Oregon Geologic Data Standard

A component of the Oregon Geoscience Framework Theme

Version 2.1

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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[2] 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 coordinated a public review of a Digital Cartographic Standard for Geologic Map Symbolization (DCSGMS). This Symbolization Standard is now endorsed by the FGDC Subcommittee and is available as a publication[3] from the U.S. Geological Survey. 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 addresses 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.oregon.gov/DAS/EISPD/GEO/fit/geoscience/GeoFrame.shtml
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 1:4,800 to 1:500,000. 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. With the FGDC's final endorsement to the Digital Cartographic Standard for Geologic Map Symbolization[3], it has been adopted and fully integrated 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 GIS formats (ESRI's ArcGIS and MapInfo Professional). However, the State of Oregon's 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.oregon.gov/DAS/EISPD/GEO/data/format.shtml

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 1:4,800 to 1:500,000. 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 identifier. 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). For 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 and the unique identifier which is taken from the original source map. These are the fields 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] Federal Geographic Data Committee http://www.fgdc.gov/

[2] Federal Geographic Data Committee, Geologic Data Subcommittee http://www.fgdc.gov/participation/working-groups-subcommittees/gsc/index_html

[3] Federal Geographic Data Committee [prepared for the Federal Geographic Data Committee by the U.S. Geological Survey], 2006, FGDC Digital Cartographic Standard for Geologic Map Symbolization; Reston, VA, FGDC document bumber: FGDC-STD-013-2006, 290p., 2 plates http://ngmdb.usgs.gov/fgdc_gds/geolsymstd/fgdc-geolsym-all.pdf

[4] 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

[5] 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

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

[7] 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.

Appendix B - Minimum Graphic Data Elements

(NOTE: The tables for Appendix B have been modified for this release, but have NOT been approved by the Geoscience FIT as the new data standard.)

GIS File Name

Field Name	Field Type	Size	Description *(Descriptive Field Names shown in italics)*
G_Map_Unit—*Geologic Map Unit polygons—geospatial objects that represent the boundaries of geologic units*			
Ref_ID_cod	Character	25	*Reference ID Code*—Unique code assigned by data steward to each original reference map
Map_unit_l	Character	12	*Map Unit Label*—Reference map unit label symbol taken from the original source map
Map_unit_n	Character	100	*Map Unit Name*—Reference map unit name taken from the map legend or explanation of map units on the original reference map
G_mrg_u_l	Character	60	*Geology Merge Unit Label*—Label (period delimited) assigned by area geologists that combines all the original map units into 7 different general geologic categories (as described below)
Geo_genl_u	Character	50	*Geology General Unit*—General geologic rock type of the geologic merge unit label, expressed by the genesis of the unit
Age_name	Character	50	*Age Name*—Age of geologic merge unit based on the Geologic Time Scale
Terrane_gr	Character	50	*Terrane or Group Name*—Stratigraphic name (formally and informally named) for the geologic terrane or group
Formation	Character	200	*Formation Name*—Stratigraphic name (formally and informally named) for the geologic formation
Member	Character	50	*Member Name*—Stratigraphic name (formally and informally named) for the member type
Unit	Character	50	*Unit Name*—Stratigraphic name (formally and informally named) for the unit type
G_rock_typ	Character	50	*Geology Rock Type*—Characteristic lithology type for the geologic merge unit label
Lith_m_u_l	Character	50	*Lithology Merge Unit Label*—Label (period delimited) assigned for the lithologic compilation merge unit that combines the original map units into 5 different lithologic categories (as described below)
Lith_gen_u	Character	75	*Lithology General Unit*—Physical characteristic of the rock expressed by the genesis of the unit
Lth_rk_typ	Character	50	*Lithology Rock Type*—Characteristic lithology name taken from the original source data for the lithologic merge unit
Layering	Character	50	*Layering*—Rock Stratum or layering information of the map unit taken from the non-graphic data elements of Appendix C
Cr_grn_siz	Character	50	*Crystal/Grain Size*—Crystal or grain size component of the different rock types, taken from the non-graphic data elements of Appendix C
Getec_prop	Character	50	*Geotechnical Properties*—Rock or structural properties of the lithologic unit, taken from the non-graphic data elements of Appendix C
Gn_lith_ty	Character	50	*General Lithology Type*—General lithology type (6 possible choices) assigned to the map unit
ArcJoinKey	Character	37	*ArcGIS Join Key*—Concatenation of 'REF_ID_COD' and 'MAP_UNIT_L' fields with no space between—for use with joins or relates of data tables (see Appendix C) in ArcGIS and other GIS software

