

# Lessons From Converting Alaska Digital Geologic Maps to the USGS Geologic Map Schema (GeMS)



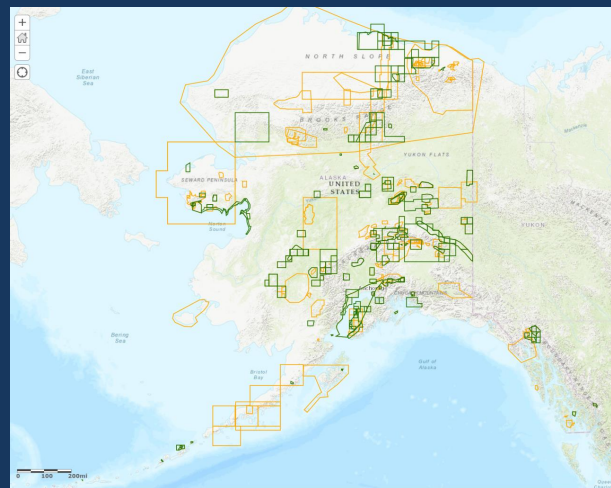
Chris Wyatt, Mike Hendricks, Jennifer Athey, and Patricia Ekberg  
Alaska Division of Geological & Geophysical Surveys  
June 9, 2020

[chris.wyatt@alaska.gov](mailto:chris.wyatt@alaska.gov)

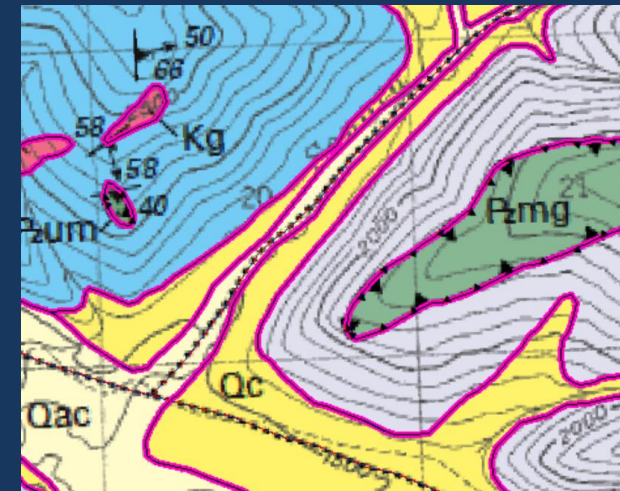
# Lessons From Converting Alaska Maps to GeMS

**This presentation:**

- The maps DGGs is prioritizing for converting to GeMS
- Getting started with a map conversion
- Challenges encountered with legacy map GIS data



[dggs.alaska.gov](http://dggs.alaska.gov)

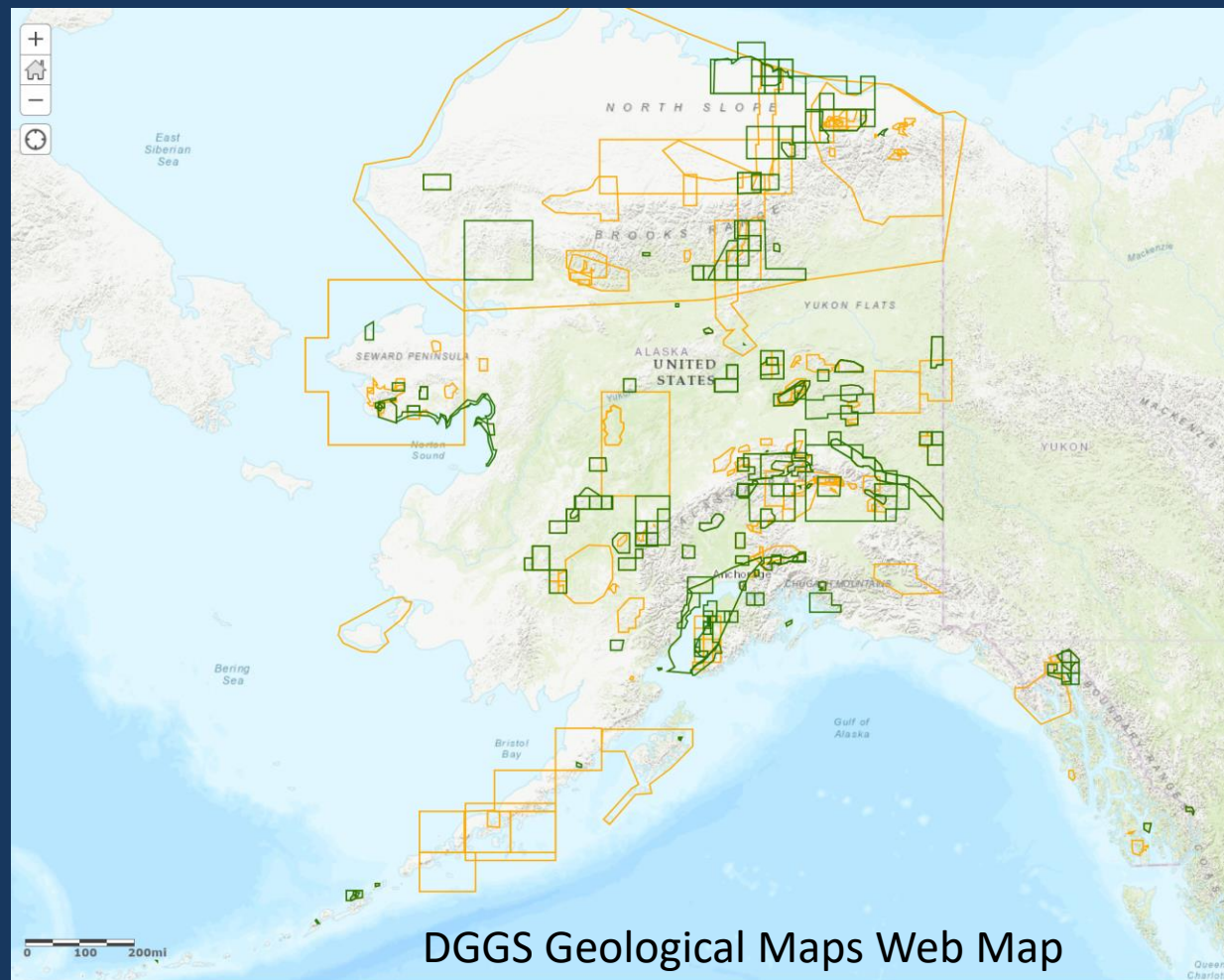


[www.newsiner.com](http://www.newsiner.com)



# Converting Alaska Maps: Where to begin?

- **Map: Bedrock and surficial maps published by DGGS**
- **Includes:**
  - Scanned paper maps, 1970s (and older?)
  - Maps with legacy digital geospatial data
  - Recently published maps with NCGMP09 and GeMS standard data



