Moving Maps to GeMS

github.com/wgnhs/gems

Caroline Rose | caroline.rose@wisc.edu

Wisconsin Geological
and Natural History Survey
UNIVERSITY OF WISCONSIN–MADISON

REGIONAL MAP SERIES

NORTHWEST SHEET

BEDROCK GEOLOGY OF WISCONSIN

M.G. Mudrey, Jr., G.L. LaBerge, P.E. Myers, and W.S. Cordua

University of Wisconsin—Extension

Published by and available from
Wisconsin Geological and Natural History Survey
R.E. Ostrom, Director and State Geologist
3817 Mineral Point Road, Madison, Wisconsin 53705

Wisconsin Geological and Natural History Survey
M004 • Sheet 1 of 2 (2012 reprint)

1987

Scale 1:250,000

Base from U.S. Geological Survey, 1:250,000 quadrangle maps – RICE LAKE, WIS. (1985) and STILLWATER, MINN., WIS. (1985)

Cartography by E.L. Patterson

DMT

NW Wisconsin

Existing Lines

Type	Feature → convert into type field
simple	map boundary
~~[illegible]~~ simple	(anything else)
~~[illegible]~~ unit boundary	(anything)

Confidence values:

- 0 NA
- → 1 definite
- 5 concealed
- → 2 approximate
- × 3 inferred
- × 30 unknown

→

GEMS LINES

Geologic Lines

Contacts And Faults

Location	Conf	Meters	ISCONCEALED	mtl
→ ~~[illegible]~~	0.0			
→ ~~[illegible]~~				

magnetic tape line

DMT

why are diabase dikes being used as unit bounds? are they faults?

- Contact, definite
- contact, approximate
- × db dike, concealed
- db dike, definite
- × fault, concealed
- fault, definite
- definite
- map bound, NA
- shoreline def

'Y'

make a new field in the contacts

Point A

Geologic maps as published by WGNHS

Point B

Geologic maps as databases in the
USGS Geologic Map Schema “GeMS”

PLEISTOCENE GEOLOGY OF THE SUPERIOR REGION, WISCONSIN
by Lee Clayton
1985
Geology of Sauk County, Wiscons
John W. Attig and Lee Clayton, 1990
PLEISTOCENE GEOLOGY OF FLORENCE COUNTY, WISCONSIN
by Lee Clayton
1986
EXPLANATION
MAP SYMBOLS
Wisconsin Geological and Natural History Survey
Bulletin 95
Pleistocene Geology of Dane County, Wisconsin
Lee Clayton and John W. Attig
1997
EXPLANATION
LOCATION MAP
Explanation

Publications / Bulletin / Pleistocene Geology of Chippewa County, Wisconsin

Pleistocene Geology of Chippewa County, Wisconsin

4 free downloads 3 prints available

Large downloads come in ZIP archives. You will need an application capable of unpacking ZIP archives, such as WinZIP, WinRAR, or 7-zip.

Free Downloads

Data Accompanying B103 Pleistocene Geology of Chippewa County, Wisconsin (2007) CLICK TO CLOSE

Authors(s):	Syverson, K.M.
Subject(s):	Glacial geology
County:	Chippewa
Physical Desc.:	Coverage, MrSID files → .e00
Product Num.:	B103-DI (WGS-BUL103DI)

View More Details

Plate 1: Pleistocene Geologic Map of Chippewa County, Wisconsin (2007) CLICK TO EXPAND

Plate 2: Pleistocene Geologic Cross Sections of Chippewa County, Wisconsin (2007) CLICK TO EXPAND

Pleistocene Geology of Chippewa County, Wisconsin (2007) CLICK TO EXPAND

Download Selected

Publications / Information Circular / Pleistocene Geology of the Superior Region, Wisconsin

Pleistocene Geology of the Superior Region, Wisconsin

1 free download 1 print available

Large downloads come in ZIP archives. You will need an application capable of unpacking ZIP archives, such as WinZIP, WinRAR, or 7-zip.