G_Ref_Map—*Geologic Reference Map Outline polygons—geospatial objects that represent the areal extent of geologic mapping of the original reference map*			
Ref_ID_Cod	Character	25	*Reference ID Code*—Unique code assigned to each original reference map by data steward
Outline_ID	Character	12	Internal identification number assigned by data steward
ID	Character	11	Framework identifier generated by data steward

Appendix B - Minimum Graphic Data Elements (cont.)

GIS File Name

Field Name	Field Type	Size	Description *(Descriptive Field Names shown in italics)*
G_Fault_Ln— *Geologic Fault lines—GIS linework that delineates the position of identified fault lines*			
Ref_ID_Cod	Character	25	*Reference ID Code*—Unique code assigned to each original reference map by data steward
Flt_Name	Character	30	*Fault Name*—name given to the fault by the original reference map author
Flt_Type	Character	40	*Fault Type*—normal, reversed, thrust, strike-slip, etc.
Flt_Cert	Character	25	*Fault Certainty*—fault location certainty as assigned by the original reference author—certain, approximately located, buried
FltPl_Dir	Character	20	*Fault Plane Direction*—azimuth of the dip of the fault plane
FltPl_Deg	Character	15	*Fault Plane Degrees*—number of degrees down from horizontal of the dip of the fault plane
Flt_Age	Character	30	*Fault Age*—age of movement on the fault, given by the original reference author
FGDC_Symbl	Character	10	Federal Geographic Data Committee's Digital Cartographic Standard for Geologic Map Symbolization reference number, if available
Fault_ID	Integer	11	Framework identifier generated by data steward

G_Fold_Ln—*Geologic Fold lines—GIS linework that delineates the position of identified fold axial planes*			
Ref_ID_Cod	Character	25	*Reference ID Code*—Unique code assigned to each original reference map by data steward
Fld_Name	Character	40	*Fold Name*—name given to the fold by the original reference map author
Fld_Type	Character	50	*Fold Type*—anticline, syncline, overturned, etc.
Fld_Cert	Character	25	*Fold Certainty*—fold axial plane location certainty as assigned by the original reference author—certain, approximately located, concealed, etc.
Fld_Pl_Dir	Character	20	*Fold Plane Direction*—azimuth of the dip of the fold axial plane
Fld_Pl_Deg	Character	5	*Fold Plane Degrees*—Number of degrees down from horizontal of the dip of the fold axial plane
FGDC_Symbl	Character	10	Federal Geographic Data Committee's Digital Cartographic Standard for Geologic Map Symbolization referece number, if available
Fold_ID	Integer	11	Framework identifier generated by data steward

Appendix C - Minimum Non-Graphic Data Elements

(NOTE: This is a new database structure that is a work in progress and has NOT been approved by the Geoscience FIT as the new data standard.)