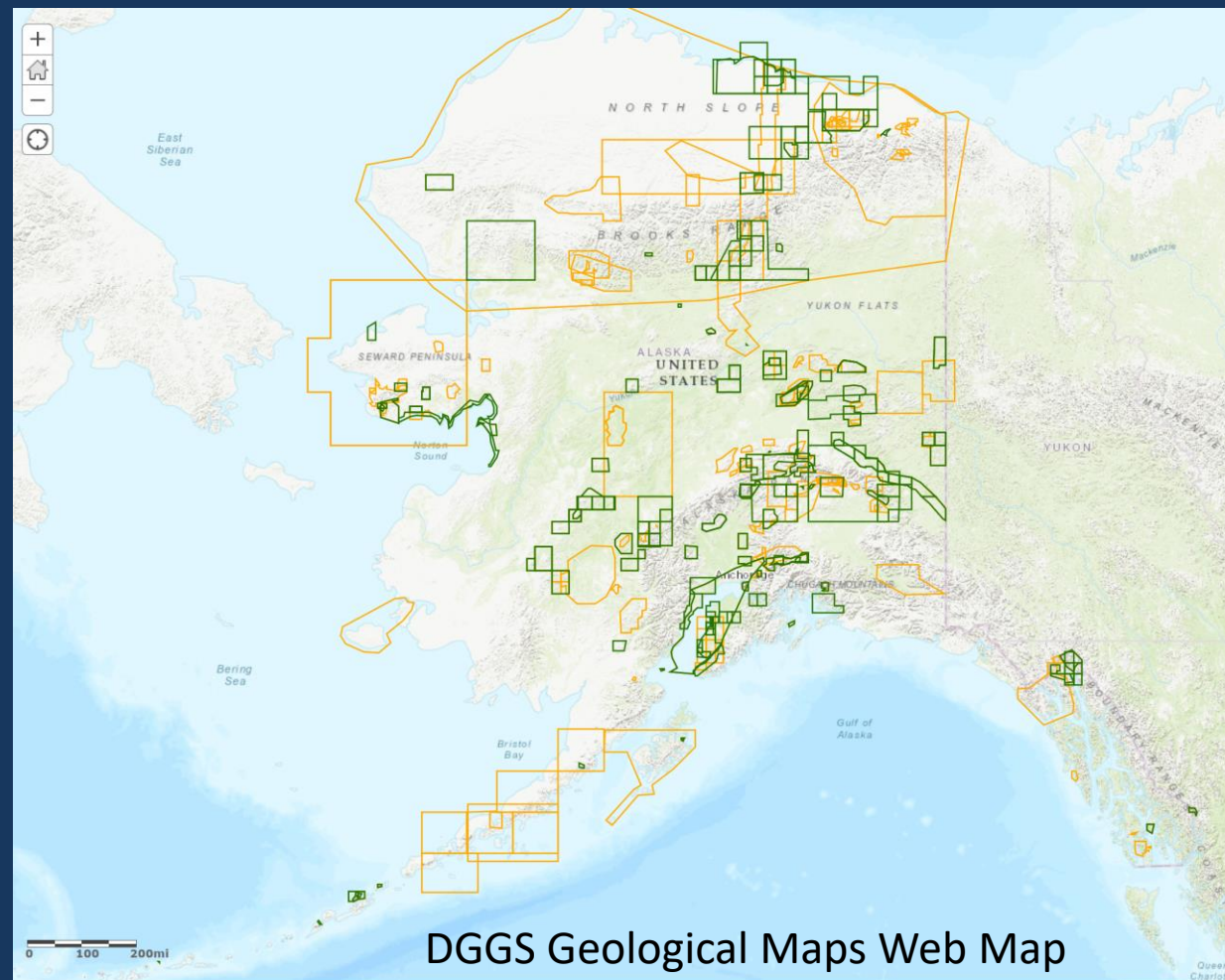
DGGS Geological Maps Web Map

<https://geoportal.dggs.dnr.alaska.gov/portal/home/>



# Converting Alaska Maps: Where to begin?

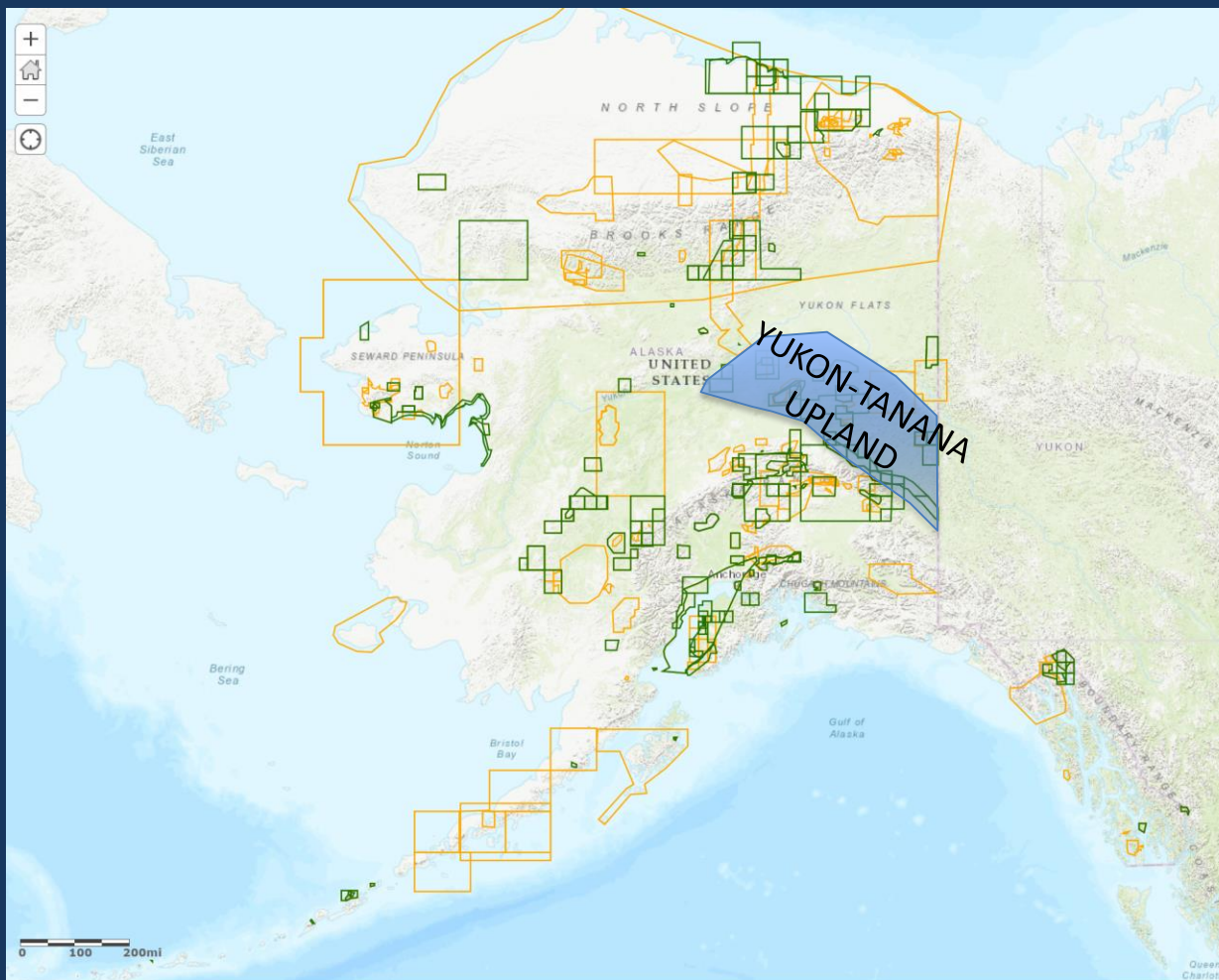
- **Bedrock and surficial maps published by DGGs**
- **Includes:**
  - Scanned paper maps, 1970s (and older?)
  - **Maps with legacy digital geospatial data**
  - Recently published maps with NCGMP09 and GeMS standard data
- **GeMS versions/conversions across the state**
  - Aleutian Islands
  - North Slope



<https://geoportal.dggs.dnr.alaska.gov/portal/home/>

# Map Conversion Target Area: YTU

- Yukon-Tanana Uplands
- “mountainous region of about 30,000 sq. mi. between the Yukon and Tanana Rivers” (Foster et al., 1970)
- **Gold** and other mineral resources identified and produced for >130 years
- Our Mission at DGGS:  
“Determine the **potential of Alaskan land for production of metals, minerals**, fuels, and geothermal resources, the locations and supplies of groundwater and construction material, and the potential geologic hazards to buildings, roads, bridges, and other installations and structures (AS 41.08.020).”



