Oregon Geologic Data Standard

A component of the Oregon Geoscience Framework Theme

Version 1.0

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1.0 Introduction

The Oregon Geographic Information Council (OGIC) is overseeing preparation of geospatial data standards for the state. The development of these standards will ease the sharing of data and assist cooperative data development efforts. OGIC assigned a Framework Implementation Team (FIT) to guide the development of standards for fourteen data themes. Separate Framework Work Groups are developing standards for each theme. Geoscience is one Oregon Framework theme and a Geologic Committee is guiding development of a Geologic Layer and a Soils Committee is coordinating a Soils Layer.

This document is a standard for compiling statewide geologic map data for Oregon. It is based on the Oregon Geologic Data Model (OGDM), developed by the Department of Geology & Mineral Industries (DOGAMI) and reviewed and approved by the Geologic Committee. The OGDM provides a structure for organizing, storing, and using a range of geologic map data. The design of the OGDM stresses flexibility as it provides a structure for the geologic interpretations of hundreds of individuals, working throughout Oregon, over the past 100 years and into the future. This document outlines a content standard emphasizing geologic features, concepts, and relationships pertaining to information presented on geologic maps. The standard addresses the graphic data elements held in a geographic information system (GIS) and the non-graphic descriptive information linked to the graphic elements but organized in a relational database.

1.1 Mission and Goals of Standard

The mission of this standard is to provide a consistent and maintainable structure for geologic map data being compiled statewide for Oregon. The name of this statewide compilation dataset is the Oregon Geology Framework Layer (OGFL). Its overall aim is to assist both producers and users of geologic map data in Oregon. The following goals influenced development of this standard:

- to assemble the best available geologic information statewide for Oregon.
- to provide for periodic updates as new local and regional geologic mapping is completed and provide a process and data structure to meld this new mapping into the OGFL.
- to create a widely usable dataset and data structure, while acknowledging that geologic terminology is extremely technical.
- to provide reference map information for each geologic data element, and not to re-interpret the reference map information.

1.2 Relationship to Existing Standards

The Federal Geographic Data Committee (FGDC)[1] has established a Geologic Data Subcommittee to coordinate work on a federal standard for digital geologic map information. To date, the Subcommittee has produced a working draft of a Geologic Map

Data Model. The working draft, called the North American Data Model (NADM) is going through the FGDC Standards Development Process. Also, the Subcommittee has coordinated public review of a Digital Cartographic Standard for Geologic Map Symbolization (DCSGMS)[2]. This Symbolization Standard is also going through the FGDC Standards Development Process. Both of these documents influenced the development of the OGDM and this standard. Additionally, a number of state geological surveys have developed their own Data Models. The Idaho Geological Survey Geologic Map Data Model[3] served as an important reference in designing the OGDM.

To assist understanding the relationship of NADM to the current Oregon standard effort, the following quote from the NADM steering committee is offered: "the geoscience community is composed of diverse agencies and individuals, with a wide range of technical expertise, budgets and user-support requirements. Therefore, the NADM steering committee expects that when various geological surveys evaluate and implement the data model, they will modify it as needed to suit their system and user requirements."[4]

1.3 Description of the Standard

This standard lays out the essential content and data structure necessary to describe, produce, and use the OGFL. These essential elements are a distillation of the important features normally included as the content of geologic maps and deemed necessary for the statewide layer.

The standard adresses four organizational components:

1. Geospatial elements (or geometry)
2. Descriptive character (lithology) of geologic units
3. Geologic content including information about the formation and naming hierarchy, age, and depositional environment, of geologic units
4. Metadata for documentation

This standard has been written recognizing that: geologic maps can be extremely complex and interpretive, the language of geology is extensive and variable, and geologic interpretations have and will continue to evolve over time. Acknowledging this, the standard strives to be highly adaptive and refrains from re-interpreting the data and interpretations the author developed in the original geologic map. However, an important part of the OGFL is the assignment of Merge Unit Labels that organize the disparate original mapped rock units into several coherent statewide classifications.

1.4 Applicability and Intended Use of the Standard

The intent of this standard is to foster the orderly development, sharing, and maintenance of the OGFL. This standard proposes a consistent format, structure, and documentation for the OGFL. It is a minimum standard intended to be usable by all levels of government, as well as academia and the private sector. As work on national geologic data standards evolves, this standard will evolve and strive to be compatible with such efforts.