Database Table Name

Field Name	Field Type	Size	Description
TblRefGeologicInfo - *Contains the general bibliographic information about each reference map or database used to make 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
Hectant	Character	10	Area of state
Other authors	Character	150	Last names and first initials of secondary authors--separated by semicolons
Publication date	Character	50	Year of the publication, if not published then Unpub
Publication title	Character	200	Title and subtitle of the reference publication,separated by a colon
First editor	Character	50	Last name and initials of the first editor of a compendium publication
Larger work citation	Character	200	Title of the compendium publication within which the reference publication is located
Publication place	Character	50	City location of the originator (also country if outside of the US)
Originator	Character	50	Name of the organization or person that developed or published the information
Series name	Character	50	Name of the series or title of the journal
Issue identification	Character	50	Series or volume no. (also pages, if applicable)
Map identifier	Character	50	If more than one geologic map is used from a single reference publication, identifies the plate, etc.
Geospatial format	Character	50	Type of reference (map, database, etc.)
TblMapUnit – *Contains every reference map's unit geologic symbol and unit name*			
MapUnitPK	Auto	N/A	Primary key
ReferenceIDcode	Character	25	Unique code assigned to each original reference map by data steward
MapUnitLabel	Character	12	Reference map label for the map unit
MapUnitName	Character	100	Formal or informal name given to the map unit by the reference map
TblAge - *Contains information about the stratigraphic and radiometric age of the map units, if available, given by the reference map's author(s)*			
AgeInfoPK	Auto	N/A	Primary key
MapUnitFK	Auto	N/A	Foreign key
MinimumStratAge	Character	50	Minimum chronostratigraphic age given to the map unit
MaximumStratAge	Character	50	Maximum chronostratigraphic age given to the map unit
QueriedMinStrat	Character	50	Minimum, queried chronostratigraphic age given to the map unit
QueriedMaxStrat	Character	50	Maximum, queried chronostratigraphic age given to the map unit
StratAgeRelation	Character	50	Designates the relation between the minimum and maximum ages
AgeCertainty	Character	50	Designates the degree of certainty and evidence for the age of the unit
RadioAgePrefix	Character	50	Reference map's limiting factor of the radiometric age date for the map unit
RadiometricAge	Character	50	Reference map's absolute age date for the map unit
RadiometricAgeError	Character	50	Reference map's plus or minus factor for the absolute age
RadiometricAgeType	Character	50	Type of elements that were compared to determine the absolute age of the map unit
RemMagnetPolarity	Character	50	Remnant magnetic polarity of the map unit
MagnetStratunit	Character	50	Reference map's designation of a magneto-stratigraphic unit for the map unit

Appendix C - Minimum Non-Graphic Data Elements (cont.)

Database Table Name

Field Name	Field Type	Size	Description
TblThickness - *Contains information about the total thickness of the mapped unit, if available, given by the reference map's author(s)*			
ThicknessInfoPK	Auto	N/A	Primary key
MapUnitFK	Auto	N/A	Foreign key
MaximumThickness	Character	50	Maximum thickness of the map unit
MinimumThickness	Character	50	Minimum thickness of the map unit
TypicalThickness	Character	50	Typical thickness of map unit if the typical thickness, rather than the maximum or minimum, is given
TblEnvironment - *Contains information about the genetic environment and landform, if available, given by the reference map's author(s), and whether or not information exists for geochemistry, paleontology or petrology*			
EnvironmentInfoPK	Auto	N/A	Primary key
MapUnitFK	Auto	N/A	Foreign key
GeneticOrigin	Character	50	Environment within which the map unit was created
Paleogeomorphology	Character	50	Landform that was created within the environment which the map unit was formed
Geochemistry	Yes/No (1)	1	Reference map contains geochemical information about the map unit
Petrography	Yes/No (1)	1	Reference map contains petrographic information about the map unit
Paleontology	Yes/No (1)	1	Reference map contains paleontological information about the map unit
TblStratigraphic - *Contains formal or informal Stratigraphic classification and names of reference map units, if any, given by the reference map's author(s)*			
StratigraphicInfoPK	Auto	N/A	Primary key
MapUnitFK	Auto	N/A	Foreign key
Terrane	Character	50	Terrane designation for the map unit
Group	Character	50	Group designation for the map unit
Formation	Character	50	Formation designation for the map unit
Member	Character	50	Member designation for the map unit
TblMapSubUnit – *Contains information about the components, or subunits, of the reference map unit*			
MapSubUnitPK	Auto	N/A	Primary key
MapUnitFK	Auto	N/A	Foreign key
MapSubUnitName	Character	50	Name of individual subunits within the larger mapped unit
MapSubUnitModifier	Character	50	Descriptive term used to modify recurring individual subunits within the larger mapped unit
MapSubunitRelAbund	Character	50	Relative abundance of the individual subunits listed within the larger unit
MapSubUnitThickness	Character	50	Thickness of the individual subunits; not to be confused with unit thickness in 'TblThickness'

