DIGITAL MAPPING TECHNIQUES 2015

The following was presented at DMT'15
(May 17-20, 2015 - Utah Geological Survey,
Salt Lake City, UT)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2015)

http://ngmdb.usgs.gov/info/dmt/

Two NCGMP09-Compliant Database Publications from the Volcano and Alaska Science Centers, U.S. Geological Survey (USGS)

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INTRODUCTION

Two recently prepared geologic map databases, one newly published and one in review, follow the NCGMP09 (NCGMP09, 2010) specification for the organization of digital geologic map data. Posters describing the general schema and workflow for the creation of the databases were presented at the 2015 Digital Mapping Techniques Workshop (DMT) in Salt Lake City, Utah and are available online at http://foobar as Adobe PDF files.

BaranofSchema.pdf shows the workflow and schema of the digital geologic map database that accompanies Scientific Investigations Map 3335, Geologic map of Baranof Island, southeastern Alaska (Karl et al., 2015). The database was transcribed from ArcINFO coverages by Evan Thoms from the Alaska Science Center and edited thereafter as an ArcGIS file geodatabase.

The schema and workflow for an NCGMP09-compliant database to accompany Scientific Investigations Map 2832, Geologic map of Mount Mazama and Crater Lake, Oregon (Bacon, 2008) is shown in CraterLakeSchema.pdf. The translation of the original geologic map data from ArcINFO coverages to an ArcGIS file geodatabase in the NCGMP09 schema was done by Heather Bleick while an employee with the Volcano Science Center.

TOWARD A VISUAL README FORMAT

In preparing these posters, I realized I was exploring the expediency of creating “visual readmes” for the increasingly complex geologic map datasets the USGS is producing. I would argue that the current formats of text-based metadata and readme files for geologic map databases do not lend themselves to quickly understanding the breadth, depth, and schema details of the data, especially for users who may lack the skills or software to investigate the data within a GIS. A single illustrated document might be easier to interpret than a readme file, cross-referenced against the NCGMP09 documentation, and the metadata. Not to mention that text-only formats are inadequate for poster presentations.

The layout of a visual readme document might contain the following items:

- An index map, or a set of index maps at successively larger scales, to show the geographic extent of the data.
- Separate map frames showing the features of just one feature class with a linked list of field names.
- Relationship lines or color-coded links between fields and other tables to which they might share relationships, including domain values.
- The list of topology rules.
- Definitions of tables, fields, domain values, and Glossary terms.
- A clear explanation of how features are symbolized and the names of style or layer files.
- The principle process steps followed during the creation of the database.

Consider an exploded diagram of a geodatabase with relationship lines (or some other symbolization) between graphical or text-based representations of the different parts. It has the potential to eliminate much page-turning through the NCGMP09 standard, file browsing, and metadata deciphering. All of the relevant information can be encoded in objects within a geodatabase (domains, relationship classes, DataSources table, a ProcessStep table, etc.) and could be called, along with the GIS-calculated metadata (spatial reference, geographic extent, feature counts, geometry details, etc.) in a script that would build the document.

An existing, but soon to be obsolete utility (see this GeoNet discussion thread: https://geonet.esri.com/thread/118432), which automates the production of some of these items is ArcGIS Diagrammer (Version 10.0.1, ESRI, 2008). It was designed for database designers to edit or analyze ArcGIS database schemas in Visual Studio and is thus more complicated than necessary to create a simple visual readme. Still, it is the program I used to create the table graphics seen in the posters and it offers HTML views of separated feature class maps, enumerated domain values, and field metadata, among other information. For the time being, this software is probably the best starting point for creating visual readme layouts.

A visual readme could be included with the publication or generated in a poster format for presentation. The posters I created for DMT do not represent the ideal product, but I am intrigued by the result and the possibility for future work.

REFERENCES

ArcGIS Diagrammer (Version 10.0.1)[computer software].(2008). Redlands, CA: ESRI Inc. Retrieved from http://www.arcgis.com/home/item.html?id=51b6066bfd024962999f6903682d8978.

Bacon, C.R., 2008, Geologic Map of Mount Mazama and Crater Lake Caldera, Oregon: U.S. Geological Survey Scientific Investigations Map 2832, 4 sheets, 49 p., http://pubs.er.usgs.gov/publication/sim2832.

Karl, S.M., Haeussler, P.J., Himmelberg, G.R., Zumsteg, C.L., Layer, P.W., Friedman, R.M., Roeske, S.M., and Snee, L.W., 2015, Geologic map of Baranof Island, southeastern

Alaska: U.S. Geological Survey Scientific Investigations Map 3335, pamphlet 82 p., http://dx.doi.org/10.3133/sim3335.

NCGMP (USGS National Cooperative Geologic Mapping Program), 2010, NCGMP09—Draft standard format for digital publication of geologic maps, version 1.1, in Soller, D.R., ed., Digital Mapping Techniques '09—Workshop Proceedings: U.S. Geological Survey Open-file Report 2010–1335, p. 93–146, http://pubs.usgs.gov/of/2010/1335/pdf/usgs_of2010-1335_NCGMP09.pdf.

NCGMP09 geodatabase for the geologic map of Mount Mazama and Crater Lake Caldera, Oregon

by

Heather Bleick, USGS; Evan Thoms, USGS, (ethoms@usgs.gov)