1.5 Standard Development Procedures

The Oregon Geoscience Framework group – Geologic Committee, was formed in June of 2002 and has since met approximately quarterly. This group prioritized the Geoscience layers for the standard development, including providing input on the priority layer elements to include. The group reviewed the draft federal geologic data model and heard a presentation of this and the Idaho Geologic Data Model by Loudon Stanford of the Idaho Geological Survey. Following this, the group approved DOGAMI to draft a (similar) model for Oregon. During the drafting stage, DOGAMI provided the Committee with updates on progress and at each step, invited comments. Elements of the draft model have also been available for wider review/comment on the Oregon Geospatial Enterprise Office (GEO) website: http://www.gis.state.or.us/coord/FrameLayers/GeoFrame.html
This site is hosted by the Oregon Department of Administrative Services.

1.6 Maintenance of the Standard

The Geologic Committee acknowledges that this standard will need periodic maintenance during preparation of the OGFL. Updates to this standard will be presented, when appropriate, to the Geologic Committee for comment, revision, and final endorsement. DOGAMI is implementing the standard in a six-year project to complete the OGFL, and will be the data steward for the OGFL.

2.0 Body of the Standard

2.1 Scope and content of the Standard

The scope of this standard encompasses the public domain vector and associated tabular geologic data compiled for the OGFL. The range of applicable reference map scales is from 1:24,000 to 1:250,000. This wide range of scales reflects the variable resolution of geologic mapping in the state. This range of scales makes documentation of the original reference map scale an important element of this standard. The standard anticipates the addition of continually improved data resolution by providing for the incorporation of new, higher resolution mapping as it becomes available. The unique identification of each reference map's geologic line, point, and polygon feature is within the scope of this standard and allows users to go to the reference, if needed. This standard does not include a standardized science language for describing, classifying and interpreting geologic materials and structures. The concept of a standard or controlled geologic language is being addressed at the national level and may become a future added component to this standard.[5]

The list of geospatial and attribute elements included in this standard will likely be modified and added to in the future. When appropriate, these modifications/additions will be submitted to the Geologic Committee for acceptance and the revised data content publicized to all interested users of the standard.

2.2 Need for the Standard

Geologic maps are very diverse in the type(s) of information that they contain and the geologic issues that they address. They are produced by State or Federal agencies, private industry consultants, and academic researchers according to loosely-accepted professional guidelines for content and form. The features displayed on geologic maps are highly interpretive and specific to each individual author. Acceptance of the various overall geologic concepts and interpretations changes over time. While geologic maps can be universally applicable, they are usually made to address a particular information need, i.e. engineering, geohazards, mineral resources, etc. All of these aspects of geologic mapping point to the need for a consistent and maintainable data content standard to guide development and use of the OGFL. Data exchange will be simplified among users of geologic information by the establishment of this standard.

2.3 Participation in Standards Development

The Geologic Committee is comprised of federal, state, and academic representatives. Participation in the Committee is open to all entities that are concerned with the production, use and exchange of statewide digital geologic information. Present member affiliations include:

Oregon Department of Water Resources
Oregon Department of Transportation
Oregon Watershed Enhancement Board
Oregon Department of Geology & Mineral Industries
Oregon Department of Administrative Services
U.S. Forest Service
U.S. Bureau of Land Management
U.S. Natural Resources Conservation Service
Oregon State University, Forest Science Department
Portland State University, Department of Geology

This standard has been tested and implemented in a pilot OGFL project during 2003-2004. The project integrated 84 original reference maps in a layer covering approximately 20,000 square miles of Northeast Oregon. Information regarding the pilot project is available from DOGAMI, Portland, OR. The OGDM and pilot study were presented in a poster session at the annual Digital Mapping Techniques Workshop, convened by the Association of American State Geologists and the U.S. Geological Survey, in May of 2004. Review comments have been incorporated into the OGDM and this standard as they were developed and implemented.

2.4 Integration with other Standards

The layout of this standard conforms to the OGIC layout template developed for the Oregon Framework Themes. The documentation component of this standard, as specified in various tables listed in Appendix C, relates to the OGIC-approved Metadata standard. When the FGDC gives a final endorsement to the Digital Cartographic Standard for Geologic Map Symbolization,[2] that standard will be adopted and integrated fully with this standard.