Free Downloads

Pleistocene Geology of the Superior Region, Wisconsin (1984) CLICK TO CLOSE

Authors(s):	Clayton, L.
Subject(s):	Glacial geology
County:	Ashland, Bayfield, Burnett, Douglas, Iron, Price, Sawyer, Washburn
Physical Desc.:	40 p. + map (scale 1:250,000)
Product Num.:	IC46 (WGS-IC46)

View More Details

Download Selected

Current Project Counties
Availability
Coverage File
Unavailable for Download
Vilas
Florence
Forest
Polk
Barron
Lincoln
Langlade
North Oconto
Chippewa
Pierce - St.Croix
Marathon
Brown
La Crosse
Sauk
Dane
Waukesha

Current Project Regions
Availability
Unavailable for Download
Superior Region
Northwest Region
Northeast Region
West Central Region
Southeast Region

Aspects of GeMS

- Geometry
  - Features in the proper layers
  - Topology
- Attributes and related tables
  - All GeMS-required fields present and filled out
  - All original data captured in the GeMS style
- Metadata
- Symbology
  - Style file or representations
- Other files required (PDF layout, .mxd, etc.)

This project

Establish and document a workflow for converting into GeMS

Use the GeMS toolbox

Improve the efficiency of individual steps in the workflow through Python scripts, custom ArcMap toolboxes, etc.

Establish *our* conventions for following GeMS, to enforce consistency across our data products

GeMS is flexible

DECISIONS:

estimating confidence values

terms to use for ‘type’ attributes

represent features as points or as lines

hierarchy key assignment

paragraph style descriptions

how to cite the map

which definitions to use in the Glossary

which layers are best suited for which points

Geology of Sauk County, Wisconsin

Geology of Sauk County, Wisconsin

Geology of Sauk County, Wisconsin

SURFICIAL GEOLOGY OF WISCONSIN

Workflow

- Collect original data & metadata
- Stage your folders

- Convert to geodatabase if needed

Examine data

- extract domains from original metadata with Python script (see github), including coded domains and unit descriptions

original metadata

```
Attribute Label:  Uname
Attribute Definition:  Geologic unit name abbreviations
Attribute Definition Source:  WGNHS
Attribute Domain Values:
        Enumerated Domain:
                Enumerated Domain Value:  p
                Enumerated Domain Value Definition:  Postglacial Sediment. Peat. Organic sediment
                Enumerated Domain Value Definition Source:  WGNHS
                Enumerated Domain Value:  ts
                Enumerated Domain Value Definition:  Sediment Deposited by the Langlade Lobe durin
                Enumerated Domain Value Definition Source:  WGNHS
                Enumerated Domain Value:  sup
                Enumerated Domain Value Definition:  Sediment Deposited by the Langlade Lobe durin
                Enumerated Domain Value Definition Source:  WGNHS
                Enumerated Domain Value:  spp
                Enumerated Domain Value Definition:  Sediment Deposited by the Langlade Lobe durin
                Enumerated Domain Value Definition Source:  WGNHS
                Enumerated Domain Value:  suf
                Enumerated Domain Value Definition:  Sediment Deposited by the Langlade Lobe durin
                Enumerated Domain Value Definition Source:  WGNHS
                Enumerated Domain Value:  sh
                Enumerated Domain Value Definition:  Sediment Deposited by the Langlade Lobe durin
                Enumerated Domain Value Definition Source:  WGNHS
                Enumerated Domain Value:  sul
                Enumerated Domain Value Definition:  Sediment Deposited by the Langlade Lobe durin
```