Appendix C - Minimum Non-Graphic Data Elements (cont.)

Database Table Name

Field Name	Field Type	Size	Description
TblMapSubUnitColors – *Lists colors of the fresh and weathered rock surfaces for each subunit, if any, given by the reference map's author(s)*			
MapSubUnitColorPK	Auto	N/A	Primary key
MapSubUnitFK	Auto	N/A	Foreign key
FreshColorKeyword	Character	50	Color(s) of rock on a fresh surface; given by the original author
FreshColorModifier	Character	50	Term(s) used to modify the FreshColorKeyword field, if any
WeatheredColorKey	Character	50	Color(s) of rock on a weathered surface; given by the original author
WeatheredColorModifier	Character	50	Term(s) used to modify the WeatheredColorKey field, if any

TblMapSubUnitLithologyMineralComp – *Contains information of mineral or composition describers for each subunit, if any, given by the reference map's author(s)*			
MapSubUnitLithologyMineralCompPK	Auto	N/A	Primary key
MapSubUnitFK	Auto	N/A	Foreign key
PiecesCrystalsClasts	Character	150	Keyword describing minerals or rock types of subunit crystals or clasts
PiecesCrystalsClastsModifier	Character	150	Modifying term(s) for the keyword of the 'PiecesCrystalClasts' field
OpenSpaceComposition	Character	150	Keyword describing mineral or other filler in subunit voids or spaces
OpenSpaceCompositionModifier	Character	150	Modifying term(s) for the keyword of the 'OpenSpaceComposition' field
PostDepositionProcessComposition	Character	150	Keyword indicating post-depositional process types
PostDepositionProcessModifier	Character	150	Modifying term(s) describing mineral- or composition-related products of the 'PostDepositionProcessComposition' keywords
GeneralCompositionTerms	Character	100	Third unit or subunit mineral describer in description
GeneralCompModifier	Character	100	Fourth unit or subunit mineral describer in description

TblMapSubUnitHandSampleTexture – *Contains information about the texture or appearance of each subunit at a hand sample level, if any, given by the reference map's*			
MapSubUnitHandSampleTexturePK	Auto	N/A	Primary key
MapSubUnitFK	Auto	N/A	Foreign key
PostDepositionProcessAmount	Character	150	Keyword indicating post-depositional process types
PostDepositionProcessModifier	Character	150	Modifying term(s) describing the amount or degree of the 'PostDepositionProcessAmount' keyword
CrystalGrainsSizeShape	Character	150	Keyword indicating crystal or grain size and shape, and the amount of rounding or sorting of clasts
CrystalGrainsSizeShapeModifer	Character	150	Modifying term(s) describing the keyword of the 'CrystalGrainsSizeShape' field
VoidsSizeandShape	Character	150	Keyword indicating the size or shape of voids in the subunits
VoidsSizeandShapeModifier	Character	150	Modifying term(s) describing the keyword of the 'VoidsSizeandShape' field
GeneralTextureTerms	Character	150	Keyword indicating other general textural terms not listed in the previous fields
GeneralTextureTermsModifier	Character	150	Modifying term(s) describing the keyword of the 'GeneralTextureTerms' field

Appendix C - Minimum Non-Graphic Data Elements (cont.)