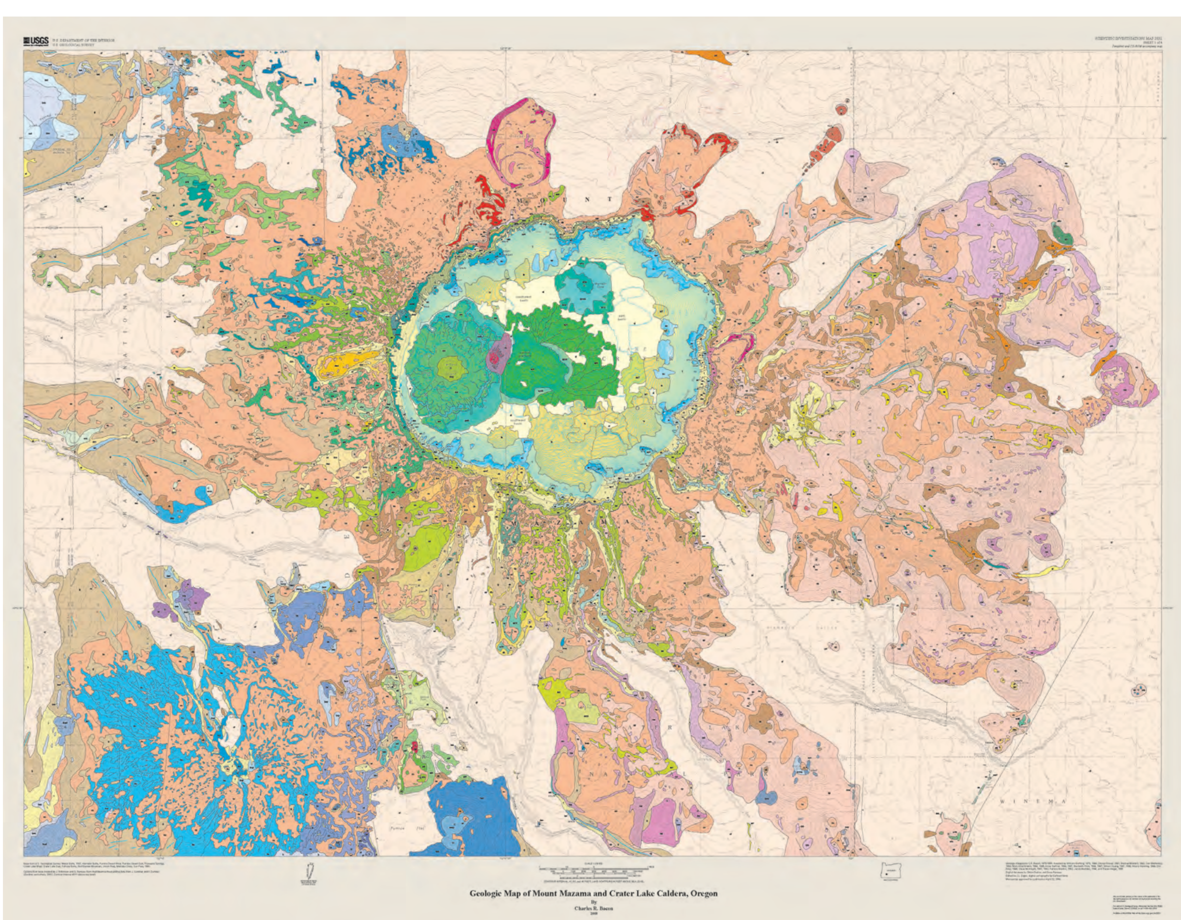
Digital Mapping Techniques Workshop 2015

About this work:
The Volcano Science Center of the USGS has begun applying the NCGMP09 standard for geologic map databases to both new and legacy publications. Heather Bleick completed the transcription shown here of legacy GIS data in 2014 but died with the publication still in review. Believing that her efforts deserve attention as another example of applying the NCGMP09 standard, I have produced this poster but take no credit for the authorship of the database. - Evan Thoms

Workflow (from the metadata)
This ArcGIS geodatabase is a transcription of the ArcInfo coverages (Ramsey and others, 2008) that were constructed in order to produce a geologic map (Bacon, 2008) as a basis for understanding processes and volcano hazards involved in the eruptions of Crater Lake Volcano.

Changes from the ArcInfo coverages to ArcGIS geodatabase include:
1) Converted the previously published quad-by-quad coverages in ArcInfo 7.2 to the more modern and widely used geodatabase in ArcGIS 10.2. In order to do this coverages were merged and imported into a geodatabase.
2)Then quadrangle boundaries were eliminated and contact lines were snapped to recreate new polygons. This will allow users to use seamless data across quadrangle boundaries.
3) Additionally, feature classes in the geodatabase were updated with the fields and layout by the NCGMP09 schema. Tables including DataSources, DescriptionOfMapUnits, and Glossary were created again following the NCGMP09 schema.
4) Lastly, metadata using the FGDC format was created reflecting updates and changes to the data. The FGDC metadata is embedded in the geodatabase and all accompanying files.

Map sheet

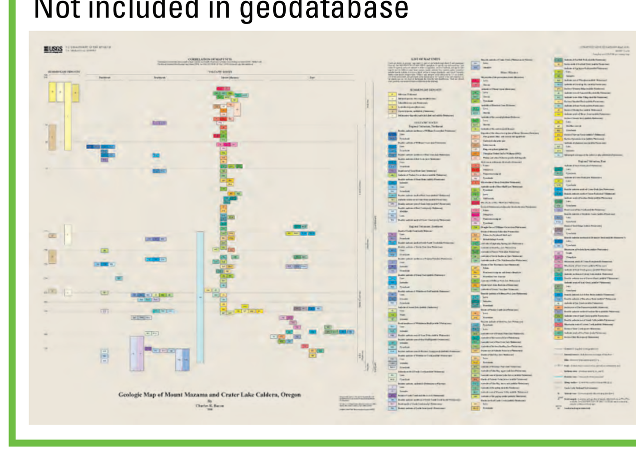


Bacon, C.R., 2008, Geologic Map of Mount Mazama and Crater Lake Caldera, Oregon: U.S. Geological Survey Scientific Investigations Map 2832, 4 sheets, 49 p.