# Mineral Potential of the YTU

- **Hundreds of mineral prospects recognized**
  - Alaska Resource Data File sites
- **Includes two of Alaska's largest producing hard-rock gold mines**
  - Fort Knox
  - Pogo

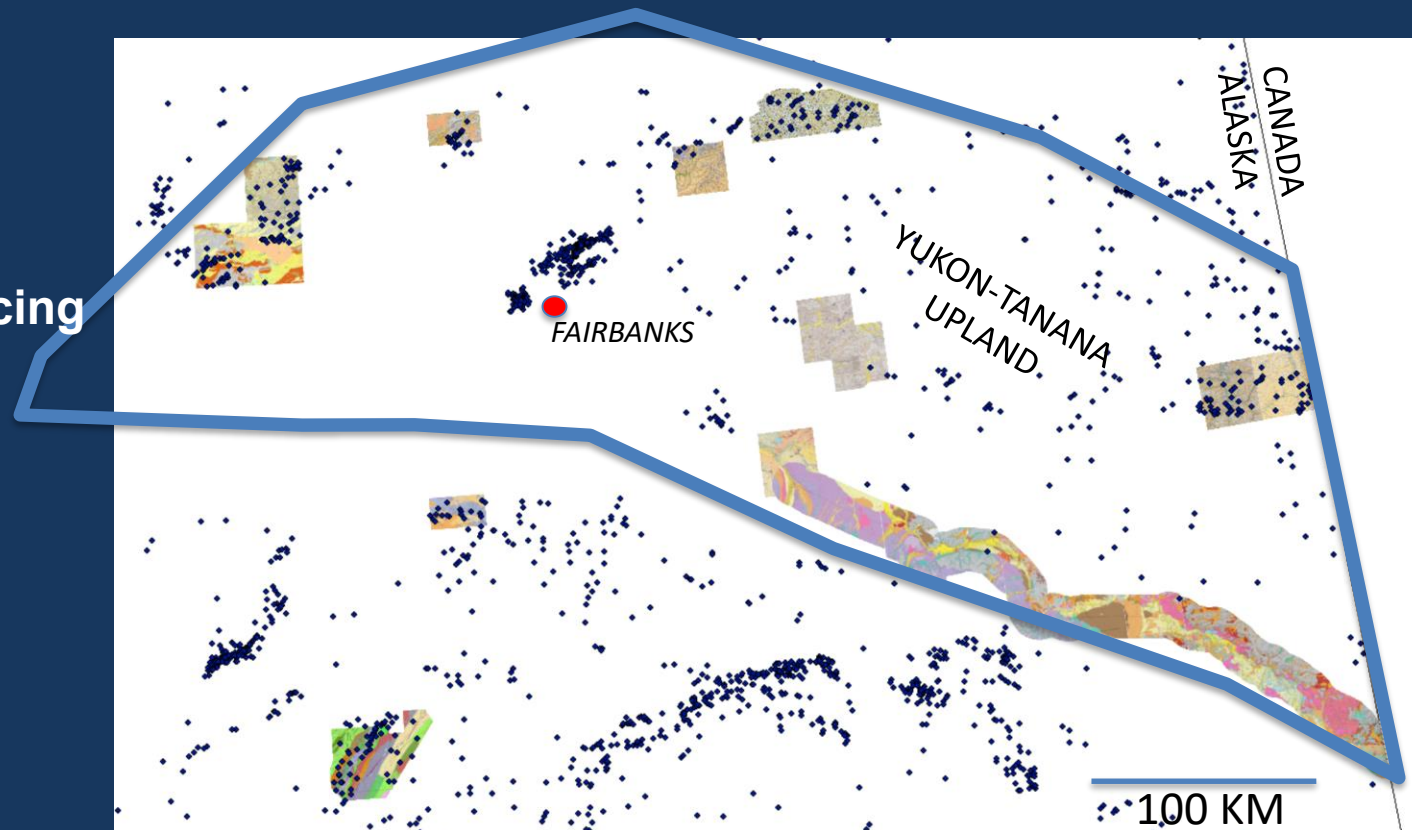


Image Service of Alaska Key Geologic Map Images  
<https://geoportal.dggs.dnr.alaska.gov/portal/home/>



# Mineral Potential of the Y-T Uplands



www.newsiner.com

Fort Knox Gold Mine  
near Fairbanks



www.newsiner.com

Pogo Gold Mine  
Southeast of Fairbanks



fortymilegold.ca







Fortymile District area placer mine  
near the US-Canada border

- Paleozoic metamorphic rocks
- Cretaceous intrusions
- Tertiary volcanics



# Map Conversion: Legacy Map Input Data

- Variety of ESRI data structures
- Distribution in these different formats continues at AKDGGS and USGS







Software:	<u>ArcInfo</u>	<u>ArcView</u>	<u>ArcGIS</u>
Developed:	1980s	1990s	2000s
Same data:			
Data format:	 Coverage	 Shapefile	 Geodatabase
	Topology required	Topology absent	Topology optional
	Complicated	Simple	Sophisticated
	Hard to use	Easy to use	Easy to use
	Efficient data	Inefficient data	↑ Functionality

(Figure from: University of Toronto and Coursera, <https://www.coursera.org>)



# Map Conversion: Legacy Map Input Data

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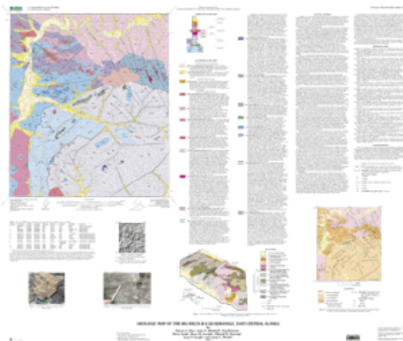


# Map Conversion: Download legacy data

## Geologic Map of the Big Delta B-2 Quadrangle, East-Central Alaska

By Warren C. Day<sup>1</sup>, John N. Aleinikoff<sup>1</sup>, Paul Roberts<sup>2</sup>, Moira Smith<sup>2</sup>, Bruce M. Gamble<sup>1</sup>, Mitchell W. Henning<sup>3</sup>, Larry P. Gough<sup>1</sup>, and Laurie C. Morath<sup>1</sup>

Version 1.0



Input data source:  
<https://pubs.usgs.gov/imap/i-2788/>

<sup>1</sup>U.S. Geological Survey

<sup>2</sup>Teck Cominco Limited, #600-200 Burrard Street, Vancouver, B.C., Canada V6C3L9

<sup>3</sup>Alaska Department of Natural Resources, Division of Mining and Water Management, Anchorage, AK 99501

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[I-2788 PDF file \(2.85 MB\)](#)

[I-2788 text only PDF file \(57 KB\)](#) (This version of the report is accessible as defined in Section 508.)

[I-2788 MET file \(21 KB\)](#) Metadata File

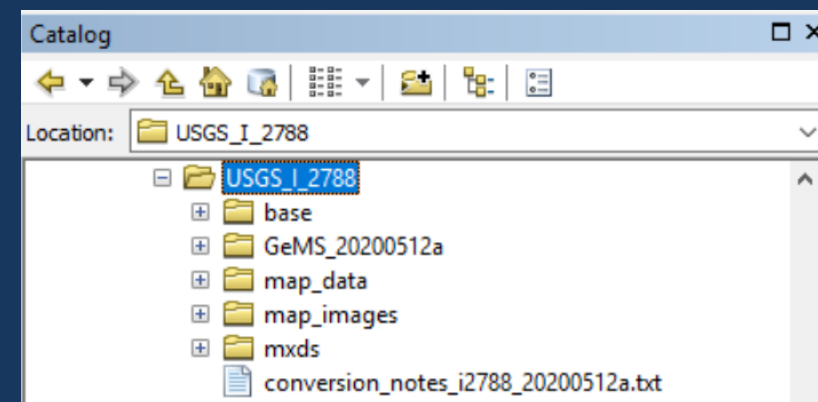
[Bases ZIP file \(1.14 MB\)](#) Contains georegistered raster images of the topographic base maps.

ArcInfo export files of each geospatial data set are included in the archived files (below).