Database Table Name

Field Name	Field Type	Size	Description
TblMapSubUnitOutcropMajorStructures– *Contains information about the structure of each subunit when viewed at the outcrop level, if any, given by the reference map's author(s)*			
MapSubUnitOutcropMajorStructuresPK	Auto	N/A	Primary key
MapSubUnitFK	Auto	N/A	Foreign key
Layering	Character	150	Keyword indicating the layering or strata type of the subunit
LayeringModifier	Character	150	Modifying term(s) describing the type
OutcropType	Character	150	Keyword indicating the outcrop type
OutcropSizeandShape	Character	150	Keyword indicating the outcrop's physical appearance or distribution
OutcropModifier	Character	150	Modifying term(s) describing the combination of the 'OutcropType' and 'OutcropSizeandShape' keyword fields
DeformationBreakage	Character	150	Keyword indicating the physical characteristics resulting from the pressure of the Earth's Crust after the rocks were formed
DeformationModifier	Character	150	Modifying term(s) describing the keyword of the 'DeformationBreakage' field
GeneralStructureTerms	Character	150	Keyword indicating other structural terms not listed in the previous fields
GeneralStructureModifier	Character	150	Modifying term(s) describing the keyword of the 'GeneralStructureTerms' field

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 method	Character	50	Method of conversion of a non-digital product to a digital product
Processing scale	Integer	Auto	Scale at which the non-digital product was digitized or converted
Processing date	Date/Time (8)	8	Approximate date that the conversion took place

TblRefBaseMap - *Contains the spatial information about the reference map and the reference map's base maps*			
Reference ID code	Character	25	Unique code assigned to each original reference map by data steward
Reference map scale	Character	15	Scale of the published 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
Base map name	Character	50	Common name of the type of base map for the reference map
Base map scale	Character	15	AutoScale of the original base map
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
North bounding coordinate	Double (8)	Auto	Coordinate of the north limit of the reference map
South bounding coordinate	Double (8)	Auto	Coordinate of the south limit of the reference map
East bounding coordinate	Double (8)	Auto	Coordinate of the east limit of the reference map
West bounding coordinate	Double (8)	Auto	Coordinate of the west limit of the reference map

Appendix C - Minimum Non-Graphic Data Elements (cont.)

Database Table Name

Field Name	Field Type	Size	Description *(Descriptive Field Names shown in italics)*
TblRefCompilationMerge— *Contains the original reference map's unit name and symbol along with the compilation, lithology and general overal unit name and symbol assigned to that original unit*			
ID	Integer	11	Framework identifier generated by data steward
Ref_ID_cod	Character	25	*Reference ID Code*—Unique code assigned to each original reference map by data steward
Map_unit_l	Character	12	*Map Unit Label*—Reference map unit label symbol taken from the original reference map
Map_unit_n	Character	100	*Map Unit Name*—Reference map unit name taken from the map legend or explanation of map units on the original reference map
G_mrg_u_l	Character	60	*Geology Merge Unit Label*—Label (period delimited) assigned by area geologists that combines all the original map units into 7 different general geologic categories (as described below)
Geo_genl_u	Character	50	*Geology General Unit*—General geologic rock type of the geologic merge unit label expressed by the genesis of the unit
Age_name	Character	50	*Age Name*—Age of geologic merge unit based on the Geologic Time Scale
Terrane_gr	Character	50	*Terrane or Group Name*—Stratigraphic name (formally and informally named) for the geologic terrane or group
Formation	Character	200	*Formation Name*—Stratigraphic name (formally and informally named) for the geologic formation
Member	Character	50	*Member Name*—Stratigraphic name (formally and informally named) for the member type
Unit	Character	50	*Unit Name*—Stratigraphic name (formally and informally named) for the unit type
G_rock_typ	Character	50	*Geology Rock Type*—Characteristic lithology type for the geologic merge unit label
Lith_m_u_l	Character	50	*Lithology Merge Unit Label*—Label (period delimited) assigned for the lithologic compilation merge unit that combines the original map units into 5 different lithologic categories (as described below)
Lith_gen_u	Character	75	*Lithology General Unit*—Physical characteristic of the rock expressed by the genesis of the unit
Lth_rk_typ	Character	50	*Lithology Rock Type*—Characteristic lithology name taken from the original source data for the lithologic merge unit
Layering	Character	50	*Layering*—Rock Stratum or layering information of the map unit taken from the non-graphic data elements of Appendix C
Cr_grn_siz	Character	50	*Crystal/Grain Size*—Crystal or grain size component of the different rock types, taken from the non-graphic data elements of Appendix C
Getec_prop	Character	50	*Geotechnical Properties*—Rock or structural properties of the lithologic unit, taken from the non-graphic data elements of Appendix C
Gn_lith_ty	Character	50	*General Lithology Type*—General lithology type (6 possible choices) assigned to the map unit
ArcJoinKey	Character	37	*ArcGIS Join Key*—Concatenation of 'REF_ID_COD' and 'MAP_UNIT_L' fields with no space between—for use with joins or relates of data tables (see Appendix C) in ArcGIS and other GIS software