2.5 Technical and Operational Context

2.5.1 Data Environment

The data environment for the OGFL is a vector model of polygons, lines, and points linked to relational database content. Digital geologic map elements are assembled in a variety of proprietary formats (both CAD and GIS). However the state exchange medium is the ESRI shapefile, a public domain data structure relating polygons, lines, points and feature attribution (including shape geometry). To take full advantage of the OGFL, the user must properly link the shapefile(s) to the descriptive content in the relational database. The data environment of this relational database will be both comma-delimited ASCII and the MS Access 2000 formats.

2.5.2 Reference Systems

Geologic map information is commonly assembled and overlayed on a U.S. Geological Survey Digital Raster Graphic quadrangle (DRG). DRGs are typically provided in the Universal Transverse Mercator coordinate referencing system. However, for the OGFL, all geologic information will be stored and exchanged in the custom Oregon Lambert Projection. This is the adopted standard projection among Oregon state agencies. Specific parameters of this projection can be found at http://www.gis.state.or.us/data/format.html

2.5.4 Integration of Themes

In a general sense, the geologic unit polygons that delineate recent alluvial deposits align along major streams and are related to the Hydrography Theme. Also, geologic polygon and line features always relate to the elevation contours shown on appropriately scaled U.S. Geological Survey topographic base maps. However, the placement of such polygonal and line features is always an interpretation by the reference map author.

2.5.5 Encoding

Geologic data incorporated into the OGFL will be encoded according to the OGDM, adopted by the Geologic Committee. Data dictionaries describing the specific format for the OGFL are in Appendix B and C of this standard.

2.5.6 Resolution

The resolution of the OGFL will vary according to the original reference geologic map(s) or individual contributor's working map scale. The range of scales is 1:24,000 to 1:250,000. The OGDM has been designed to allow the best available geologic data to nest together in a single statewide dataset, regardless of original map scale. This process is managed through assignment of Merge Unit Labels to map unit labels in both the spatial data (polygons) and in the descriptive data (database) in the Compilation Merge Unit table.

2.5.7 Accuracy

This standard supports varying levels of positional accuracy, as implied by the range of original reference map scales. The accuracy of interpreted geologic information varies with the scale of its base map. Geologic interpretations from the original written explanatory reference materials are carried directly into the relational database without reinterpretation, thereby promoting attribute accuracy.

2.5.8 Edge Matching

The concept of seamless geometry is not compatible with integration and maintenance of data from widely varying original map scales. As this standard guides incorporation of the best available data for the OGFL, the concept of 'logical seamlessness' is applied. Individual reference map polygon and line features are not edgematched, however, a 'logical seamlessness' is achieved through assignment of the Merge Unit Labels in the Compilation Merge Unit table. Improvement in edgematching is anticipated as the OGFL continually incorporates newer, higher resolution mapping.

2.5.9 Feature Identification Code

The feature identification code is the concatenation of two separate fields: a unique Reference_ID_Code for the reference geologic map plus the individual polygon/line/point unique ID. The Reference_ID_Code is a text field that identifies the reference author by the first four letters of the last name, followed by the first and middle initials, followed by the year of work or the unpublished status, followed by the plate information (if any). Example:

> **BrowDE1980aPlate3** = *Brown, David E., published 1980, "a" indicates that the OGFL contains more than one map by this author for this year, and where multiple maps from the same publication are used, the particular map cited (Plate 3).*

DOGAMI will maintain the list of Reference_ID_Codes. All information about the geologic features is tracked by the Reference_ID_Code, this is the field linking all spatial features with the relational database table content.

2.5.10 Attributes

2.5.10.1 Polygons

Polygons are geospatial objects that represent the boundaries of geologic units that have been mapped by a geologist and digitally encoded. Each polygon is uniquely identified according to the Feature Identification Code described in Section 2.5.9.

2.5.10.2 Lines

Lines are geospatial objects that represent the azimuths and locations of faults or folds that have been mapped by a geologist and digitally encoded. Lines are uniquely identified according to the Feature Identification Code described in Section 2.5.9.

2.5.10.3 Points *(not currently implemented)*

Points are geospatial objects that identify the location on the ground of various geologic related feature sites. Points are uniquely identified according to the Feature Identification Code described in Section 2.5.9.