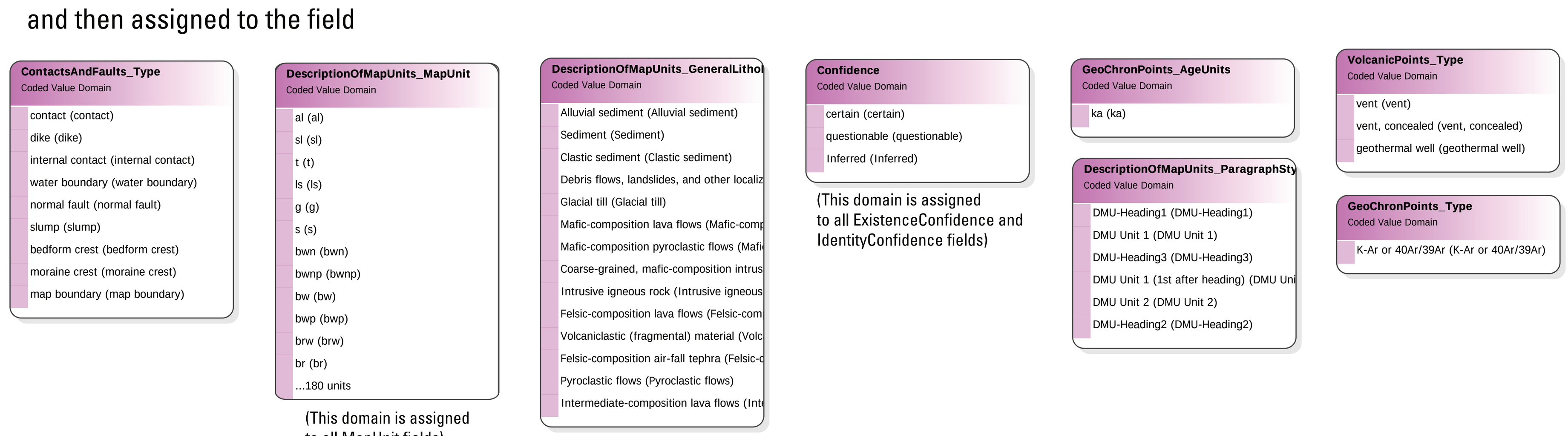
Geodatabase objects

- DSXXXXGeologicMapCraterLake.gdb
  - GeologicMap
    - ContactsAndFaults
    - GeoChronPoints
    - MapUnitPolys
    - VolcanicPoints
  - BaseMaps
  - ContactsAndFaultsExistenceConfidence_Glossary
  - ContactsAndFaultsIdentityConfidence_Glossary
  - ContactsAndFaultsType_Glossary
  - DataSources
  - DescriptionOfMapUnits
  - GeoChronPointsAgeUnits_Glossary
  - GeoChronPointsMapUnit_DMU
  - GeoChronPointsType_Glossary
  - Glossary
  - MapUnitPolysIdentityConfidence_Glossary
  - MapUnitPolysMapUnit_DMU
  - VolcanicPointsIdentityConfidence_Glossary
  - VolcanicPointsMapUnit_DMU
  - VolcanicPointsType_Glossary

Correlation of map units sheet
Not included in geodatabase



Domains - created from values in <table name>_<field name> and then assigned to the field



(This domain is assigned to all MapUnit fields)

(This domain is assigned to all ExistenceConfidence and IdentityConfidence fields)

Process notes

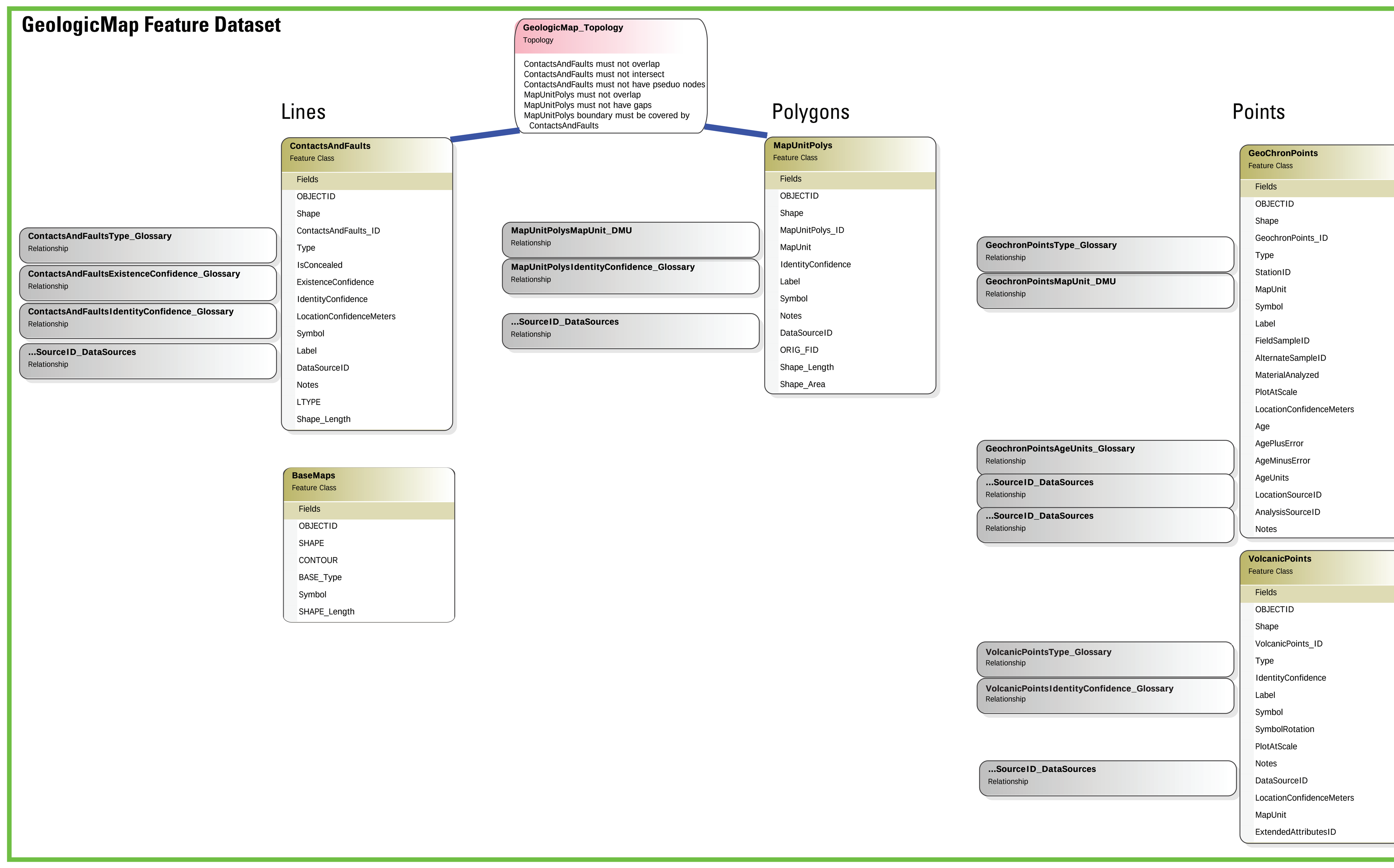
[Hard copy of Heather Bleick's notes pinned here during presentation. Contact Evan Thoms (ethoms@usgs.gov) for a copy]

