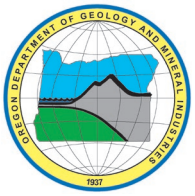
State of Oregon
Oregon Department of Geology and Mineral Industries
Brad Avy, State Geologist

DIGITAL DATA SERIES

OREGON GEOLOGIC DATA COMPILATION, RELEASE 7 (OGDC-7)

compiled by Jon J. Franczyk[1], Ian P. Madin[1], Carlie J.M. Duda[1], and Jason D. McClaughry[2]



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[1] Oregon Department of Geology and Mineral Industries, 800 NE Oregon Street, Suite 965, Portland, OR 97232
[2] Oregon Department of Geology and Mineral Industries, Baker City Field Office, 1995 3rd Street, Suite 130, Baker City, OR 97814

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WHAT'S IN THIS PUBLICATION?

This Esri-format geodatabase integrates the best available published geologic mapping for the state by combining maps and data into a single consistent and maintainable digital database. This release of the geodatabase was migrated to the National Cooperative Geologic Mapping Program (NCGMP) Geologic Map Schema (GeMS).

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For additional information:
Administrative Offices
800 NE Oregon Street, Suite 965
Portland, OR 97232
Telephone (971) 673-1555
Fax (971) 673-1562
https://www.oregongeology.org
https://oregon.gov/DOGAMI/

TABLE OF CONTENTS

LIST OF TABLES

GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA

See the digital folder for files.
Geodatabase is Esri® version 10.7.1 format. Metadata is embedded in the geodatabase and is also provided as separate .xml format files.

OGDC7.gdb:

Feature dataset: GeologicMap

feature classes:

- CartographicLines
- ContactsAndFaults
- DataSourcePolys
- GeochemPoints
- GeochronPoints
- GeologicLines
- MapUnitPolys
- OrientationPoints

Tabular data:

- DataSources
- DescriptionOfMapUnits
- GeoMaterialDict
- Glossary

Metadata in .xml file format:

- CartographicLines.xml
- ContactsAndFaults.xml
- DataSourcePolys.xml
- GeochemPoints.xml
- GeochronPoints.xml
- GeologicLines.xml
- MapUnitPolys.xml
- OrientationPoints.xml
- DataSources.xml
- DescriptionOfMapUnits.xml
- GeoMaterialDict.xml
- Glossary.xml

ABSTRACT

The Oregon Geologic Data Compilation (OGDC) is a digital data collection of geologic studies created by the Oregon Department of Geology and Mineral Industries (DOGAMI). The purpose of the compilation is to integrate and make available the best available published geologic mapping for the state by combining maps and data into a single consistent and maintainable digital database. OGDC was first released by DOGAMI in 2004, with successive releases building either geographically or qualitatively on previous releases. OGDC-6 was published in 2015 and serves as the Oregon Geologic Data Standard for the state as a data element component of the Geosciences Theme within the Oregon Framework Themes. The release of OGDC-7 builds directly from data published in OGDC-6 by migrating the database structure to the National Cooperative Geologic Mapping Program (NCGMP) Geologic Map Schema (GeMS). DOGAMI has implemented the GeMS schema as the database standard for all geologic mapping projects published from 2019 onward to meet NCGMP requirements and to support the state's contribution to standardized nationwide geologic content. The transition to OGDC-7 required migrating the existing OGDC statewide compilation to the GeMS format for streamlining future updates, data creation, and data maintenance. Additionally, the transition to GeMS adds fundamental geologic map point data (e.g., structural data, geochronology, and geochemistry) as comprehensive geospatial datasets not included as part of previous versions of OGDC.