[I-2788 ZIP file \(807 KB\)](#)

[I-2788 TAR.GZ file \(813 KB\)](#)

## ArcCatalog view of working folders on server or PC:



.zip → .e00 → coverage → feature class → feature class  
(in .gdb) (in feature dataset, in desired projection)



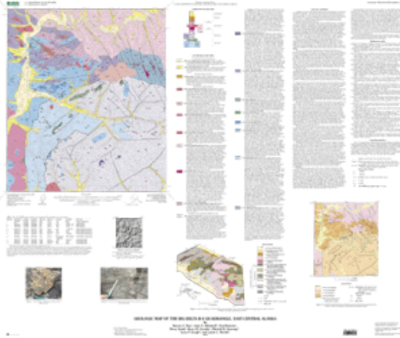


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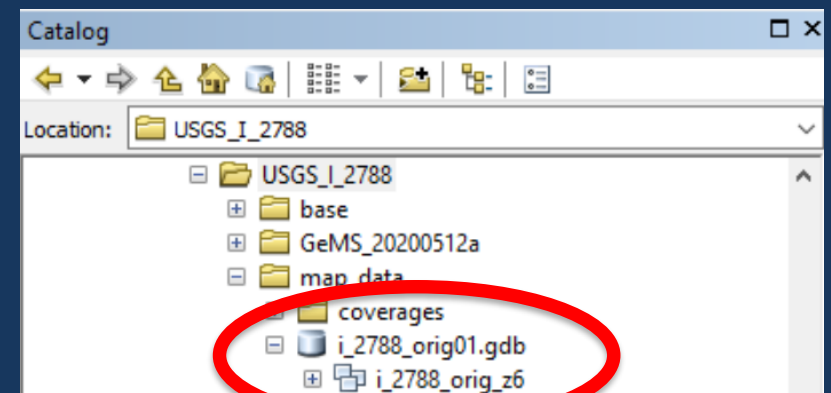
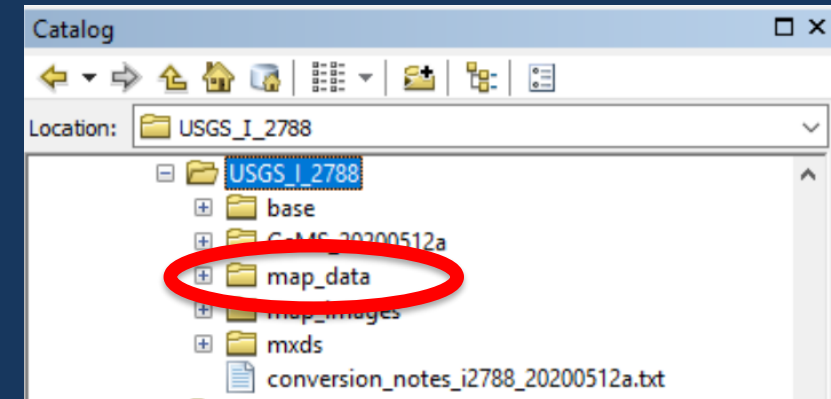
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[I-2788 metadata file \(613 KB\)](#)