2.5.11 Transactional Updating

An exact process to handle transactional updating of geologic data is being explored. The data steward for the OGFL is DOGAMI. The OGDM design strives to make possible the timely incorporation of new data as it becomes available.

2.5.12 Records Management

Versions of the OGFL, as it is developed, will be tracked using a relational database management system hosted by DOGAMI. At a minimum, the OGFL versions will satisfy the archiving mandates applying to Oregon State agencies.

2.5.13 Metadata

This standard follows the Oregon Core Metadata Standard for geospatial data. Metadata detailing the characteristics, content, and quality of geologic map information must be provided. Metadata reports should make every effort to meet the more rigorous standards set forth in the federal Metadata Content Standard[6]. The metadata will provide sufficient information to allow the potential user to determine if the dataset will meet their intended purpose, as well as to assist the user in accessing and interpreting the data.

3.0 Data Characteristics

The data characteristics detailed below are subject to revision, based on continuing refinement of the OGDM. The data characteristics described in this section represent the minimum set of graphical and non-graphical attributes required to meet this standard.

3.1 Minimum Graphic Data Elements

See Appendix B

3.2 Minimum Attribute or Non-graphic Data Elements

See Appendix C

3.3 Optional Graphic Data Elements

None specified at this time

3.4 Optional Attribute or Non-Graphic Data Elements

None specified at this time

References

[1] FGDC Geologic Data Subcommittee, http://ncgmp.usgs.gov/fgdc_gds/

[2] Public Review Draft – Digital Cartographic Standard for Geologic Map Symbolization, Geologic Data Subcommittee, Federal Geographic Data Committee, April 2000 http://ncgmp.usgs.gov/fgdc_gds/

[3] A Brief Documentation of the Idaho Geological Survey's Digital Geologic Map Data Model, v 2.1, A Variant of the North American Digital Geologic Map Data Model, V 4.3, Loudon R. Stanford, June, 2002 http://www.idahogeology.org/Lab/datamodel.htm

[4] Developing the North American Geologic Map Data Model, North American Data Model Steering Committee, in Digital Mapping Techniques 01 – Workshop Proceedings, USGS Open-File Report 01-223 http://pubs.usgs.gov/of/2001/of01-223/nadmsc.html

[5] Science Language for Geologic Map Databases http://geology.usgs.gov/dm/terms/

[6] Content Standard for Digital Geospatial Metadata, FGDC, 1998 http://www.fgdc.gov/metadata/contstan.html

Appendix A

DEFINITIONS OF TERMS

Depositional environment—the physical conditions that produced a geologic unit, like the settling of sediment out of a flowing stream to form a layer of sand, or the eruption of a volcano to form a related group of lava flow layers.

Faults—the map depiction of a place where the Earth's surface has been broken and then moved by the forces of nature. A fault shows the approximate location of the line of breakage and the angle down from horizontal of the plane along which the adjoining broken parts of the earth moved against each other.

Folds—the map depiction of a place where the Earth's surface has been compressed and folded, but not broken (like pushing on the edge of a piece of cloth produces folds in the cloth) by the forces of nature. A fold shows the approximate location and the angle down from horizontal of the plane that bisects the fold, as well as the general angle that the layers of rock dip away from that plane.

Geologic age—the relative age, in millions of years before the present, of a particular rock or group of rocks. The age is determined either by the association of the rocks with particular fossilized remains of plants or animals, or by the radioactive decay of the elements found in the rock's minerals since it was deposited.

Geologic naming hierarchy—as with the naming of plants and animals, geological science has developed a naming convention/classification system that it gives to areas of related rocks (from the most general to the most specific: terrane, group, formation, member, unit). Each hierarchy level divides the related rocks of a particular area into less complex areas. Therefore, the basalt of Eden (unit) is part of the larger Saddle Mountain Basalt (member), which is part of the Yakima Basalt (formation), which is part of the Columbia River Basalt Group (group). The classification system is based on the age of the rock and its physical characteristics.

Geologic structure—the map depiction of any feature that shows the direction and angle down from horizontal of a layer of rock. These structures can show larger crustal disruptions, such as faults and folds, as well as smaller local disruptions, such as fractures and joints.