Disclaimer
Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government

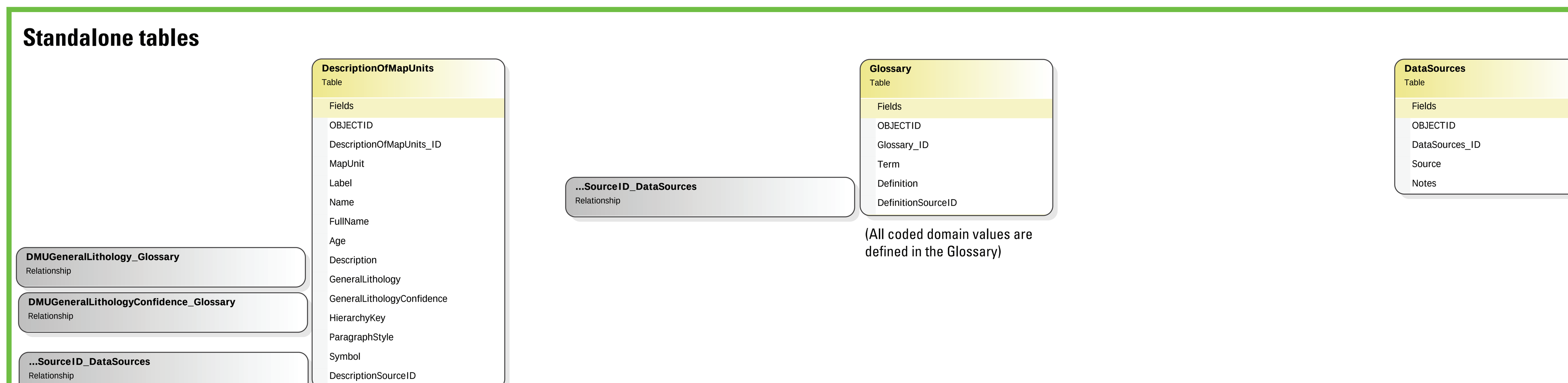
Planned to be published:

Bleick, H.A., Ramsey, D.W., Dutton, D. R., Bacon, C.R, XXXX, Database for the Geologic Map of Mount Mazama and Crater Lake Caldera, Oregon: U.S. Geological Survey, Data Series XXXX, Geodatabase; FGDC Styles/Fonts; Shapefile; Readme; Metadata

GeologicMap Feature Dataset



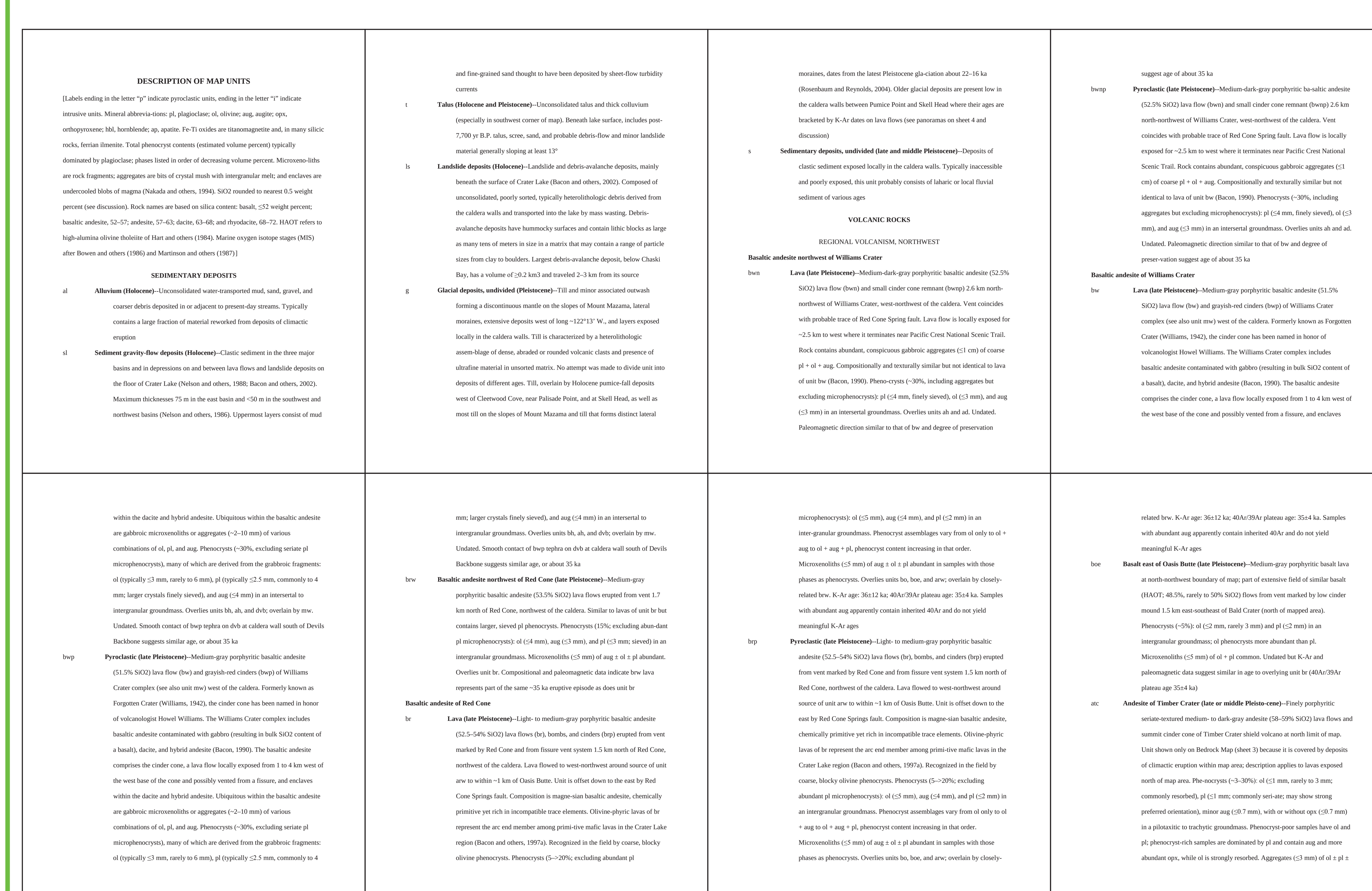
Standalone tables



(All coded domain values are defined in the Glossary)

DescriptionOfMapUnits table to MSWord docx using 'DMU to .docx' tool in NCGMP09v1.1_Toolbox1_Arc10.tbx.