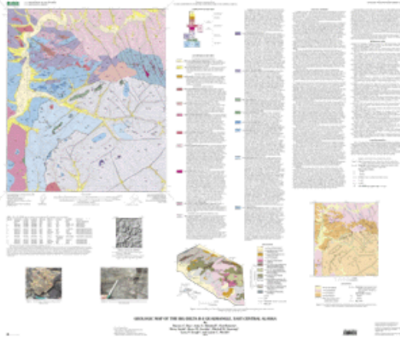


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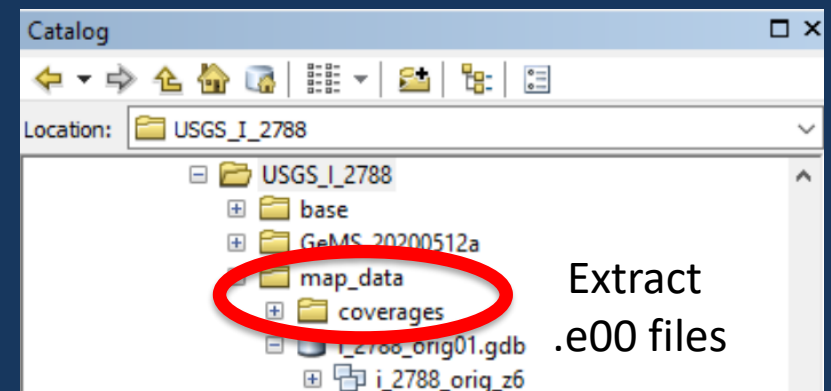
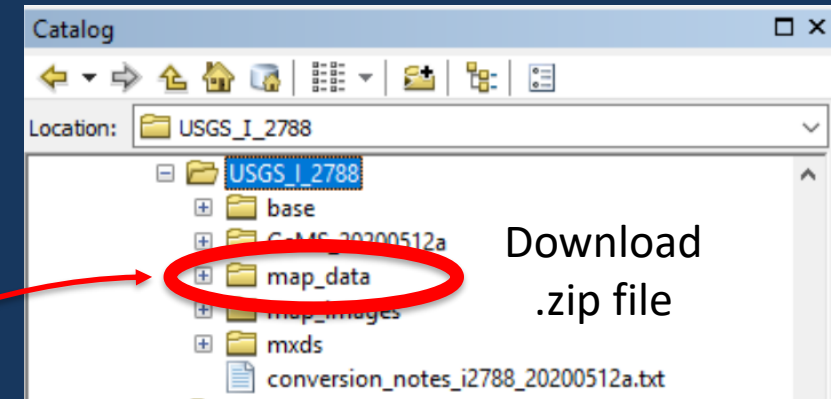
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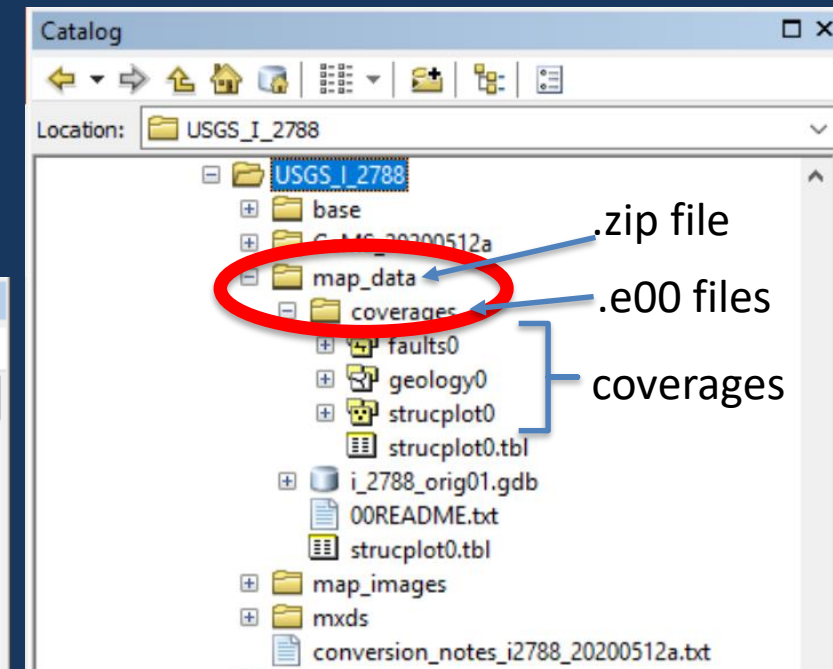
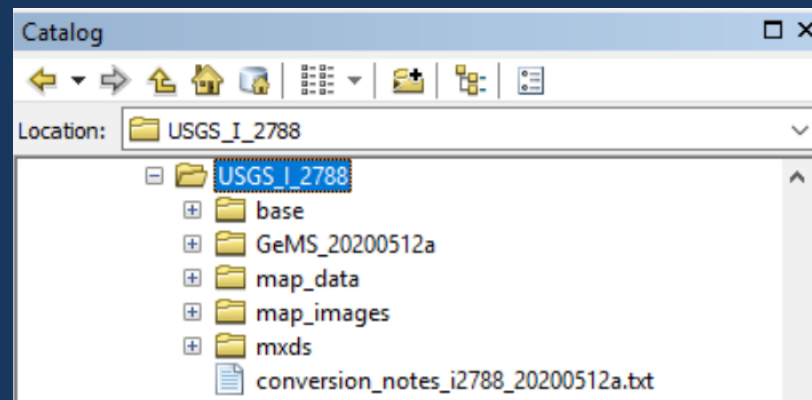
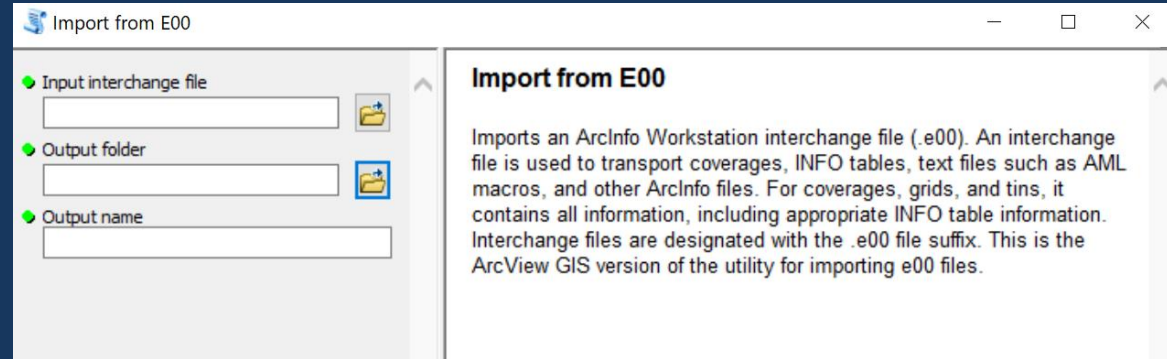
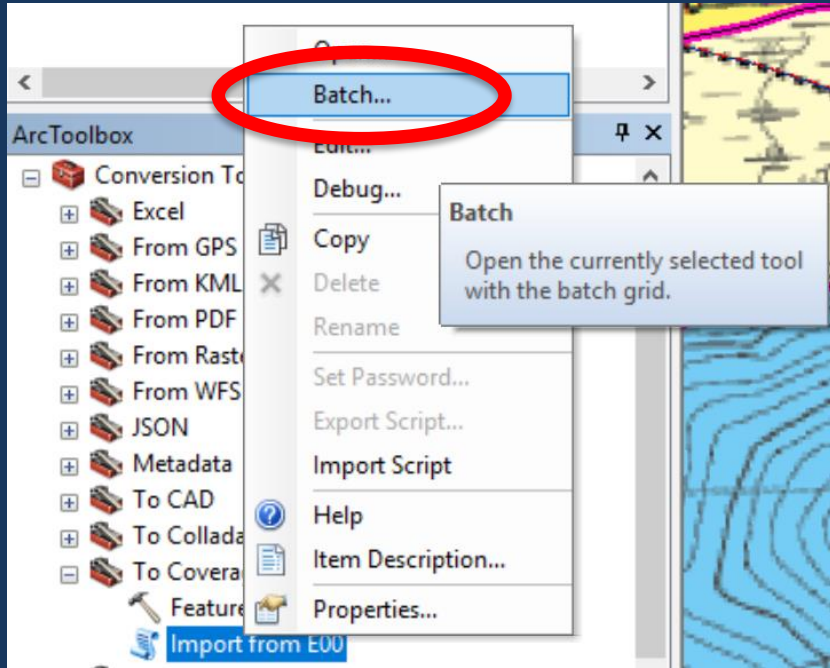
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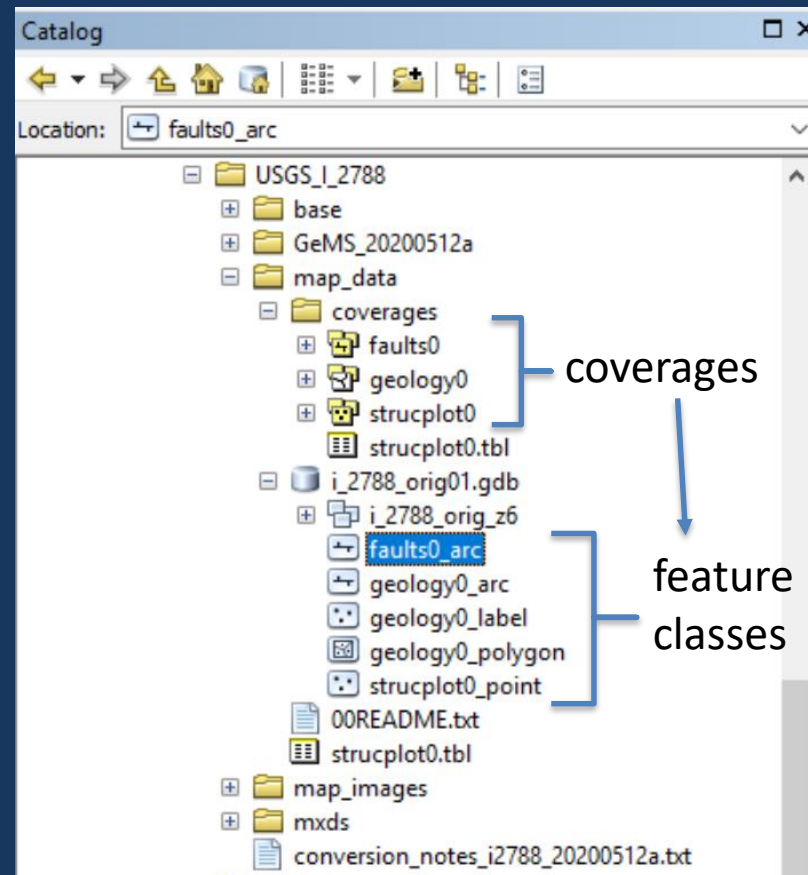
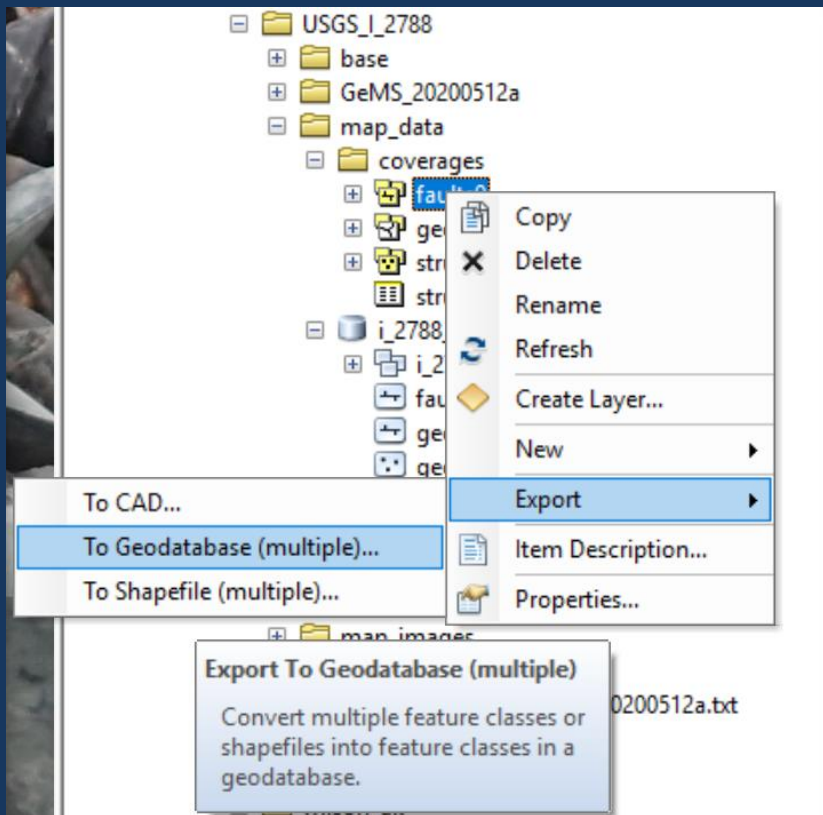