Geologic unit—the name (and associated map label) that is given in the map legend to a particular type of rock or group of rocks. The name can be from any level of the geologic naming hierarchy and is generally associated with a located place name from a US Geological Survey topographic map. The name can be very general (Qv-Quaternary volcanics) or very specific (Kbp-Cretaceous basalt of Portland).

Lithology—the type of rock that is found in a particular place. This name is either general, like igneous, metamorphic, and sedimentary, or a particular name that describes the physical or chemical characteristics of a rock, like gravel, granite, and sandstone.

Stratigraphy—the order, in terms of geologic age, of a group of related geologic units. Each geologic map has the stratigraphy for that area shown in the map legend.

GIS Table Name

Item Name	Field Type	Size	Description
G_Map_Unit --> *Geologic Map Unit polygons-- geospatial objects that represent the boundaries of geologic units that have been digitally encoded*			
REF_ID_COD	Character	25	Unique code assigned to each original reference map by data steward
SHAPE_ID	CounterFLDPL	4	Framework identifier generated by data steward
MAP_UNIT_L	Character	10	Map Unit Label--original map unit label assigned to the polygon by the original author
GEN_MRGE_U	Character	20	General Merge Unit--assigned unit that merges all of the original map unit shapes into 7 general rock categories
FRM_MRGE_U	Character	50	Formation Merge Unit--assigned geologic unit that merges all of the original map unit shapes into a stratigraphic unit list, based on the formation level
LTH_MRGE_U	Character	50	Lithologic Merge Unit--assigned unit that merges all of the original map unit shapes into a lithology unit list, based on the rock type
G_Ref_Map --> *Geologic Reference Map Outline polygons—geospatial objects that delineate the areal extent of geologic mapping in the reference map*			
REF_ID_COD	Character	25	Unique code assigned to each original reference map by data steward
SHAPE_ID	Counter	4	Framework identifier generated by data steward
OUTLINE_ID	Long	4	Internal identification number assigned by data steward
G_Fault_Ln --> *Geologic Fault lines--GIS linework that delineates the position of identified fault lines that have been digitally encoded*			
REF_ID_COD	Character	25	Unique code assigned to each original reference map by data steward
SHAPE_ID	Long	4	Framework identifier generated by data steward
FLT_NAME	Character	25	Fault Name--given to the fault by the original reference map author
FLT_TYPE	Character	30	Fault Type--normal, reversed, thrust, strike-slip
FLTPL_DIR	Character	10	Fault Plane Dip--azimuth of the dip of the fault plane
FLTPL_DEG	Character	4	Fault Plane Degrees--number of degrees down from horizontal of the dip of the fault plane
FLT_CERT	Character	15	Fault Certainty--fault location certainty as assigned by the original reference author--certain, approximately located, buried
FGDC_SYMBL	Character	10	Digital Cartographic Standard for Geologic Map Symbolization, Reference Number
G_Fold_Ln --> *Geologic Fold lines--GIS linework that delineates the position of identified fold axial plane*			
REF_ID_COD	Character	25	Unique code assigned to each original reference map by data steward
SHAPE_ID	Counter	4	Framework identifier generated by data steward
FLD_NAME	Character	30	Fold Name--given to the fold by the original reference map author
FOLD_TYPE	Character	30	Fold Type--anticline, syncline, overturned
FLDPL_DEG	Character	5	Fold plane degrees--Number of degrees down from horizontal of the dip of the fold axial plane
FLDPL_DIR	Character	15	Fold plane dip--azimuth of the dip of the fold axial plane
FLD_CERT	Character	25	Fold Certainty-- fold axial plane location certainty as assigned by the original reference author—certain, approximately located, buried
FGDC_SYMBL	Character	10	Digital Cartographic Standard for Geologic Map Symbolization, Reference Number

NOTE: The **REF_ID_COD** item is the linking field for joins / queries between this graphic information in GIS and the non-graphic attribute tables listed in Appendix C