table

	A	B	C
4	spp	Sediment Deposited by the Langlade Lobe during the Late Wisconsin Glaciation, Nashville Member of the Copper Falls Formation. Sand and Gravel in Pitted and Unpitted Plains. Sand and gravel deposited by meltwater streams well to moderately well sorted, well stratified; underlies gently sloping surfaces; pits occupy between 20 and 80 percent of the surface area.	
5	suf	Sediment Deposited by the Langlade Lobe during the Late Wisconsin Glaciation, Nashville Member of the Copper Falls Formation. Sand and Gravel in unpitted fan. Sand and gravel deposited by meltwater streams in fan-shaped deposit; moderately well sorted, well stratified; original depositional surface is preserved in more than 80 percent of the area.	
6	sh	Sediment Deposited by the Langlade Lobe during the Late Wisconsin Glaciation, Nashville Member of the Copper Falls Formation. Sand and gravel in areas of hummocky topography. Sand and gravel deposited by meltwater streams; poorly to moderately well sorted; original depositional surface is present in less than 20 percent of the area; remainder is hummocky with many closely spaced depressions caused by collapse of sediment above melted ice; generally higher in elevation than the surrounding land surface.	
7	sul	Sediment Deposited by the Langlade Lobe during the Late Wisconsin Glaciation, Nashville Member of the Copper Falls Formation. Sand in unpitted lacustrine plain. Well sorted, predominantly medium and fine sand; underlies flat plains formerly occupied by shallow lakes; generally occurs in a low position in the landscape.	
8			

12	Drumlin (longitudinal axis)
13	Drumlin (lateral axis)
14	Eskers and esker-like ridges. Arc direction points in direction of stream flow.
21	Ice margin position

Data Source Citation

Source	URL	DataSources_ID
Ham, Nelson R. and Attig, John W., 1997, Geologic Map of Lincoln County, Wisconsin, plate 1 *in* Ham, Nelson R. and Attig, John W., Pleistocene Geology of Lincoln County, Wisconsin: Wisconsin Geological and Natural History Survey Bulletin 93, 31 pages, scale 1:100,000, available at https://wgnhs.wisc.edu/pubs/000117/	https://wgnhs.wisc.edu/pubs/000117/	Lincoln _Pleistocene_Ham_1997

Create this in Word for future use
USGS citation style

Feature classes
Glossary
DMU
Add any type value to the master glossary

	Langlade County	point types	Outcrop of Precambrian rock
	Lincoln County	line types	Crest of small, parallel ice-marginal ridge.
	Lincoln County	line types	Direction of flow of meltwater stream (as indicated by modern surface slope).
	Lincoln County	line types	Drumlin width-lateral axis
	Lincoln County	line types	Drumlin-longitudinal axis
	Lincoln County	line types	Esker
	Lincoln County	line types	Geologic contact. Solid where position shown on the map is generally within 0.1km of actual posi
	Lincoln County	line types	Ice-contact face. Dashed line indicates subdued face.
	Lincoln County	line types	Ice-contact face. Solid line indicates prominent face.
	Lincoln County	line types	Ice-marginal ridge. Dashed line shows subdued ridges.

	Barron County		striation on in-place sandstone or quartzite
	Chippewa County		Glacial striation with arrow pointing in ice-flow direction. Dot marks location of measurement.
	Superior		Direction of subglacial scratches on rock surfaces.
	Polk County		Ice-flow from striation measurement
	Florence County		Glacial scratches on Precambrian rock surfaces

Type =
glacial striation

*point features
(not lines)

Stream cutbank	cutbank	
Stream cut bank	cutbank	
Stream-cut bank	cutbank	
stream-cut scarp	cutbank	
Stream cutbank. Only those more than about 5 m high are shown.	cutbank	
Stream cut scarp. Where paired, they represent large abandoned melt-water channel.	cutbank	
River cutbank	cutbank	
River cutbank. Only those higher than about 5 m shown; cutbanks in sandstone at the Wiscon	cutbank	
Cutbanks of large abandoned river channels.	cutbank	
Cutbanks of glacial meltwater streams	cutbank	
High cutbanks, more than 15 m high	high cutbank	
Low cutbanks, from approximately 5 to 15 m high.	low cutbank	