DescriptionOfMapUnits_ID	MapUnit *	Label	Name	FullName	Age	Description	GeneralLithology	GeneralLithologyConfidence	HierarchyKey	ParagraphStyle	Symbol	DescriptionSourceID
DMU001	<Null>		DESCRIPTION OF MAP UNITS			<Null>	<Null>	<Null>	01	DMU-Heading1		DAS03
DMU002	<Null>					[Labels ending in the letter "p" indicate pyro	<Null>	<Null>	01-01	DMUHeadnote		DAS03
DMU003	<Null>		SEDIMENTARY DEPOSITS			<Null>	<Null>	<Null>	01-02	DMU-Heading2		DAS03
DMU004	al	al	Alluvium	Alluvium	Holocene	Unconsolidated water-transported mud, san	Alluvial sediment	certain	01-02-01	DMUUnit1		DAS03
DMU005	sl	sl	Sediment gravity-flow deposits	Sediment gravity-flow deposits	Holocene	Clastic sediment in the three major basins	Sediment	certain	01-02-02	DMUUnit1		DAS03
DMU006	t	t	Talus	Talus	Holocene and Pleistocene	Unconsolidated talus and thick colluvium (e	Clastic sediment	questionable	01-02-03	DMUUnit1		DAS03
DMU007	ls	ls	Landslide deposits	Landslide deposits	Holocene	Landslide and debris-avalanche deposits, m	Debris flows, landslides, and other lo	certain	01-02-04	DMUUnit1		DAS03
DMU008	g	g	Glacial deposits, undivided	Glacial deposits, undivided	Pleistocene	Till and minor associated outwash forming a	Glacial till	certain	01-02-05	DMUUnit1		DAS03
DMU009	s	s	Sedimentary deposits, undivided	Sedimentary deposits, undivided	late and middle Pleistocene	Deposits of clastic sediment exposed locall	Clastic sediment	certain	01-02-06	DMUUnit1		DAS03
DMU010	<Null>		VOLCANIC ROCKS			<Null>	<Null>	<Null>	01-03	DMU-Heading2		DAS03
DMU011	<Null>		Regional volcanism, northwest			<Null>	<Null>	<Null>	01-03-01	DMU-Heading3		DAS03
DMU012	<Null>		Basaltic andesite northwest of Willi				<Null>	<Null>	01-03-01-01	DMUUnit1		DAS03
DMU013	bwn	bwn	Lava	Lava of basaltic andesite northwest of Wil	late Pleistocene	Medium-dark-gray porphyritic basaltic ande	Mafic-composition lava flows	certain	01-03-01-01-01	DMUUnit2		DAS03
DMU014	bwnp	bwnp	Pyroclastic	Pyroclastic of basaltic andesite northwest	late Pleistocene	Medium-dark-gray porphyritic ba-saltic ande	Mafic-composition pyroclastic flows	certain	01-03-01-01-02	DMUUnit2		DAS03
DMU015	<Null>		Basaltic andesite of Williams Crater				<Null>	<Null>	01-03-01-02	DMUUnit1		DAS03
DMU016	bw	bw	Lava	Lava of basaltic andesite of Williams Crat	late Pleistocene	Medium-gray porphyritic basaltic andesite (	Mafic-composition lava flows	certain	01-03-01-02-01	DMUUnit2		DAS03
DMU017	bwp	bwp	Pyroclastic	Pyroclastic of basaltic andesite of William	late Pleistocene	Medium-gray porphyritic basaltic andesite (	Mafic-composition pyroclastic flows	certain	01-03-01-02-02	DMUUnit2		DAS03
DMU018	brw	brw	Basaltic andesite northwest of Red	Basaltic andesite northwest of Red Cone	late Pleistocene	Medium-gray porphyritic basaltic andesite (	Mafic-composition lava flows	certain	01-03-01-03	DMUUnit1		DAS03
DMU019	<Null>		Basaltic andesite of Red Cone				<Null>	<Null>	01-03-01-04	DMUUnit1		DAS03
DMU020	br	br	Lava	Lava of basaltic andesite of Red Cone	late Pleistocene	Light- to medium-gray porphyritic basaltic a	Mafic-composition lava flows	certain	01-03-01-04-01	DMUUnit2		DAS03
DMU021	brp	brp	Pyroclastic	Pyroclastic of basaltic andesite of Red C	late Pleistocene	Light- to medium-gray porphyritic basaltic a	Mafic-composition pyroclastic flows	certain	01-03-01-04-02	DMUUnit2		DAS03



U.S. Department of the Interior
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NCGMP09 geodatabase for the geologic map of Baranof Island, Southeast Alaska

by

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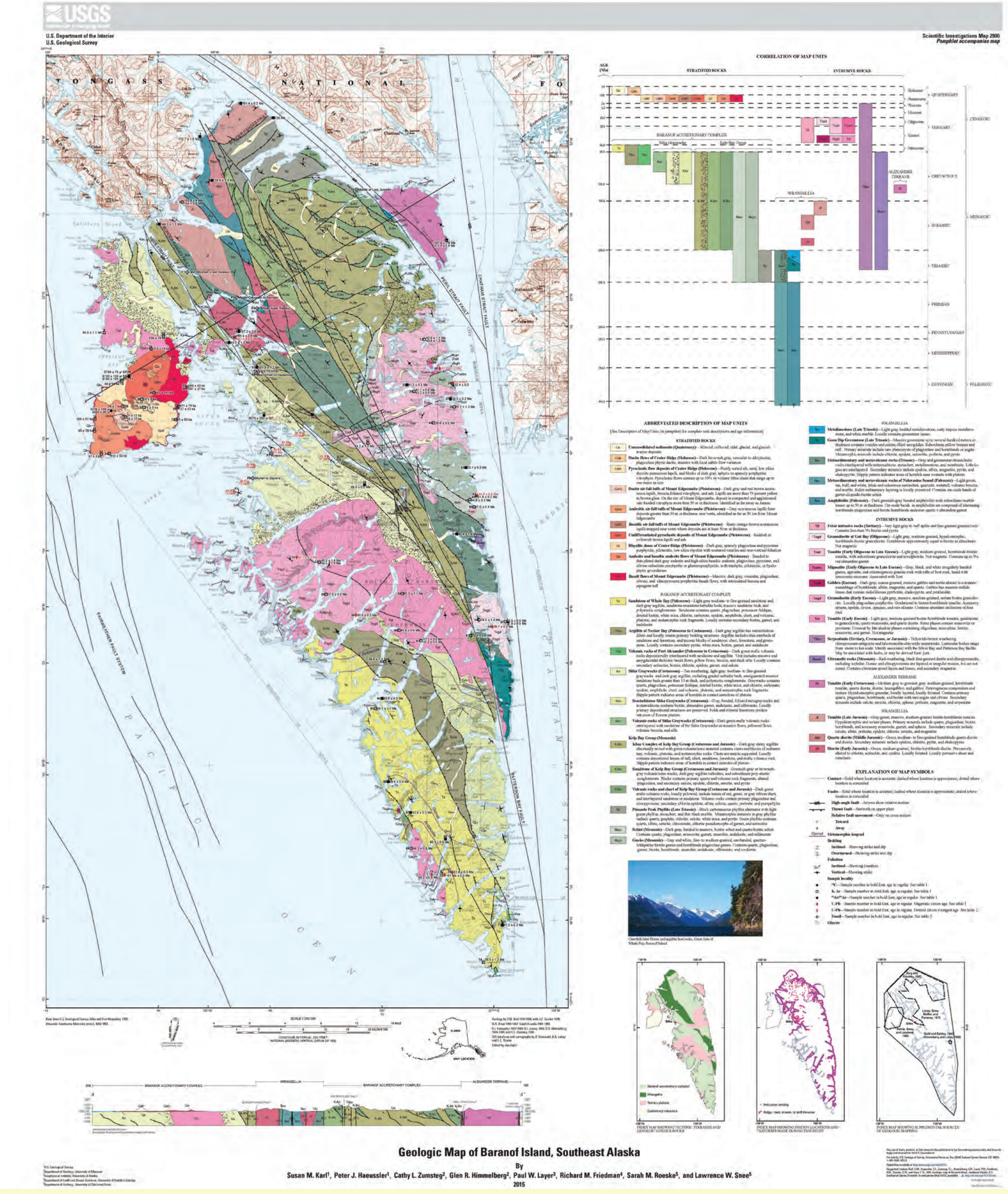
Digital Mapping Techniques Workshop 2015