1.0 INTRODUCTION

The Oregon Geologic Data Compilation (OGDC) and the Oregon Geologic Data Standard (OGDS), were developed by the Oregon Department of Geology and Mineral Industries (DOGAMI) in consultation with an interdisciplinary group of geologists between 2003 and 2009 (Ma and others, 2009; Smith and Roe, 2015). The purpose of OGDC and OGDS was to compile statewide geospatial datasets (e.g., map unit polygons, faults, and folds) from the best available published traditional geologic maps, to provide a consistent and maintainable structure for Oregon geologic map data, and to simplify data exchange among all users. In 2009 the U.S. Geological Survey (USGS) National Cooperative Geologic Mapping Program (NCGMP) released a separate geologic mapping database schema: the National Cooperative Geologic Mapping Program 2009 draft standard format for digital publication of geologic maps, version 1.1 (NCGMP09; USGS National Cooperative Geologic Mapping Program, 2010). This was followed in 2014 by an updated Geologic Map Schema (GeMS; USGS National Cooperative Geologic Mapping Program, 2018). The 2014 schema was finalized in 2020, with the publication of "GeMS (Geologic Map Schema) – A Standard Format for the Digital Publication of Geologic Maps" (U.S. Geological Survey National Cooperative Geologic Mapping Program, 2020). GeMS is designed to 1) encode traditional geologic map information from the USGS, state geological surveys, or other entities in a digital Esri® ArcGIS™ ArcMap™ geodatabase format, and 2) facilitate the development of multi-map databases, the National Geologic Map Database (NGMDB). The standard GeMS database is being used to build a national archive of standardized geologic map content. GeMS has undergone extensive review and testing and is in the process of being formally published by the USGS (USGS National Cooperative Geologic Mapping Program, 2018). When published, this standard will be submitted to the Federal Geographic Data Committee (FGDC) for standard implementation and will become the required digital format for all geologic map deliverables supported by NCGMP.

DOGAMI has implemented the GeMS schema as the database standard for all geologic mapping projects published in 2019 and onward to meet NCGMP requirements and to support construction of standardized nationwide geologic content. This operational database transition necessitates migrating the existing

OGDC statewide compilation to the GeMS format for streamlining future updates, data creation, and data maintenance. Additionally, the OGDC to GeMS transition adds fundamental geologic map point data (e.g., structural data, geochronology, and geochemistry) as comprehensive geospatial datasets not included as part of OGDC (Ferns and McConnell, 2005; Niewendorp and others, 2010; Ricker and Niewendorp, 2013). This OGDC-7 geospatial database is formatted as an Esri ArcGIS ArcMap geodatabase. It will enrich the user's understanding of geologic information in Oregon and will provide a higher level of accessibility to users of future studies requiring knowledge of local, regional, statewide, or nationwide geologic information. This project also continues data development and maintenance of the Geology Data element and Data Standard in the Oregon Framework Program Geosciences Framework (https://www.oregon.gov/geo/pages/fit.aspx).

2.0 CONVERSION METHODOLOGY

The revised database structure for OGDC-7 follows that developed for the USGS NCGMP Geologic Map Schema (USGS National Cooperative Geologic Mapping Program, 2018). DOGAMI's conversion of OGDC-6 to the OGDC-7 GeMS schema followed the internal methodology described below. Although the primary goal of this project was the schema conversion, there were adjustments and additions to the spatial data to improve the integrity of the data and to provide better feature representation. However, the methodology was developed to keep the source data as true to the original studies as possible.

2.1 Topology Rules

As a preliminary step to converting the statewide geology data from the OGDC-6 into the GeMS schema, numerous topological checks and fixes were made to resolve violations in the existing feature classes. These checks and fixes were implemented in Esri ArcGIS ArcMap using the Topology toolset. Feature classes from OGDC-6 included MapUnitPolys, Contacts, Faults, and Folds. **Table 2-1** shows the topology rules that were used, as defined by the USGS NCGMP Geologic Map Schema (USGS National Cooperative Geologic Mapping Program 2018) and internal DOGAMI protocols (USGS National Cooperative Geologic Mapping Program, 2018).

Table 2-1. Topology rules run on select statewide or regional OGDC-6 feature classes.