Feature classes
Glossary
Add any type value to the master glossary
Decide which terms to use in Type fields
DMU
Copy the empty template .xls
Add all units to DMU in .xls
Ask a geologist to complete DMU

Feature classes

- Sort features into layers

Quick reference sheets (see github)

Glossary

- Add any type value to the master glossary
- Decide which terms to use in Type fields

DMU

- Copy the empty template .xls
- Add all units to DMU in .xls
- Ask a geologist to complete DMU

MapUnitPolys (polygon feature class) required

Fields:

MapUnit	*Short plain-text key (identifier) for the map unit. Example values: "Qal", "Tg", "Kit", "water", "Trc3", etc. Foreign key to DescriptionOfMapUnits table. Null values not permitted—a mapped polygon must have an assigned map unit*
IdentityConfidence	*How confidently is this polygon identified as MapUnit? Value is usually "certain", "questionable", or "unspecified". Null values not permitted. Suggest setting default value to "certain". Values must be defined in Glossary.*
Label	*Determined from the appropriate value of the Label in the DescriptionOfMapUnits table and IdentityConfidence: if IdentityConfidence = "questionable", then append "?" to Label value from the DescriptionOfMapUnits table. Allows for subscripts and special characters. Null values permitted*
Symbol	*References an area fill symbol (background color + optional pattern). Area fill symbols must be defined in an accompanying style file. If Esri Cartographic Representations are used to symbolize map units, the value may be null or blank. Null values permitted*
DataSourceID	*Foreign key to DataSources table, to track provenance of each data element. Null values not permitted*
Notes	*Optional field. Free text for additional information specific to this polygon. Null values permitted*
MapUnitPolys_ID	*Primary key.* Example Values = MUP1, MUP2, MUP3, etc. Values must be unique in database. Null values not permitted

Topology rules:

- Polygons must not overlap
- No gaps between polygons
- Boundaries must be overlain by lines in ContactsAndFaults

Note that not all lines in ContactsAndFaults necessarily bound polygons: polygons separated by concealed contacts or faults may have been merged during construction of the database; also some faults, concealed contacts, and concealed faults may dangle (terminate within polygons) and thus not separate polygons. Note also that open water (lakes, double-line rivers), glaciers, and unmapped areas are polygons, and so must have non-null MapUnit values (e.g., water, glacier, unmapped). Water and glacier areas commonly are not labeled (Label=null).

OrientationPoints (point feature class) as-needed

Point structure data (bedding attitudes, foliation attitudes, slip vectors measured at a point, etc.) may be recorded in OrientationPoints, one point per measurement. This table has fields:

Type	*Values must be defined in* Glossary *or by reference to external glossary. Null values not permitted*
Azimuth	*Data type=float. Values limited to range 0-360. Strike or trend, measured in degrees clockwise from geographic North. Use right-hand rule (dip is to right of azimuth direction). Horizontal planar features may have any azimuth. Null values not permitted*
Inclination	*Data type=float. Values limited to range -90 to 90. Dip or plunge, measured in degrees down from horizontal. Negative values allowed when specifying vectors (not axes) that point above the horizon, e.g., paleocurrents. Types defined as horizontal (e.g., horizontal bedding) should have Inclination=0. Null values not permitted*
Symbol	*References a symbol in the accompanying style file. Null values permitted*
Label	*Text to accompany displayed symbol, typically the dip or plunge value for the measured orientation. Null values permitted*
LocationConfidenceMeters	*Data type = float. Radius in meters of positional uncertainty envelope for the observation locale. Null values not permitted. Recommended value is -9 if value is not otherwise available*
IdentityConfidence	*Values = 'certain', 'questionable', 'unspecified'. Specifies confidence that observed structure is of the type specified. Null values not permitted*
OrientationConfidenceDegrees	*Data type=float. Estimated circular error, in degrees. For planar features, error in orientation of pole to plane. Null values not permitted*
PlotAtScale	*Data type = float. At what scale (or larger) should this observation or analysis be plotted? At smaller scales, it should not be plotted. Useful to prevent crowding of display at small scales and to display progressively more data at larger and larger scales. Value is scale denominator. Null values not permitted, default value is 0 (display at all scales)*
StationID	*Foreign key to* Stations *point feature class. If the table represents stations, this field is not required—it would duplicate the Stations_ID primary key field. Null values permitted*
MapUnit	*It is useful to know the map unit to which an analysis or observation pertains. Value obtained by intersection with feature class MapUnitPolys. Foreign key to DescriptionOfMapUnits. Null values permitted*
LocationSourceID	*Foreign key to DataSources. Identifies source of location of this point. Null values not permitted*