Workflow

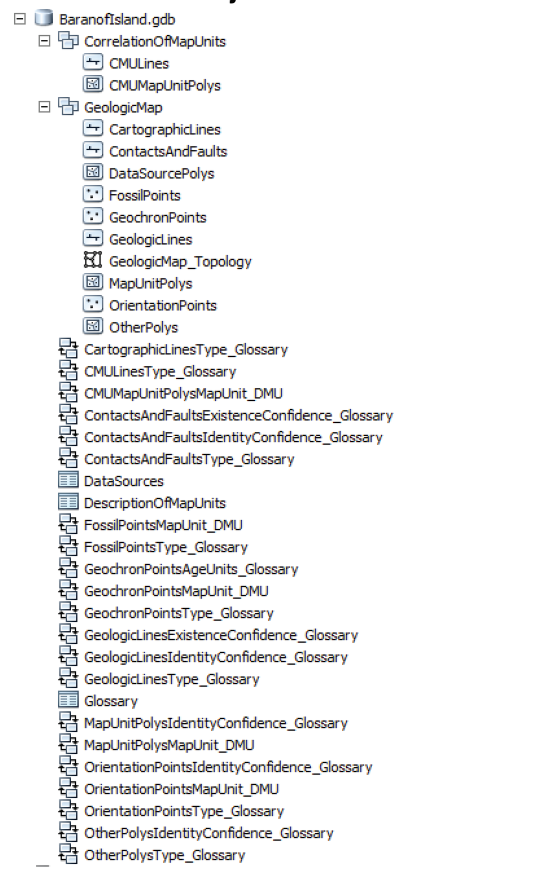
1) Converted ArcINFO coverages to ArcGIS 10.2 file geodatabase, mostly keeping intact the original National Surveys and Analysis (NSA) schema.
2) Edited lines and polygons with a lines-and-label-points-method, not through explicit topology class. A geoprocessing script automated the polygon feature class deletion, creation, and layer creation steps required for this method.
3) Moved data into NCGMP09 v1.1 schema and attributed the tables based on the Description of Map Units pamphlet, arccodes from the NSA schema, parsing of existing concatenated values, etc. LocationConfidenceMeters for all lines was determined by starting with, roughly, the thickness of a 'fault, certain' line on the map at the published scale (75 m) and doubling for each additional level of uncertainty, e.g. originally tagged 'approximate', 'concealed', or with query marks.
4) Scripted the discovery of unique values for all NCGMP09 controlled fields throughout the geodatabase and populated the Term field in the Glosssary. Created definitions or copied them in through joins with other dictionary-like tables, e.g, NCGMP09 General Lithology, although there are many instances of 'This study'.
5) Edited one metadata template xml file for the geodatabase as a whole. A geoprocessing script then exported FGDC metadata files for all data objects, migrated appropriate metadata elements to each metadata files, and wrote Entity Attribute Domain values for each NCGMP09 controlled field based on entries in the Glossary and DataSources.
6) Scripted the creation and assignment of domains based on controlled fields and Glossary entries. Scripted the creation of relationships. Used ArcGIS Diagrammer to create the object and relationship graphics seen here.
7) Mostly because of limited time, opted not to convert the cross section from Illustrator to ArcGIS.

Map sheet (in review)



Karl, S.M., Haeussler, P.J., Zumsteg, C.L., Himmelberg, G.R., Layer, P.W., Friedman, R.M., Roeske, S.M., and Snee, L.W., 2015, Geologic map of Baranof Island, southeast Alaska: U.S. Geological Survey Scientific Investigations Map 3335, pamphlet 82p., http://dx.doi.org/10.3133/sim3335

Geodatabase objects



Tip - you have HierarchyKey values like 1.2.3.4 and you need 01.02.03.04. Run this python expression in the Field Calculator:

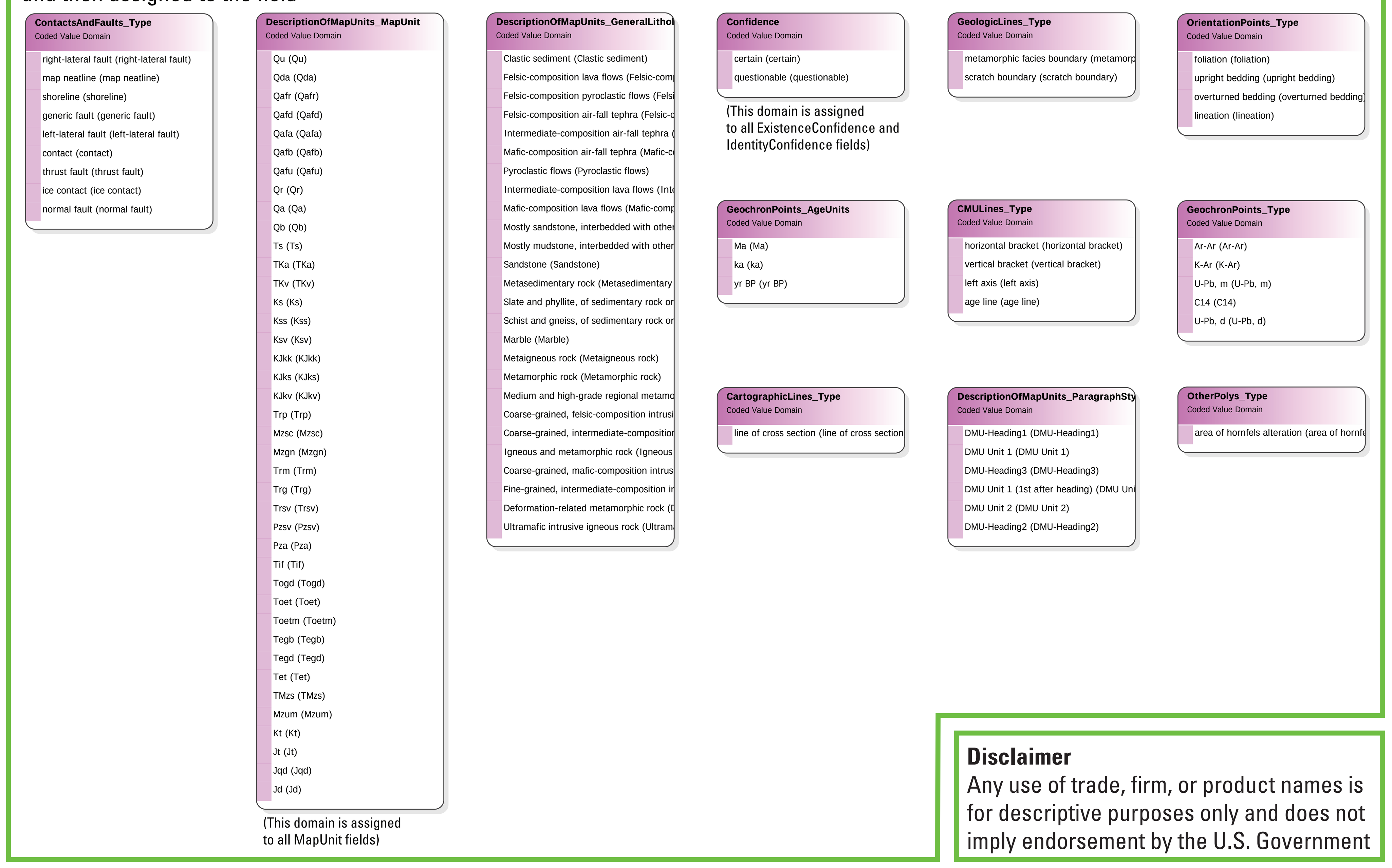
Pre-Logic Script Code:

```
def zfill(hkey):
  l = hkey.split('.')
  return '.'.join([x-
.zfill(2) for x in l])
```

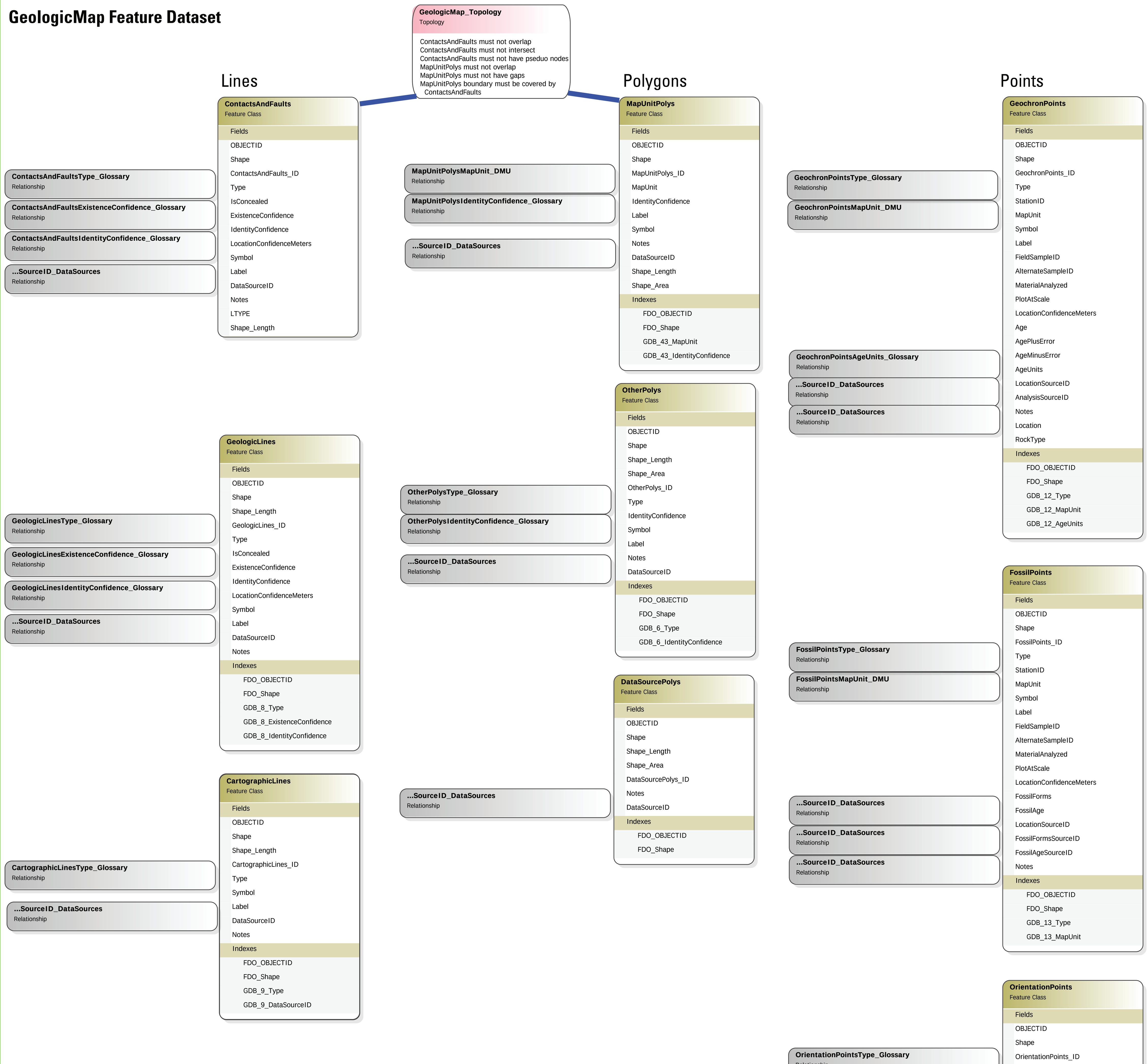
Source =

```
HierarchyKey =
zfill(!HierarchyKey!)
```