OGDC-6 Feature Class	Topology Check
MapUnitPolys	Must Not Have Gaps Must Not Overlap
Contacts	Must Not Overlap Must Not Have Dangles Must Not Self-Overlap Must Not Self-Intersect Must Be Single Part
Faults	Must Not Overlap With (Contacts) Must Not Self-Overlap Must Not Self-Intersect Must Not Overlap Must Be Single Part
Folds	Must Not Self-Intersect Must Not Self-Overlap Must Be Single Part

2.2 OGDC-6 Topology Check Procedure

Topology checks of OGDC-6 data were started in areas of more recent geologic mapping, including Bear Creek Valley, Hood River, and the South Coast (Wiley and others, 2011; McClaughry and others, 2012; McClaughry and others, 2013; Wiley and others, 2014, 2015). These studies had the most detail of any areas throughout the state and required additional attention. Most issues were in and around edge-match boundaries between adjacent, less-detailed datasets, but fixes were considered on all MapUnitPolys, Contacts, Faults, and Folds feature classes in these areas. After errors in the three recent study areas had been inspected and fixed, the topology checks outlined in section 2.1 were run on the remaining statewide feature classes.

The OGDC-6 dataset did not originally contain a statewide polyline feature class representing contacts, so one was created based on the map unit polygons. This process used the Esri ArcGIS ArcMap Polygon to Line tool on the topologically corrected MapUnitPolys feature class. Because geologic rules (and topological rules) indicate that faults should not overlap contacts, the Esri ArcGIS ArcMap Erase tool was used to remove contacts that overlapped with existing faults, as found through topology checks. See the Known Issues section (5.0) for more details on remaining topology errors.

2.3 OGDC-6 to the GeMS Schema: Methods for Loading Data

The update of OGDC-6 to the OGDC-7 GeMS schema was organized so that each OGDC-6 feature class and its attribute fields were matched with its correct GeMS feature class and attribute fields. This update also included matching geodatabase table information. To facilitate this process, a script written in the Python computer language (v2.7.14) was created to identify the attributes and attribute properties for each feature class and geodatabase table and to output this information to a Microsoft® Excel® spreadsheet. **Table 2-2** shows the match between feature classes, and **Table 2-3** shows the match between geodatabase tables from OGDC-6 and GeMS. Geologic symbolization in both OGDC-6 and OGDC-7 is based on geodatabase representation rules. The numeric values that represent specific geologic symbols in these representation rules changed from OGDC-6 to OGDC-7, and these values were updated for all the GeMS feature classes so that the correct symbology, when available, would be reproduced when added to a map.

Table 2-2. Feature class matches between OGDC-6 and GeMS.

OGDC-6	GeMS
MapUnitPolys	MapUnitPolys
Contacts Faults	ContactsAndFaults
Folds JointsAndLineaments SmallMinorFolds VolcanicLineFeatures	GeologicLines
REF_MAP	DataSourcePolys
Bedding Foliation Cleavage Lineation SmallMinorJoints	OrientationPoints

Table 2-3. Table matches between OGDC-6 and GeMS.

OGDC-6	GeMS
tblRefBaseMap tblRefConversionInfo tblRefGeologicInfo	DataSources
tblGlossary	Glossary
tblMapUnits tblMapSubUnit tblMapSubUnitColors tblMapSubUnitHandSampleTexture tblMapSubUnitLithologyMineralComp tblMapSubUnitOutcropMajorStructures tblThickness	DescriptionOfMapUnits

2.4 Description of Map Units

One strength of the GeMS schema is an efficient use of geodatabase tables. The previous OGDC-6 schema distributed the information contained within the typical geologic pamphlet's Explanation of Map Units section to multiple tables (**Table 2-3**). To retain this tabular data in the new schema, this information was concatenated using a script written in the Python computer language (v2.7.14). The script output was in paragraph format and provided an approximation of a prose long-form map unit description for each map unit type within each geologic study and was written to the "Description" field of the OGDC-7.gdb DescriptionOfMapUnits table. The appendix provides a key for this paragraph, including the order of each map unit and subunit(s) information and the original OGDC-6 table and feature class sources. For geologic studies with no tabular data, description paragraphs were copied from the original geologic pamphlet and do not conform to the format described in this section. It is important to remember that the concatenated data description simply lists the attribute class and values from the original table, in a specified order and hierarchy. Many entries are blank, and even where richly populated, the entries do not resemble a written description. Users are directed to the source material for full descriptions.