Quick reference sheets (see github)

	(many maps)		Drumlin. Length of line is proportional to length of drumlin axis.
	(many maps)		drumlin - lateral axis (not all maps have this)
	Dane Co		Drumlin. A symbol shown on the map may represent several drumlins that are too small to be shown individually at the map scale. Thick symbol represents prominent drumlins.
	Superior		High, wide drumlins formed during an earlier glacial episode and only slightly modified during the last glacial episode.
	Superior		Low, narrow drumlins formed during the last glacial advance. Arrowhead Indicates direction of glacial movement.

Drumlins: Geologic Lines layer

	Barron County		striation on in-place sandstone or quartzite
	Chippewa County		Glacial striation with arrow pointing in ice-flow direction. Dot marks location of measurement.
	Superior		Direction of subglacial scratches on rock surfaces.
	Polk County		Ice-flow from striation measurement
	Florence County		Glacial scratches on Precambrian rock surfaces
	Barron County		Ice-flow direction interpreted from pebble fabric

Glacial striations: Orientation Points layer

unique set of attributes → unique feature class

	Chippewa County	Direction of meltwater flow as indicated by modern surface slope and flow features observed on aerial photographs.
	Florence County	Direction of flow of proglacial streams
	Lincoln County	Direction of flow of meltwater stream (as indicated by modern surface slope).
	Marathon County	Flow direction on fluvial surface
	Northern Oconto County	direction of meltwater flow
	Sauk County	Direction of meltwater flow
	Lincoln County	Direction of flow of meltwater stream (as indicated by modern surface slope).
	Vilas County	Flow direction on fluvial surfaces
	Waukesha County	Direction of meltwater flow, interpreted from channel scars (arrowheads without stems)
	Waukesha County	Direction of meltwater flow, interpreted from the slope of land (arrowheads with short stems)
	Superior	Direction of flow of proglacial streams.

DirectionPoints (point feature class) as-needed

This feature class has been created to capture map symbols which indicate a general trend in direction, such as direction of meltwater flow or direction of surface slope, but do not correspond to a specific point location. The symbols are generally dispersed across an area on the map and could be arranged in various ways without changing their meaning. These points represent geologic interpretations of observations and measurements, but these points have no specific real-world physical location; therefore, LocationConfidenceMeters, ExistenceConfidence, and IdentityConfidence attributes are meaningless. They do not participate in map-unit topology.
These features can be stored in a DirectionPoints feature class with fields:

Type	*Term that categorizes what the line represents. Values must be defined in* Glossary *table. Null values not permitted.* *Examples: flow direction, surface slope*
Azimuth	*Data type=float. Values limited to range 0-360. Direction, measured in degrees clockwise from geographic North. Horizontal planar features may have any azimuth. Null values not permitted*
OrientationConfidenceDegrees	*Data type=float. Estimated circular error, in degrees. Null values not permitted*
Symbol	*References a symbol in the accompanying style file. May be determined from Type*
Label	*Text to accompany displayed symbol. Null values permitted*

- Un-do coded domains
  (if you didn't get this from the metadata)