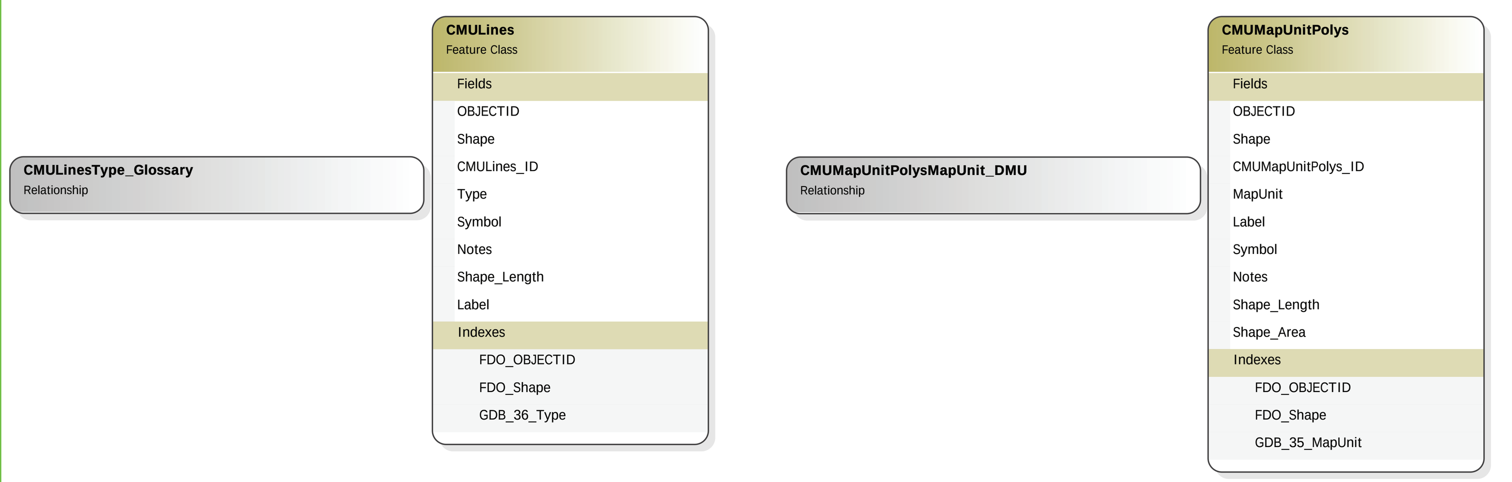
Domains - created from values in <table name>_<field name> and then assigned to the field



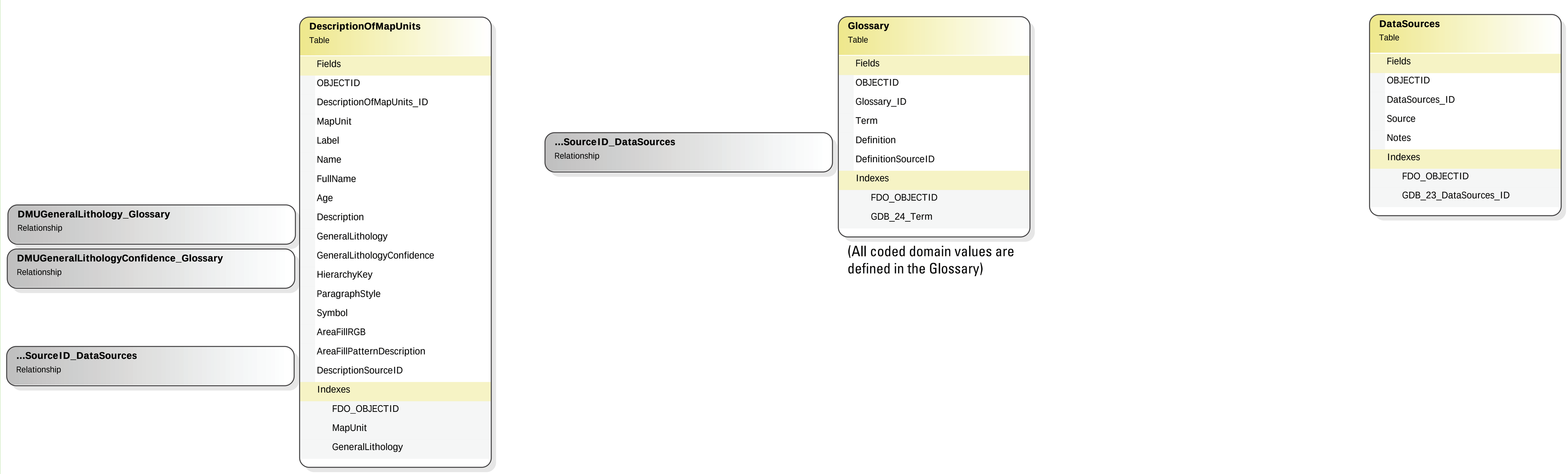
GeologicMap Feature Dataset



CorrelationOfMapUnits Feature Dataset



Standalone tables



Tip - 'MUP' + OBJECTID gives you a MapUnitPolys_ID of 'MUP84' but you want 'MUP0084'. Use this python expression in the Field Calculator:

```
'MUP' + str(!OBJECTID!).zfill(4)
```

Tip - XML metadata resources: scripting - ElementTree python module, manual element inserting or deleting - XML Notepad, manual element text editing and viewing - Notepad++, validating - mp.exe (*http://geology.usgs.gov/tools/metadata/tools/doc/mp.html* - faster than the ArcGIS geoprocessing tools built on mp.exe)

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Acknowledgements

Keith Labay and Nora Shew (both USGS) originally digitized into ArcINFO coverages and attributed the map features according to the National Surveys and Analysis schema.

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