2.5 Updates to MapUnitPolys Attributes

Updating the MapUnitPolys feature class attributes involved not only modifying the formatting, but also streamlining the data included in the attribute table. Converting the existing OGDC-6 feature classes and tables into the GeMS schema included standardizing sections of the attribute table so that they followed the schema rules (GeMS 2018) (**Table 2-4**). This process first took the existing field names and converted them to PascalCase (the first letter of each word is in upper case), while removing any spaces or special characters. Long field names (no abbreviations) were used that most accurately described the field's data content and type. Any field names that contained "_ID" were reserved for primary keys. Finally, unique IDs were created for the MapUnitPolys.

Table 2-4 shows the OGDC-6 MapUnitPolys feature class fields that carried over to OGDC-7 and how they were renamed. Descriptions for all OGDC-7 attribute fields can be found in the dataset's corresponding metadata.

Table 2-4. Updates in the MapUnitPolys attribute table from OGDC-6 to OGDC-7.

OGDC-6 Fields	OGDC-7 Fields
OBJECTID	OBJECTID
Shape	Shape
MAP_UNIT_N	MapUnit
Identity Confidence	IdentityConfidence
n/a	Symbol
REF_ID_COD	DataSourceID
n/a	Notes
n/a	MapUnitPolys_ID
MAP_UNIT_L	Label
ArcJoinKey	ArcJoinKey
G_MRG_U_L	ThematicUnitLabel
GEO_GENL_U	ThematicRockType
AGE_NAME	ThematicAge
TERRANE_GR	ThematicTerraneGroup
FORMATION	ThematicFormation
MEMBER	ThematicMember
UNIT	ThematicUnit
G_ROCK_TYP	ThematicLithology
LITH_M_U_L	Removed
LITH_GEN_U	Removed
LTH_RK_TYP	Removed
LAYERING	Removed
CR_GRN_SIZ	Removed
GETEC_PROP	Removed
GN_LITH_TY	Removed
MapUnitPK	Removed
DataSources_ID	Removed
Shape_Length	Shape_Length
Shape_Area	Shape_Area

2.6 Previous Study Data Updates

The update to OGDC-7 provided the opportunity to improve the accuracy of geologic information from select previous studies (**Table 2-5**). These studies included either incorrect attribute information (wrong type of data) or values that needed to be updated to current standards. These changes were based on revisions by DOGAMI geologists. The table below shows the studies included and the changes that were made.

Table 2-5. Geologic information improvements on select studies. See the OGDC-7 geodatabase for the study that corresponds to the REF ID COD.

Study REF_ID_COD	Field	From	To
McClJD2013	ThematicUnitLabel	"ct"	"ter"
	ThematicFormation	"Coastal terrace deposits"	"Terrace deposits"
MadilP1995, BlacGL1995, BaldEM1969, BeauJD1975, NewtVC1980, NiemAR1985, SchlHG1974, SnavPD1976a, SnavPD1976b, SnavPD1976c, SnavPD1996, VallTL1974, WellRE1995	ThematicUnitLabel	All "Q"	All "Pl"
	ThematicAge	"Quaternary"	"Pleistocene"
MadilLUnpub	ThematicUnitLabel	"al"	"eol"
	ThematicFormation	"alluvial deposits"	"eolian deposits"
McClJD2012	ThematicUnitLabel	"r"	"H"
	ThematicFormation	??????	"alluvial deposits"
	ThematicUnitLabel	After "qsd"	"ls"
	ThematicFormation	Blank	"Landslide"
McClJD2010	ThematicUnitLabel	"brk"	"bed"
	ThematicFormation	"bedrock"	"bedrock"

2.7 Geologic Point Data

OGDC-7 also includes DOGAMI's statewide Geoanalytical Information Layer for Oregon (GILO; Niewendorp and others, 2010) and Radiometric Age Information Layer for Oregon (RAILO; Ricker and Niewendorp, 2013). These datasets correspond to the GeochronPoints feature class (RAILO) and a newly created GeochemPoints feature class (GILO) in GeMS. The GeochemPoints feature class was formatted based on the standards found in the USGS NCGMP Geologic Map Schema (GeMS, 2018.