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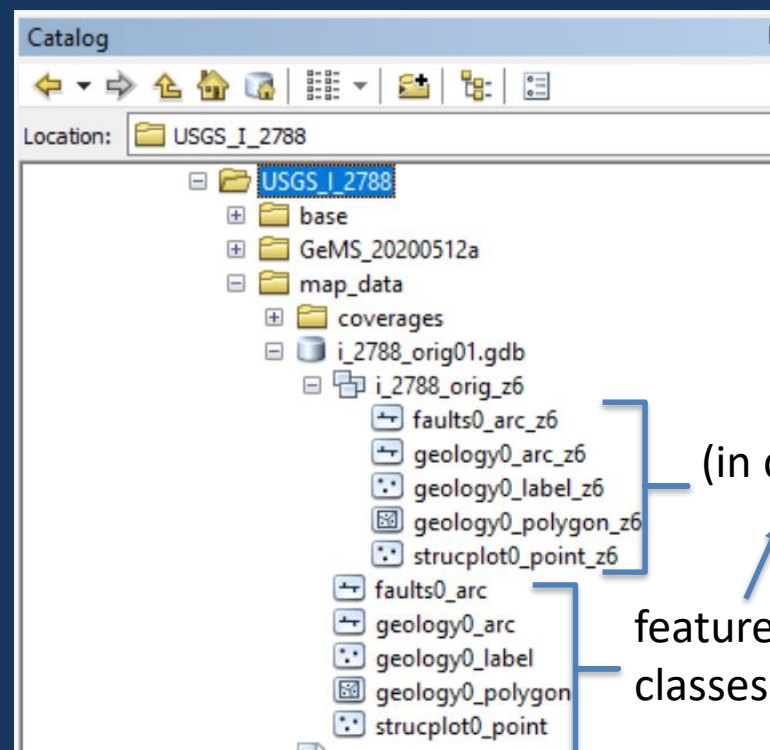
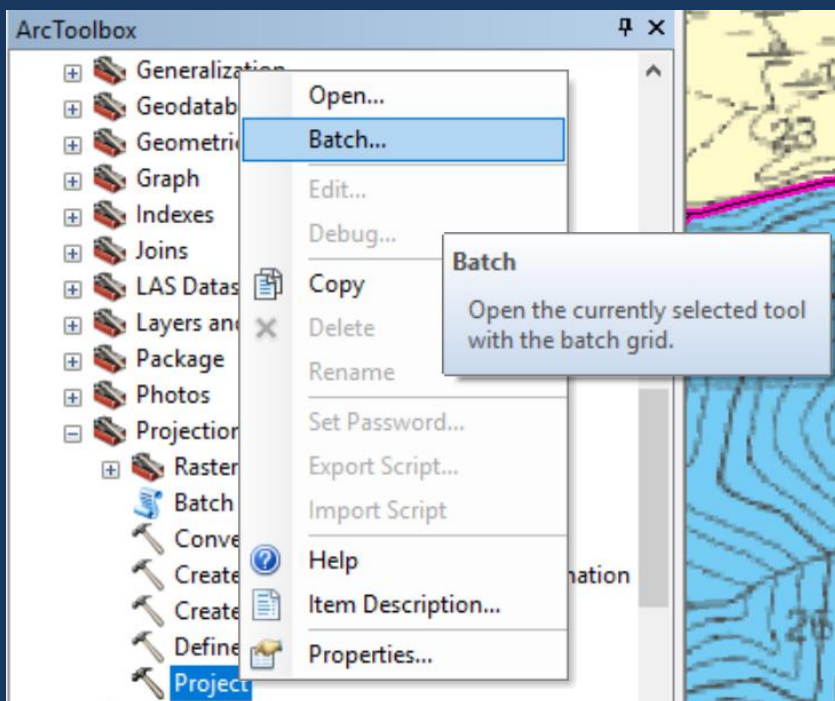


# Map Conversion: coverage to .gdb





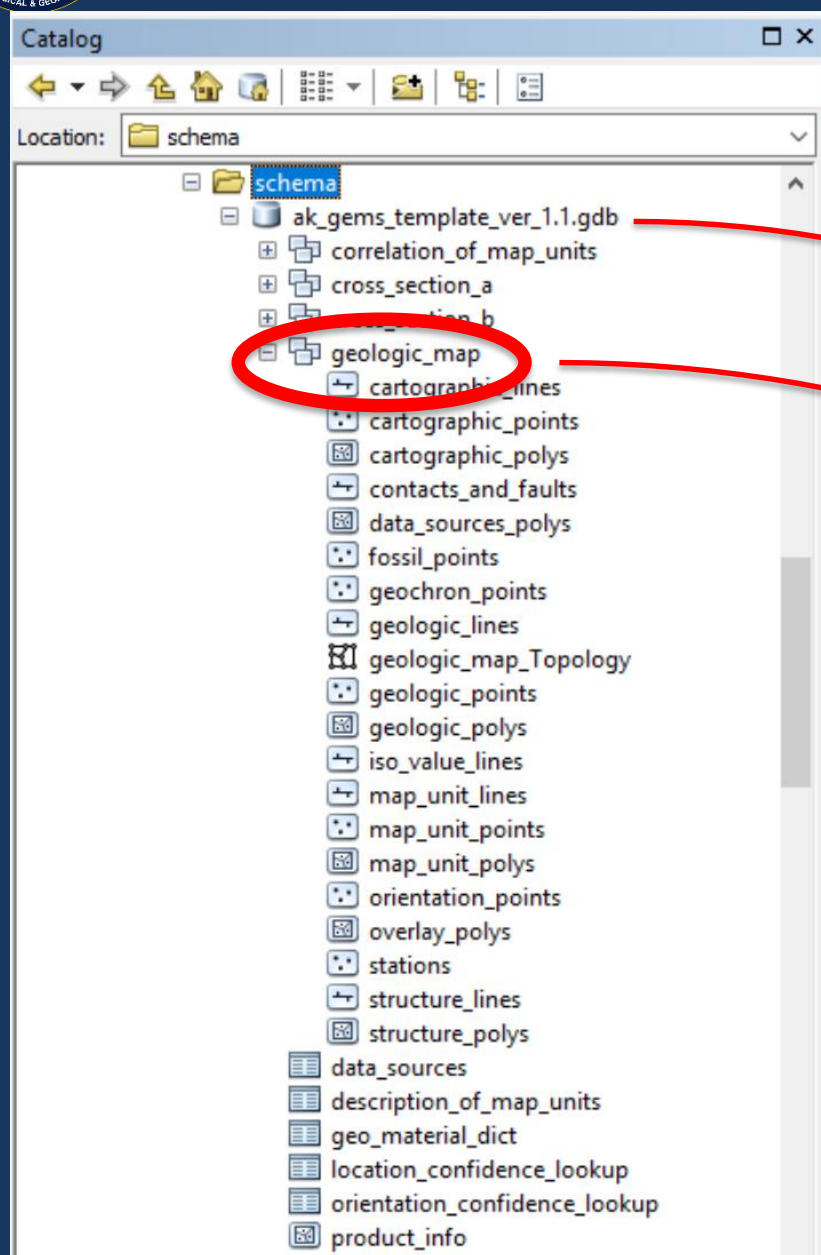
# Map Conversion: Feature Class into Feature Dataset



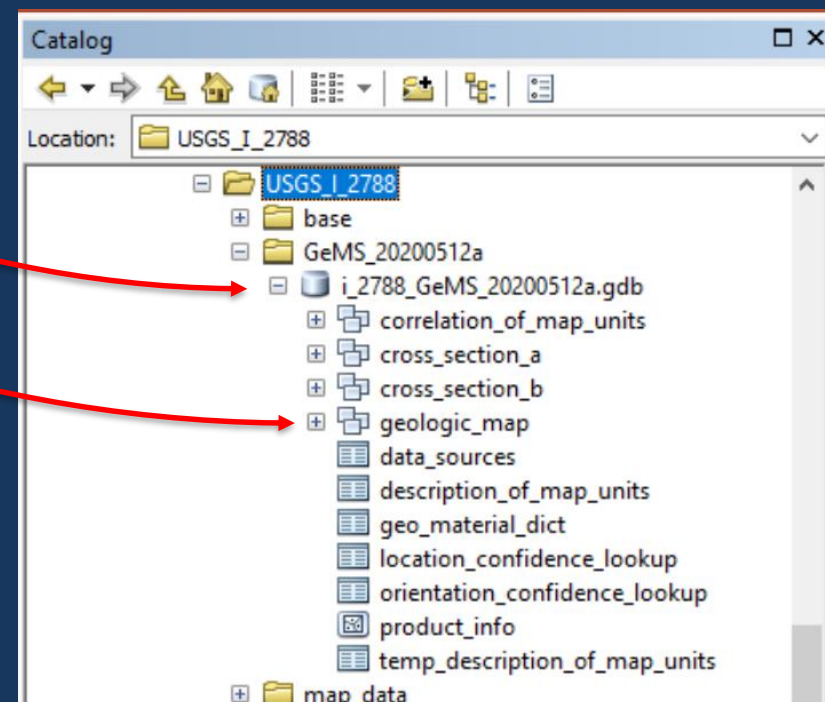
feature classes  
within a  
feature dataset  
(in desired coordinate system)

feature  
classes

# GeMS: empty schema template



Copy/rename the  
empty template geodatabase  
to the working folder



Redefine the coordinate system  
of the empty  
‘geologic\_map’ feature dataset



# GeMS Description of Map Units Table (DMU)

Run “Frequency” on the input polygon feature class to generate a table with a row for each map unit:

**Frequency**

Input Table: geology0\_polygon\_z6

Output Table: C:\Users\Chris\Documents\ArcGIS\Default.gdb\geology0\_polygon\_z6\_Frequen

Frequency Field(s):

- ☐ OBJECTID\_1
- ☐ Shape
- ☐ AREA
- ☐ PERIMETER
- ☐ GEOLOGY0\_
- ☐ GEOLOGY0\_ID
- ☐ OBJECTID
- ☒ UNIT\_NAME

Summary Field(s) (optional):

OK Cancel Environments... << Hide Help Tool Help

**Input Table**

The table containing the field(s) that will be used to calculate frequency statistics.