  Custom toolbox (see github)

	stems)
914	Direction of meltwater flow. Arrows show the flow direction of meltwater rivers, from the slope of land (arrowheads with short stems).
917	Drumlin
918	Prominent Drumlin
920	Ice-Wedge Polygons
921	Spillway. Small meltwater channels that were lake outlets.
922	Jordan scarp
923	St. Peter scarp
924	Lip of bench at base of East Blue Mound
925	Lip of bench at top of East Blue Mound

- Add fields to match up to GeMS, populate attribute values

  Combined add-populate python script (see github)

- Preliminary topology check and fix errors

- Create GeMS database
- Load features into GeMS database

Glossary table
Import to GeMS DMU table
Correct all type values
DMU table
Complete Data Sources table

- Run GeMS Topology check and correct errors

- Run the Validate Database tool and correct errors

- Add any custom fields and layers to “myGeMSDefinitions.py” (in the GeMS Tools Scripts folder) so they will be referenced by the metadata script

GeMS_TranslateToShape_Arc10.py	5/19/2019 10:44 A...	Python File
GeMS_utilityFunctions.py	5/19/2019 10:44 A...	Python File
GeMS_ValidateDatabase_Arc10.py	5/19/2019 10:44 A...	Python File
GeMS_WPGCMYK_RGB.py	5/19/2019 10:44 A...	Python File
mapOutline_Arc10.py	5/19/2019 10:44 A...	Python File
my_GeMSDefinitions.py	5/19/2019 10:44 A...	Python File
wpgdict.py	5/19/2019 10:44 A...	Python File

By now, you must have decided on all layers and fields that will be included

- Populate feature dataset metadata in ArcCatalog

Reference:

An example of FGDC metadata for a geologic map:
https://geo-nsdi.er.usgs.gov/metadata/map-i/2395/metadata.html

The Esri Illustrated Guide to FGDC metadata:
http://desktop.arcgis.com/en/arcmap/10.6/manage-data/metadata/illustrated-guide-to-complete-fgdc-metadata.htm

*print this?

The map's original metadata file

- Run the metadata tool

County/Region	What is the initial data type?	Check glossary terms	Create Geodatabase	Create feature dataset	Run initial topology check and go through errors	Check line directions	Lines to points?	Transfer line to points	Add and fill necessary columns	Create GeMS geodatabase	Load data into GeMS geodatabase	Geologist filled DMU?	Fill in tables and any missing columns
Barron County	ArcInfo interchange file (E00)	Yes	✓	✓	✓	✓	Yes	✓	✓	✓	✓	Yes	
Brown County		Yes	✓	✓	✓		None	✓	✓	✓	✓		
Chippewa County	ArcInfo interchange file (E00)	Yes	✓	✓	✓	✓	Yes	✓	✓	✓	✓		
Dane County	ArcInfo interchange file (E00)	Yes	✓	✓	✓		Yes	✓	✓	✓	✓		
Florence County		Yes	✓	✓	✓	✓	Yes	✓	✓	✓	✓	Yes	✓
Forest County		Yes	✓	✓	✓	✓	None	✓	✓	✓	✓	Yes	✓
LaCrosse County	ArcInfo interchange file (E00)	Yes	✓	✓	✓		None	✓	✓	✓	✓		
Langlade County	ArcInfo interchange file (E00)	Yes	✓	✓	✓	✓	None	✓	✓	✓	✓	Yes	
Lincoln County	ArcInfo interchange file (E00)	Yes	✓	✓	✓	✓	Yes	✓	✓	✓	✓	Yes	
Marathon County	shapefiles	Yes	✓	✓	✓	✓	Yes	✓	✓	✓	✓	Yes	
North Oconto County		Not Yet	✓	✓	✓	✓	Yes	✓	✓	✓	✓		
NE Wisconsin Region		Yes	✓	✓	✓		None	✓	✓	✓	✓		
NW Wisconsin Region		Yes	✓	✓			Yes						
Pierce-St. Croix Counties		Yes	✓	✓	✓		None	✓	✓	✓	✓		
Polk County		Not Yet					Yes						
Sauk County	ArcInfo interchange file (E00)	Yes	✓	✓	✓		Yes		✓	✓	✓		
SE Wisconsin Region		Yes					None	✓					
Superior Region		Yes	✓	✓	✓		Yes	✓	✓	✓	✓		
Vilas County	ArcInfo interchange file (E00)	Yes	✓	✓	✓	✓	Yes	✓	✓	✓	✓	Yes	
Waukesha County	ArcInfo interchange file (E00)	Yes	✓	✓	✓		Yes						
West Central Wisconsin Regic		Yes	✓	✓	✓		None	✓					