Additional structural data were compiled from 352 geologic reference maps of various scales statewide. These structural data were primarily limited to bedding (strike and dip). The dip values were recorded from the bedding labels as shown on the reference maps. To reproduce the angle of the strike symbol, each strike was traced with a specific start and end point based on the right-hand rule. This process creates a line "direction" and the strike symbol are drawn based on this direction. The midpoint of each traced line was used to define the x and y coordinates of the strike. Digitizing other elements such as foliation, cleavage, or lineation was limited due to time constraints. For newly digitized bedding points, all cartography was done in accordance with FGDC standards (U.S. Geological Survey, 2006).

Structural data (bedding) points were digitized at the following scales.

- Points were digitized at scales 1:8,000 or greater for maps of 1:48,000 scale or greater.
- Points were digitized at scales 1:25,000 or greater for maps of scale ranging between 1:50,000 and 1:125,000.
- Points were digitized at scales 1:62,500 or greater for maps of 1:125,000 scale and greater.

3.0 METADATA

Feature class level metadata has been created for OGDC-7 in accordance with the internal DOGAMI metadata standard v 1.4. DOGAMI's internal metadata standard is compliant with the approved Oregon GIS Metadata Standard (currently v. 2.04), as provided by the Oregon Geospatial Enterprise Office. The DOGAMI metadata standard is a more rigorous version of the Federal Geographic Data Committee (FGDC)

Content Standard for Digital Geospatial Metadata (CSDGM), version 2, standard (https://www.fgdc.gov/metadata/csdgm-standard). The CSDGM is also the state of Oregon metadata standard.

4.0 OREGON GEOLOGIC DATA STANDARD

Geologic map data being compiled and updated statewide for Oregon now follows the database design detailed in the 2020 publication "GeMS (Geologic Map Schema)—a standard format for digital publication of geologic maps" (Geologic Map Schema, 2020) (https://pubs.er.usgs.gov/publication/tm11B10). While new data conform to the USGS national standard, OGDC-7 no longer conforms to the original Oregon data standard. The new standard does not result in the loss of data present in the Oregon standard. The Oregon standard will be updated when resources allow.

5.0 KNOWN ISSUES

Despite the steps taken to resolve topological problems within and between features from OGDC-6, numerous issues remain in OGDC-7. Some issues are carried over from the geologic data before the schema change, and some issues are the result of the new schema format limitations.

- **CartographicLines feature class:** This empty feature class is included in this dataset to facilitate additions of data in future updates. Cartographic lines provide a map view and direction of the cross section trace at the surface. Cross sections of the subsurface are illustrated along these lines and are used for cartography.
- **GeologicLines feature class:** The GeMS representation rules for the GeologicLines feature class does not contain symbology codes for some of the less common folds that were present in the OGDC-6 dataset. The result is that a random symbology is assigned to these folds, which does not represent the correct fold symbol, as identified in FGDC Digital Cartographic Standard for Geologic Map Symbolization (USGS, 2006).
- **ContactsAndFaults feature class:** Geologic study citations are not present for the contact lines that represent study boundaries for all but three of the geologic studies. New contact lines created from the MapUnitPolys were assigned -9999 to indicate that the contact characteristics are not included. Additionally, some areas contain faults that should overlap and thus replace contacts. However, these faults were not originally digitized with enough accuracy; correcting this issue was beyond the scope of this project.
- **DataSourcePolys feature class:** There are sliver polygons between some study area boundaries in this dataset. This is the result of boundary polygons from older studies that were digitized from scanned maps and in different projections, which has propagated throughout the development of OGDC. Fixing this issue was beyond the scope of this project.
- **OrientationPoints feature class:** An effort was made to digitize all remaining bedding points from previous geologic studies and include these in OGDC-7. There are multiple study areas that do not include bedding points because the studies did not have a georeferenced map available and obtaining and georeferencing additional maps was beyond the scope of this study. Therefore, their orientation points were not digitized.
- Some features have systematic offsets from their true locations as a result of projection issues (often NAD 27 versus NAD 83 datum errors) during the initial construction of OGDC. Fixing thee errors was beyond the scope of this project.

6.0 UPDATES

Updates to OGDC-7 will occur based on the availability of new data or information and staff resources and funding. To keep track of updates, a primary release number such as the current release 7 will be appended with a number identifying the update (e.g., 7.1). For major updates to the database, a new primary release number (e.g., 8) will be assigned.