Database Table Name

Item Name	Field Type	Size	Description
TblRefGeologicInfo - *Contains the general bibliographic information about each reference map or database used in the compilation*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
First author	Character	25	Last name and initials of the first author of the reference publication
First editor	Character	50	Last name and initials of the first editor of a compendium publication
Geospatial format	Character	50	Type of reference (map, database, etc.)
Issue identification	Character	15	Series or volume no. (also pages, if applicable)
Larger work citation	Character	200	Title of the compendium publication within which the reference publication is located
Map identifier	Character	15	If more than one geologic map is used from a single reference publication, identifies the plate, sheet or figure number
Originator	Character	50	Name of the organization or person that developed or published the information
Other authors	Character	150	Last names and first initials of secondary authors--separated by semicolons
Publication date	Character	6	Year of the publication, if not published then Unpub
Publication place	Character	50	City location of the originator (also country if outside of the US)
Publication title	Character	200	Title and subtitle of the reference publication, separated by a colon
Series name	Character	50	Name of the series or title of the journal
TblGeolMapUnitName - *Lists every reference map's unit geologic label, unit name, subunit name, subunit relative abundance and thickness, and formational classification and names*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Formation name	Character	50	Formation name for the map unit
Group name	Character	50	Group name for the map unit
Map subunit modifier	Character	50	
Map subunit name	Character	50	Name given in the reference map unit explanation for the unmapped lithologic subunit
Map subunit relative	Character	50	Qualitative estimate for the abundance of the subunit
Map subunit thickness	Character	50	Typical thickness of the map subunit; written in meters
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	50	Formal or informal name given to the map unit by the reference map
Member name	Character	50	Member name for the map unit
Terrane designation	Character	50	Terrain designation for the map unit
TblGeolMapUnitCharacter - *Contains information about the thickness, genetic environment and landform, and whether or not information exists for geochemistry, paleontology and petrology*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Genetic/environment origin	Character	50	Environment within which the map unit was created
Geochemistry	Yes/No	1	Reference map contains geochemical information about the map unit
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	100	Formal or informal name given to the map unit by the reference map
Maximum thickness	Character	50	Maximum thickness of the map unit
Minimum thickness	Character	50	Minimum thickness of the map unit
Paleogeomorphology	Character	50	Landform/geomorphology that was created within the environment within which map unit wasformed
Paleontology	Yes/No	1	Reference map contains paleontological information about the map unit
Petrography	Yes/No	1	Reference map contains petrographic information about the map unit
Typical thickness	Character	50	Typical thickness of map unit if the typical thickness, rather than the maximum or minimum, is given

Database Table Name

Item Name	Field Type	Size	Description
TblGeolStratigraphicAge - *Contains everything that has to do with the age of each reference map unit, including both general and absolute ages*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Age certainty	Character	50	Designates the degree of certainty and evidence for the age of the unit
Magneto-stratigraphic unit	Character	50	Reference map's designation of a magneto-stratigraphic unit for the map unit
Map unit label	Character	50	Unique code that identifies the original map unit in the reference map
Map unit name	Character	50	Formal or informal name given to the map unit by the reference map
Maximum stratigraphic age	Character	50	Maximum chronostratigraphic age given to the map unit
Minimum stratigraphic age	Character	50	Minimum chronostratigraphic age given to the map unit
Queried stratigraphic age	Character	50	Single, queried chronostratigraphic age given to the map unit
Radiometric age	Character	50	Reference map's absolute age date for the map unit
Radiometric age error	Character	50	Reference map's plus or minus factor for the absolute age
Radiometric age prefix	Character	50	Reference map's limiting factor of the radiometric age date for the map unit
Radiometric age type	Character	50	Type of elements that were compared to determine the absolute age of the map unit
Remanent magnetic polarity	Character	50	Remnant magnetic polarity of the map unit
Stratigraphic age relation	Character	50	Designates the relation between the minimum and maximum ages
TblLithoColor - *Lists, in no order, up to 4 colors for the rock fresh surface and 3 colors for the weathered surface for each reference map subunit*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Fresh color1	Character	50	First unit or subunit fresh color in description
Fresh color2	Character	50	Second unit or subunit fresh color in description
Fresh color3	Character	50	Third unit or subunit fresh color in description
Fresh color4	Character	50	Fourth unit or subunit fresh color in description
Map subunit modifier	Character	50	
Map subunit name	Character	50	Name given in the reference map unit explanation for the unmapped lithologic subunit
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	50	Formal or informal name given to the map unit by the reference map
Weathered color1	Character	50	First unit or subunit weathered color in description
Weathered color2	Character	50	Second unit or subunit weathered color in description
Weathered color3	Character	50	Third unit or subunit weathered color in description
TblLithoMajStruct - *Lists, in no order, up to 6 overall, or outcrop level, describers for every reference map subunit*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Lithologic structure describer1	Character	100	First unit or subunit Lithologic structure describer in description
Lithologic structure describer2	Character	100	Second unit or subunit Lithologic structure describer in description
Lithologic structure describer3	Character	100	Third unit or subunit Lithologic structure describer in description
Lithologic structure describer4	Character	100	Fourth unit or subunit Lithologic structure describer in description
Lithologic structure describer5	Character	100	Fifth unit or subunit Lithologic structure describer in description
Lithologic structure describer6	Character	100	Sixth unit or subunit Lithologic structure describer in description
Map subunit modifier	Character	50	
Map subunit name	Character	50	Name given in the reference map unit explanation for the unmapped lithologic subunit
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	50	Formal or informal name given to the map unit by the reference map