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

Appendix D - OREGON GEOLOGIC DATA MODE
Table Diagram
February, 2009

(NOTE: The tables for Appendix D have been modified for this release, but have NOT been approved by the Geoscience FIT as th

Geospatial Information Tables
(in GIS)

Descriptive and Metadata Tables
(in Relational Database)

G_Map_Unit
ID
Ref_ID_cod
Map_unit_l
Map_unit_n
G_mrg_u_l
Geo-genl_u
Age_name
Terrane_gr
Formation
Member
Unit
G_rock_typ
Lith_m_u_l
Lth_rk_typ
Layering
Cr_grn_siz
Getec_prop
Gn_lith_ty
ArcJoinKey

G_Ref_Map
Ref_ID_Cod
Outline_ID
ID

G_Fault_Ln
Ref_ID_Cod
Flt_Name
Flt_Type
Flt_Cert
FltPl_Dir
FltPl_Deg

TblRefGeologicInfo
ID
Reference ID Code
First author
Other authors
Hectant
Publication date
Publication title
First editor
Larger work citation
Publication Place
Originator
Series name
Issue identification
Map identifier
Geospatial format

TblAge
AgeInfoPK
MapUnitFK
MinimumStratAge
MaximumStratAge
QueriedMinStrat
QueriedMaxStrat
StratAgeRelation
AgeCertainity
RadioAgePrefix
RadiometricAgeError
RadiometricAgeType
RemMagnetPolarity
MagnetStratunit

TblRefBaseMap
Reference ID code
Reference map scale

TblMapSubUnitOutcropMajorStructures
MapSubUnitOutcropMajorStructuresPK
MapSubUnitFK
Layering
LayeringModifier
OutcropType
OutcropSizeandShape
OutcropModifier
DeformationBreakage
DeformationModifier
GeneralStructureTerms
GeneralStructureModifier

TblMapSubUnitHandSampleTexture
MapSubUnitHandSampleTexturePK
MapSubUnitFK
PostDepositionProcessAmount
PostDepositionProcessModifier
CrystalGrainSizeShape
CrystalGrainSizeShapeModifier
VoidsSizeandShape
GeneralTextureTerms
GeneralTextureTermsModifier

TblMapUnitLithologyMineralComp
MapSubUnitLithologyMineralCompPK
MapSubUnitFK
PiecesCrystalsClasts
PiecesCrystalsClastsModifier
OpenSpaceComposition
OpenSpaceCompositionModifier
PostDepositionProcessComposition
PostDepositionProcessModifier