7.0 ACKNOWLEDGMENTS

This update and release of OGDC-7 was supported through a grant from the State of Oregon through an Office of the State Chief Information Officer/Oregon Geospatial Enterprise Office (OSCIO/GEO) and DOGAMI Interagency Agreement DASPS-110112-17 (2017). Additional funds were provided by a National Geological and Geophysical Data Preservation Program (NGGDPP) grant under cooperative agreement number G18AP00102 (2018) and the Oregon Earthquake Database project under contract DASPS-3350-19. Critical and insightful reviews by Christina Appleby (DOGAMI) greatly enriched the final manuscript and geodatabase.

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9.0 APPENDIX: KEY TO THE "DESCRIPTION" FIELD OF THE OGDC-7.GDB DESCRIPTIONOFMAPUNITS TABLE

To retain OGDC-6 tabular and feature information in the new GeMS format, these data were concatenated using a script written in the Python computer language. The script provided a long-form map unit description for each map unit type within each geologic study. The output was a text file (.txt), saved as a comma delimited file (.csv) in paragraph format. These description paragraphs were then imported to the DescriptionOfMapUnits table in the OGDC-7 "Description" field. The brackets were retained in the output to assist in translating the description; where a map unit contained multiple subunits, a period was placed between subunit descriptions. This appendix provides a translation key for the OGDC-7 paragraph description, including the order of each map unit characteristic and the original OGDC-6 table and feature class source. For additional descriptions of OGDC-6 tables, feature classes, and fields, see the Readme File for Oregon Geologic Data Compilation (OGDC) – release 6, Appendix A (Smith and Roe, 2015). Colors were used to help differentiate between the different source tables and feature classes.

OGDC-6 source tables and feature classes (in order of use):
[MapUnitPolys] [tblMapUnit] [MapUnitPolys] [tblThickness]: [tblMapSubUnit]
[tblMapSubUnitLithologyMineralComp] [tblMapSubUnitOutcropMajorStructures]
[tblMapSubUnitHandSampleTexture] [tblMapSubUnitColors]

Abbreviations for OGDC-6 tables:
MSU = tblMapSubUnit
LMC = tblMapSubUnitLithologyMineralComp
OMS = tblMapSubUnitOutcropMajorStructures
HST = tblMapSubUnitHandSampleTexture
COL = tblMapSubUnitColors

Description paragraph explanation (table or feature class fields shown within brackets):
[Age Name] [Map unit name] [General geology unit, General rock type] [Thickness is Maximum thickness, Minimum thickness, Typical thickness]: [MSU: Relative abundance, Relative abundance modifier, Name] [LMC: Pieces crystals clasts, Pieces crystals clasts modifier, Open space filling composition, Open space filling composition modifier, Post deposition process composition, Post deposition process composition modifier, General composition terms, General composition terms modifier] [OMS: Outcrop type, Outcrop size and shape, Outcrop type modifier, Layering, Layering modifier, Deformation breakage, Deformation modifier, General structure terms, General structure terms modifier] [HST: Post deposition process amount, Post deposition process amount modifier, Crystal grains size and shape, Crystal grains size and shape modifier, Voids size and shape, Voids size and shape modifier, General texture terms, General texture terms modifier] [COL: Fresh color keyword, Fresh color keyword modifier, Weathered color key, Weathered color key modifier] .

Example description paragraph:
[Miocene] [Basalt dikes] [intrusive rocks, basalt] [Thickness is 50ft, no data, 15-25ft]: [MSU: major, mixed fluvial; sediment] [LMC: phenocrysts, plagioclase; no data, no data; no data, no data; no data, no data] [OMS: outcrop; form, thin plates, vertical, low mounds, steep canyon walls, fairly straight-sided borders; no data, no data; jointing, well developed horizontal columnar; contacts, straight-sided borders, waver

slightly]] [HST: no data, no data; crystal size, very fine to fine grained, aphanitic aphyric; no data, no data; crystallization, tachylytic close texture] [COL: gray, dark; brown, reddish] .