Database Table Name

Item Name	Field Type	Size	Description
TblLithoMineralCompositio - *Lists, in no order, if available up to six mineral or composition describers for every reference map subunit*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Map subunit modifier	Character	50	
Map subunit name	Character	50	Name given in the reference map unit explanation for the unmapped lithologic subunit
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	50	Formal or informal name given to the map unit by the reference map
Mineral describer1	Character	100	First unit or subunit mineral describer in description
Mineral describer2	Character	100	Second unit or subunit mineral describer in description
Mineral describer3	Character	100	Third unit or subunit mineral describer in description
Mineral describer4	Character	100	Fourth unit or subunit mineral describer in description
Mineral describer5	Character	100	Fifth unit or subunit mineral describer in description
Mineral describer6	Character	100	Sixth unit or subunit mineral describer in description

TblLithoTexture - *Lists, in no order, if available up to six hand sample level describers for every reference map subunit*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Map subunit modifier	Character	50	
Map subunit name	Character	50	Name given in the reference map unit explanation for the unmapped lithologic subunit
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	50	Formal or informal name given to the map unit by the reference map
Texture describer1	Character	100	First unit or subunit texture describer in description
Texture describer2	Character	100	Second unit or subunit texture describer in description
Texture describer3	Character	100	Third unit or subunit texture describer in description
Texture describer4	Character	100	Fourth unit or subunit texture describer in description
Texture describer5	Character	100	Fifth unit or subunit texture ddescriber in description
Texture describer6	Character	100	Sixth unit or subunit texture describer in description

TblRefBaseMap - *Contains information about the reference map and the reference map's base map(s)*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Base map date	Character	50	Date that the base map was published
Base map media	Character	50	Type of media used for the original base map
Base map name	Character	50	Common name of the type of base map for the reference map
Base map scale	Character	50	Scale of the original base map
Reference map media	Character	50	Type of media used for the original reference map
Reference map projection	Character	50	Original coordinate system of the reference map
Reference map scale	Character	50	Scale of the published map
East bounding coordinate	Double (8)	8	Coordinate of the east limit of the reference map
North bounding coordinate	Double (8)	8	Coordinate of the north limit of the reference map
South bounding coordinate	Double (8)	8	Coordinate of the south limit of the reference map
West bounding coordinate	Double (8)	8	Coordinate of the west limit of the reference map

Database Table Name

Item Name	Field Type	Size	Description
TblRefCompilationMerge - *Contains the original reference map's ID, unit name and label and the assigned Merge Unit Label for: Formation geology, Lithology and General Lithology*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
General lithology type	Character	50	Overall lithology type of map unit
Geology merge comments	Memo	0	Comments about the choice of geology merge unit
Geology merge unit label	Character	50	Label for the compilation map unit
Geology merge unit name	Character	175	Name for the compilation map unit
Lithology merge comments	Memo	0	Comments about the choice of lithology merge unit
Lithology merge unit label	Character	50	Label for the lithology map unit
Lithology merge unit name	Character	100	Name for the lithology map unit
Lithology type comments	Memo	0	Comments about the choice of general lithology type
Map unit label	Character	50	Reference map label for the map unit
Map unit name	Character	50	Reference map name for the map unit