Table

geology0\_polygon\_z6\_Frequen

	FID *	FREQUENCY	UNIT_NAME
▶	1	7	Alluvium and colluvium
	2	6	Augen gneiss
	3	1	Basalt
	4	1	Biotite-sillimanite gneiss
	5	2	Biotite gneiss
	6	17	Biotite orthogneiss
	7	95	Colluvium
	8	5	Diorite and tonalite
	9	2	Dioritic orthogneiss
	10	15	Goodpaster batholith
	11	2	Granite of Slide Peak
	12	18	Granite stock
	13	1	Granite Stock
	14	14	Granite-like
	15	1	Granodiorite to granite, undivided
	16	9	Mafic gneiss
	17	21	Paragneiss
	18	5	Quartzite and metapelite
	19	1	Shawnee Peak intrusion
	20	4	Ultramafic schist



# GeMS Description of Map Units Table (DMU)

Run “Merge” on the “Frequency” output table and the empty GeMS description\_of\_map\_units table to generate a table with a row for each map unit:

Fields from empty GeMS DMU

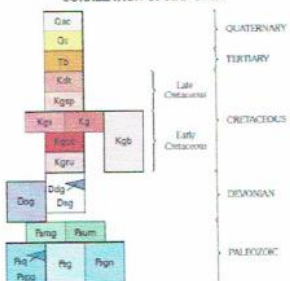
Fields from “Frequency” output table

geology0_polygon_z6_Frequenc			
FID *	FREQUENCY	UNIT_NAME	
1	7	Alluvium and colluvium	
2	6	Augen gneiss	
3	1	Basalt	
4	1	Biotite-sillimanite gneiss	
5	2	Biotite gneiss	
6	17	Biotite orthogneiss	
7	95	Colluvium	
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10	15	Goodpaster batholith	
11	2	Granite of Swede Peak	
12	18	Granite stock	
13	1	Granite Stock	
14	14	Granitoid dike	
15	1	Granodiorite to granite, undivided	
16	9	Mafic gneiss	
17	21	Paragneiss	
18	5	Quartzite and metapelite	
19	1	Shawnee Peak intrusion	
20	4	Ultramafic schist	

temp_description_of_map_unitsB											
OBJECTID *	symbol	map_unit	name	full_name	label	description	hierarchy_key	area_fill_rgb	geo_material	FREQUENCY	UNIT_NAME
1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	7	Alluvium and colluvium
2	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	6	Augen gneiss
3	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1	Basalt
4	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1	Biotite-sillimanite gneiss
5	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	2	Biotite gneiss
6	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	17	Biotite orthogneiss
7	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	95	Colluvium
8	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	5	Diorite and tonalite
9	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	2	Dioritic orthogneiss
10	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	15	Goodpaster batholith
11	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	2	Granite of Swede Peak
12	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	18	Granite stock
13	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1	Granite Stock
14	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	14	Granitoid dike
15	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1	Granodiorite to granite, undivided
16	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	9	Mafic gneiss
17	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	21	Paragneiss
18	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	5	Quartzite and metapelite
19	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	1	Shawnee Peak intrusion
20	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	4	Ultramafic schist

# GeMS DMU: Hierarchy Key

## CORRELATION OF MAP UNITS



## DESCRIPTION OF MAP UNITS

**QUATERNARY SURFICIAL DEPOSITS**

**01-01 Qac** Alluvial and colluvial deposits (Quaternary)—Boulder to silt-size, unconsolidated alluvial and colluvial deposits. Unit includes material deposited in stream channels, flood plains, abandoned river and stream channels, meanders, and wetlands.

**02-01 Qc** Colluvial deposits (Quaternary)—Boulder to silt-size, unconsolidated talus, depositional deposits, colluvium, and minor alluvial deposits. Unit includes alluvial deposits within small, narrow active stream channels.

**02-01 Tb** Basalt (Tertiary)—Dark-gray to black, nonfoliated basalt dikes containing small, randomly oriented plagioclase phenocrysts set in a fine-grained, aphanitic groundmass. Age uncertain, but may be consistent with a 50 Ma basaltic dike margin occurring throughout the Valdez-Tazewell Upland. Crisp out poorly in sec. 15, R. 15 E., T. 6 S. in upper part of Sonoma Creek drainage.

**03-01 Kgt** Diorite and tonalite (Late Cretaceous)—Medium-grained, dark-gray, nonfoliated, equigranular, hornblende-biotite diorite to tonalite. In Lave Creek, outcrops of unit exhibit weak to moderate quartz-feldspar-silica alteration and include the Pogo gold deposit. Smith and others (1999) reported a ~94.5 Ma U-Pb zircon age for the diorite of Lave Creek. Sericite alteration of the diorite of Lave Creek ranges in age from 91.2 to 91.7 Ma using <sup>40</sup>Ar/<sup>39</sup>Ar technique (Smith and others, 1999) and postdates the main gold mineralization event at the Pogo gold deposit at 104.3 ± 0.3 Ma (Sally and others, 2002).

**03-02 Kgs** Shawnee Peak intrusion (Late Cretaceous)—Coarse-grained, nonfoliated, equigranular, light-gray, biotite diorite to biotite tonalite, from western flank of Shawnee Peak. Lacks evidence for intergranular recrystallization as seen in the granite of Swede Peak (unit Kgd) implying intrusive occurred at a higher structural level relative to the granite of Swede Peak and emplacement postdated regional Early Cretaceous deformation.

**03-03 Kgb** Granite of Swede Peak (Early Cretaceous)—Coarse-grained, light-gray to white, biotite-garnet-muscovite leucocratic. In thin section, quartz and feldspar crystals exhibit a coarse texture, and quartz shows undulatory extinction indicating post-emplacement strain and intergranular recrystallization possibly due to relatively deeper level of initial emplacement or emplacement during later stages of Early Cretaceous (~110 Ma) regional tectonism. Western margin of unit is intrusive into country rock unit Dag. Contact with thrust fault on northeast margin of intrusion is buried beneath valley fill alluvium; southwest trending thrust fault does not appear to cut the intrusion. Eastern margin of unit cut by high-angle fault.

**03-04 Kgd** Granite stock (Early Cretaceous)—Small, medium- to coarse-grained, nonfoliated to weakly foliated stock and plugs of leucocratic biotite granodiorite to granite composition; locally contains muscovite. Muscovite texture between quartz and feldspar phenocrysts, combined with weak foliation to microscopic scale, indicates unit was at least partially recrystallized. Age uncertain, but predominantly nonfoliated texture indicates unit emplaced after Early Cretaceous regional tectonism.

**03-05 Kgru** Goodpastor batholith (Early Cretaceous)—Composite batholith made up of nonfoliated to weakly foliated, coarse-grained, equigranular biotite granodiorite, granite, and pegmatite. Southern part of batholith is a border phase of medium-grained, hypidiomorphic, equigranular, moderately lobate biotite granodiorite, distinguished from adjacent biotite-sillimanite gneiss (unit Rgn), which unit Kgb intrudes, by lack of recrystallization and lesser amount of intense sericite alteration. Foliated southern margin of batholith probably represents an earlier

Dasil-Bacon and others (2001) reported a Late Devonian U-Pb zircon SHRIMP age of 362 ± 3 Ma for their sample AG-25 from an augen gneiss sample taken north of Central Creek and west of Chalk Creek. 13 Pb zircon SHRIMP ages of 365 ± 4 Ma (Late Devonian) obtained for continuous unit approximately 10 km west of map area (sample AG-3, table 1). A sample from the same map unit yielded a 388 ± 3 Ma (Middle Devonian) age as reported by Dasil-Bacon and others (2001) for sample AG-5, lat 64° 18' 54" N, long 144° 26' 30" W. The Late Devonian age reported here (sample AG-3, table 1) supersedes that reported by Alenikoff and others (1986), who published a U-Pb concordia age of 341 ± 3 Ma (Early Mississippian) on zircon from several samples of the gneiss. Alenikoff and others (1986), their sample AG-1 reported K-Ar dates on muscovite of 113 ± 4 Ma and on biotite of 110 ± 4 Ma, reflecting postmetamorphic cooling during the Early Cretaceous.

