_DID*

Code	Description
99	not applicable

*Domain Name: RankTerm\_DID*

Code	Description
bed	Bed
complex	Complex
formation	Formation
group	Group
lithodem	Lithodem
megasequence	Megasequence
member	Member
not_specified	Rank not specified
sequence	Sequence
subgroup	Subgroup
suite	Suite
supergroup	Supergroup
supersequence	Supersequence
supersuite	Supersuite
not_entered	not entered

## ANNEX D

This annex contains all project related *Domain Values* not controlled by a *Subtype*. A list of codes and descriptions are presented for each of the *Domain Values*.

### *Domain Name: BooleanTruth\_PID*

Code	Description
0	No
1	Yes

### *Domain Name: CartoTheme\_PID*

Code	Description
geochronology	Geochronology
fossil	Fossil
wells	Wells
drill	Drill Holes
fieldLegacy	Field (Legacy)
mineral_occurences	Mineral Occurrences
gossans	Gossans

### *Domain Name: LegendItemTheme\_PID*

Code	Description
mapUnit	Map Unit
geoline	Geoline
geopoint	Geopoint
header	Headers
fieldPoint	Field Stations
cartographicPoint_FieldLegacy	Field (Legacy)

### *Domain Name: Scale\_PID*

Code	Description
0	Do not display
1	1:1
66	not entered

### *Domain Name: SourceRef\_PID*

Code	Description
1	working project
2	historical source
3	undefined source