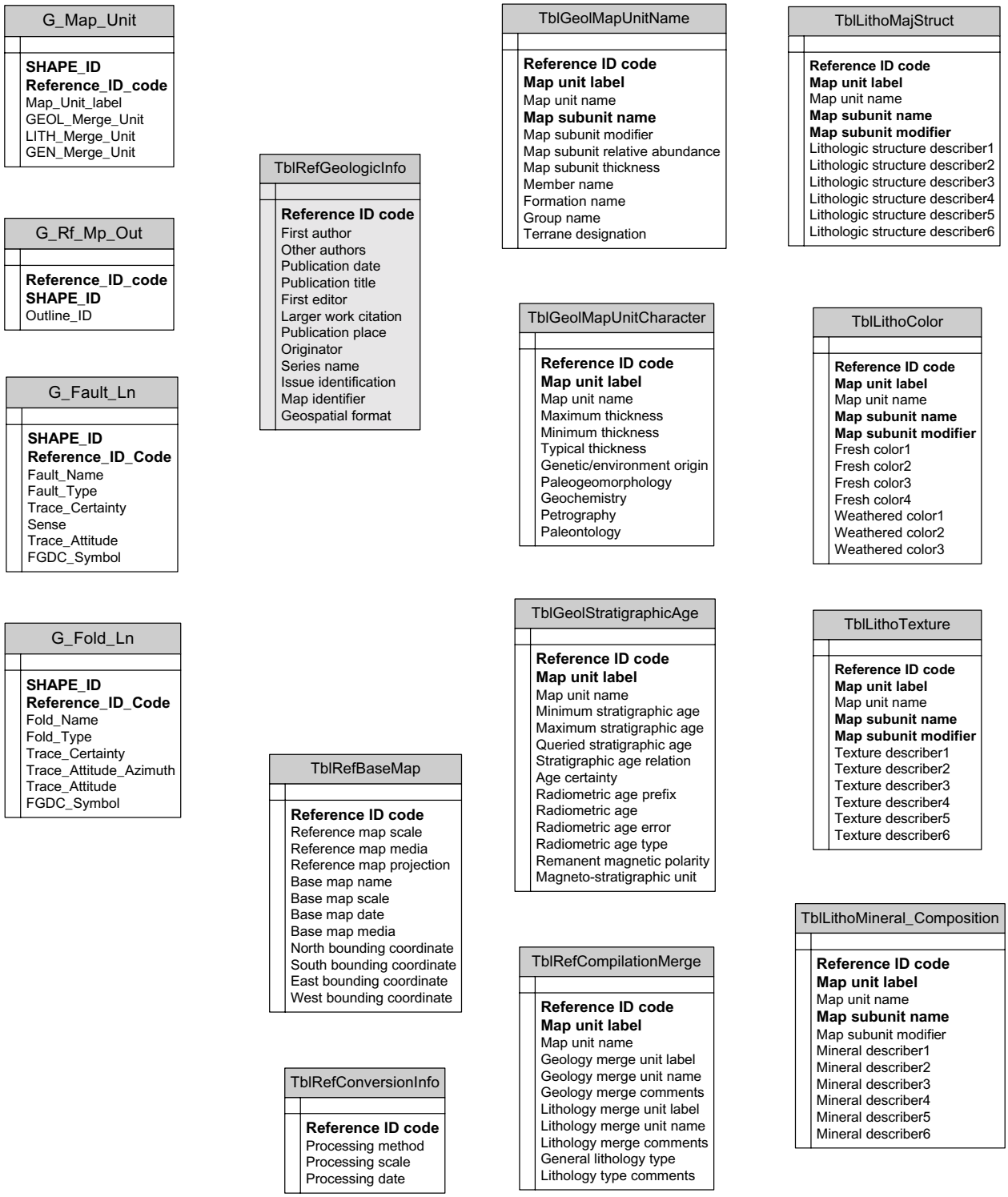
TblRefConversionInfo - *Contains information about the conversion process to digital format of the reference geologic maps*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Processing date	Date/Time	8	Approximate date that the conversion took place
Processing method	Character	50	Method of conversion of a non-digital product to a digital product
Processing scale	Character	50	Scale at which the non-digital product was digitized or converted

NOTE: Item(s) shown in **boldface** are the linking field(s) for performing joins / queries between these descriptive tables and between graphic elements in GIS, listed in Appendix B.

OREGON GEOLOGIC DATA MODEL

Geospatial Information Tables
(in GIS)

Descriptive and Metadata Tables
(in Relational Database)



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