Boards
Maps for Data Update
WGNHS Free
Team Visible
Invite
Show Menu
Getting the data set up
(1) SE Wisconsin Regional Bedrock (Preliminary Bedrock Geologic Map of Walworth, Racine, Kenosha, Milwaukee, Waukesha, Ozaukee, and Washington Counties)
(4) Polk County Pleistocene
Add another card
In Progress
(3) West Central (WC) Wisconsin Regional Bedrock
(3) NW Wisconsin Regional Bedrock
(4) Pleistocene Geology of Waukesha County
Add another card
Maps that need clarifications
(2) Pierce / St. Croix County Bedrock
Add another card
Needs to be sent to a geologist
(4) Pleistocene Geology of Dane County
(4) Pleistocene Geology of Chippewa County
(4) Geology
(3) NE Wisconsin Regional Bedrock (Bedrock Geology of Wisconsin, Northeast Sheet)
Add another card
Waiting for geologist
Elmo has these DMU tables
Quaternary Geology of Northern Oconto County
Add another card
Back from Geologist
Add a card
DMU Added to GeMS Waiting for Validation
Lincoln County Pleistocene
Add another card
Needs glossary and data sources and consistency checks
Vilas County Pleistocene
Langlade County Pleistocene
(3) Pleistocene Geology of the Superior Region
Marathon County Pleistocene
(4) Pleistocene Geology of Barron County
Add another card
needs metadata
Florence County Pleistocene
Forest County Pleistocene
Add another card
metadata completed
Add a card
Trello

	Barron County	Brown County	Chippewa County	Dane County	Florence County	Forest County	LaCrosse County	Langlade County	Lincoln County	Marathon County	North Oconto County	NE Wisconsin Region	NW Wisconsin Region	Pierce-St. Croix Counties	Polk County	Sauk County	SE Wisconsin Region	Superior Region	Vilas County	Waukesha County	West Central Wisconsin Region
Create Folders for Data	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Fill in Basic DescriptionOfMapUnits	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Fill in DataSources	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Fill in MiscellaneousMapInformation					■	■															
Check glossary terms	■	■	■	■	■	■	■	■	■	■		■	■			■	■	■	■	■	■
Create Geodatabase	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Create feature dataset	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Run initial topology check and go through errors	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■	■	■	■
Check line directions	■	■	■		■	■		■	■	■	■								■		
Transfer line to points	■	■	■	■	■	■	■	■	■	■	■	■		■			■	■	■		■
Add and fill necessary columns	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■	■		
Create GeMS geodatabase	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■	■		
Load data into GeMS geodatabase	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■	■		
Geologist filled DMU?	■				■	■		■	■	■											
Fill in tables and any missing columns					■	■															
Are all fields/tables filled?					■	■															
Run List Glossary Terms Tool	■	■	■	■	■	■	■	■	■	■	■	■		■		■		■	■		
Run (Re)set ID tool					■	■															
Run GeMS “Topology check”					■	■															
Run GeMS “Validate database”					■	■															
Fill in Metadata					■	■															
Set cartographic representation						■															

github.com/wgnhs/gems

OrientationPoints [point feature class] (or equivalent)

Point structure data (bedding attitudes, foliation attitudes, slip vectors measured at a point, etc.) may be recorded in OrientationPoints, one point per measurement. This table has fields:

Type	*Values must be defined in Glossary or by reference to external glossary. Null values not permitted*
Azimuth	*Data type=float. Values limited to range 0-360. Strike or trend, measured in degrees clockwise from geographic North. Use right-hand rule (slip is to right of azimuth direction). Horizontal planar features may have any azimuth. Null values not permitted*
Inclination	*Data type=float. Values limited to range -90 to 90. Dip or plunge, measured in degrees down from horizontal. Negative values allowed when specifying vectors (not axes) that point above the horizon, e.g., pulvecurrents. Types defined in Glossary. Null values not permitted*
Symbol	*References a symbol in the accompanying style file. Null values permitted*
Label	*Text to accompany displayed symbol, typically the dip or plunge value for the measured orientation. Null values permitted*
LocationConfidenceMeters	*Data type = float. Radius in meters of positional uncertainty envelope for the observation locale. Null values not permitted. Recommended value is -9 if value is not otherwise available*
IdentityConfidence	*Values = 'certain', 'questionable', 'unspecified'. Specifies confidence that observed structure is of the type specified. Null values not permitted*
OrientationConfidenceDegrees	*Data type=float. Estimated circular error, in degrees. For planar features, error in orientation of pole to plane. Null values not permitted*
PlotAtScale	*Data type = float. At what scale (or larger) should this observation or analysis be plotted? At smaller scales, it should not be plotted. Useful to prevent crowding of display at small scales and to display progressively more data at larger and larger scales. Value is scale denominator. Null values not permitted, default value is -9 (display at all scales)*
StationID	*Foreign key to Stations point feature class. If the table represents stations, this field is not required—it would duplicate the Stations_ID primary key field. Null values permitted*
MapUnit	*It is useful to know the map unit to which an analysis or observation pertains. Foreign key to DescriptionOfMapUnits. Null values permitted. ForeignKeyMapUnit. Foreign key to DescriptionOfMapUnits. Null values permitted*
LocationSourceID	*Foreign key to DataSources. Identifies source of location of this point. Null values not permitted*
OrientationSourceID	*Foreign key to DataSources. Identifies source of orientation data at this point. Null values not permitted*
Notes	*Optional field. Free text for additional information specific to this feature. Null values permitted*
OrientationPoints_ID	*Primary Key. Example values = ORP1, ORP2, ORP3, ... Null values not permitted*

The Type field identifies the kind of feature for which the orientation was measured, e.g., bedding, overturned bedding, stretching lineation, open joint. Type definitions (in the Glossary table) shall specify the orientation measurement convention for that Type (strike and dip, trend and plunge, dip direction and dip, etc.). Data creators should ensure that multiple measurements at a single station (e.g., bedding and cleavage) have the same MapUnit.

Quick-reference sheets

```
def extractDomain(layerName, attributeName, text):
    #create empty lists to hold domain values and definitio
    domainvalues = []                          # The list whe
    domaindefs = []

    pattern1 = re.compile("Enumerated Domain Value: ", re.IG
    pattern2 = re.compile("Enumerated Domain Value Definitio

    for line in text.split('\n'):
        if pattern1.search(line) != None:          # If patt
            value = line.split("Value:")[1]        # isolate
            v = value.rstrip('\n')                 # strip r
            e = v.lstrip()
            domainvalues.append(e)

        if pattern2.search(line) != None:
            definition = line.split("Definition:")[1]
            d = definition.rstrip('\n')        #strip newlines
            f = d.lstrip(' ')                  #strip spaces fr
            domaindefs.append(f)

    print("Domain values:", domainvalues)
    # print("Domain defs:", domaindefs)
```

Scripts

Workflow steps

github.com/wgnhs/gems

Caroline Rose | caroline.rose@wisc.edu