**Dioritic orthogneiss (Late Devonian)**—Dark-green, medium-grained, foliated, hornblende-biotite dioritic orthogneiss. Interpreted to be a cognate mafic phase of the Devonian augen gneiss (unit Dag); contact zone with augen gneiss is apparently not faulted and is a typical igneous contact. Major- and trace-element geochemical data (W. Dag, unpubl. data, 2002) are compatible with interpretation that unit Dag is cognate with plagioclase protolith of unit Dag. A SHRIMP U-Pb date of 369 ± 6 Ma from zircon core from a dioritic orthogneiss (sample 02AD332, table 1) represents a Devonian age of primary crystallization. No Cretaceous metamorphic overgrowth were noted on the zircon, although unit experienced the same tectonic events recorded in the enclosing augen gneiss (unit Dag). Dasil-Bacon and others (2001) reported an age of 361 ± 3 Ma for an "amphibolite" interpreted to be a mafic phase within the augen gneiss body (Dasil-Bacon, oral commun., 2002). Wilson and others (1985) reported a K-Ar age of 188 ± 6 Ma for hornblende (metamorphic) from unit Dag. Dasil-Bacon and others (2002) reported <sup>40</sup>Ar/<sup>39</sup>Ar ages of 181 ± 7 Ma and 130 Ma on hornblende from the unit, which would represent time of post-peak metamorphic cooling from Mesozoic deformation and metamorphic events. Dasil-Bacon and coworkers' previous studies also interpreted the unit to be a cognate mafic enclave within protolith intrusion of the augen gneiss.

**Granodioritic orthogneiss (Middle to Late Devonian)**—Predominantly light to medium gray, medium-grained, layered, trondhemitic to granodioritic orthogneiss with lesser amounts of biotite schist, quartzite, and pegmatite. Occurs in northern and western parts of map area and is distinguished from unit Rgn by lack of sillimanite. Xenocrystic zircon cores vary in age from 367 Ma to 1,184 Ma (sample 02AD339, table 1). One zircon core yields a U-Pb SHRIMP age of 367 ± 7 Ma and is replaced by a 300 ± 12 Ma moderately zoned (granitic) zircon overgrowth. Both Devonian ages are within error of each other and indicate a Middle to Late Devonian emplacement age of the protolith, which is equivalent to slightly older than that of the protolith for the augen gneiss (unit Dag). U-Pb SHRIMP ages on zircon from these two populations—an older group at 114 ± 2 Ma and a younger group at 109 ± 2 Ma (sample 02AD339, table 1). U-Pb SHRIMP data on zircon from unit indicate that protolith intrusion preceded zircon from a crustal source that was in part Precambrian, was emplaced during the Devonian, and was recrystallized twice during pulses of regional Cretaceous tectonism at ~114 Ma and at ~109 Ma.

**Mafic gneiss (Paleozoic)**—Dark-gray, fine- to medium-grained, strongly foliated, hornblende-biotite amphibolite gneiss interfolded with foliated, medium-grained, equigranular calc-silicate schist. Calc-silicate schist contains hornblende, biotite, and diopside. Biotite contact with underlying augen gneiss (unit Dag) is highly deformed biotite phyllonite; contact is a mylonite zone (fig. 1) interpreted to be associated with regional low-angle faulting. Biotite represent structural klippe resting upon the augen gneiss (unit Dag).

**Ultramafic schist (Paleozoic)**—Dark-green, foliated, sericitized ultramafic schist. Weathering to light-brown color, protolith was peridotite. Equivalents to unit Rg of Weber and others (1978). Age uncertain, but protolith presumed coeval with unit Pmg. Biotite contact poorly exposed, but structural discordance in foliation direction with underlying gneiss suggests unit is low-angle fault (see fig. 1) interpreted to be associated with regional low-angle faulting.

**Quartzite and metapelite (Paleozoic)**—Light-gray, equigranular, muscovite-bearing quartzite and metapelite. Protolith was an igneous granitoid interfolded with pelite. Age uncertain, but protolith assumed to be part of non-structurally discordant sedimentary sequence that includes the protolith for units Pzg, Rg, and Rgn.

**Paragneiss (Paleozoic)**—Medium-gray, equigranular, medium- to fine-grained quartz-feldspathic biotite schist with lesser amounts of metapelite and quartzite. Locally, dark-gray, medium-grained biotite schist horizons are interfolded with light gray, fine- to medium-grained, equigranular quartz-feldspathic biotite schist horizons (1–5 cm thick) as well as light-gray, medium-grained pelitic horizons. Metamorphic mineral assemblage includes biotite, muscovite, garnet, and locally, sillimanite. Protolith for unit was granitoid to weakly silicified sediment and sandstone. Depositional age of protolith uncertain. Zircon U-Pb age dates by Alenikoff and others (1986) on a sample from same map unit of Weber and others (1978) unit Pzg-Dag range from Mississippian to Paleogene-tertiary; the older ages are from foliated detrital zircon emplaced from a Precambrian crustal source. Dasil-Bacon and others (2002) reported <sup>40</sup>Ar/<sup>39</sup>Ar age of 135 Ma on hornblende from ridge crest east of Sonoma Creek. The Early Cretaceous age is thought to represent a metamorphic cooling temperature from regional tectonism.

## Table

### temp\_description\_of\_map\_units

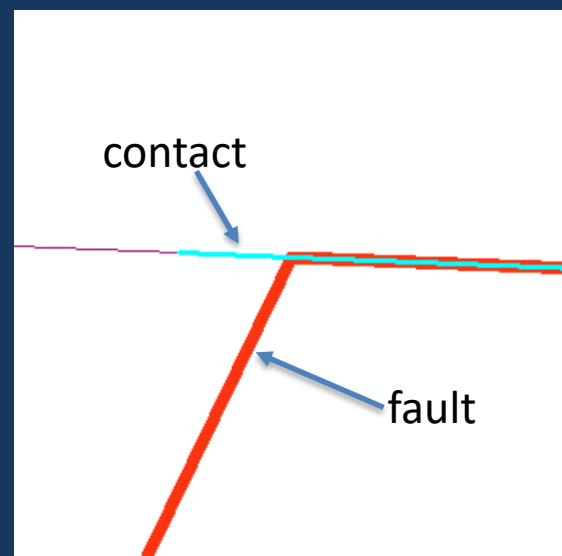
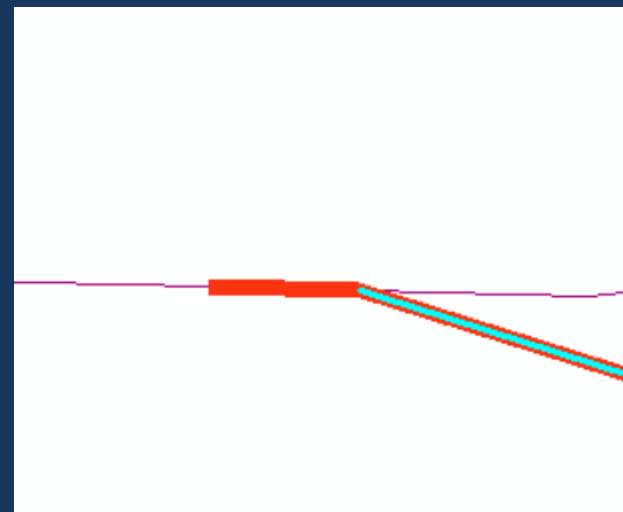
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21 <Null>		QUATERNARY SURFICIAL UNITS	01
1 Qac		Alluvial and colluvial deposits	01-01
7 Qc		Colluvial deposits	01-02
22 <Null>		TERTIARY IGNEOUS ROCKS	02
3 Tb		Basalt	02-01
23 <Null>		CRETACEOUS IGNEOUS ROCKS	03
8 Kdt		Diorite and tonalite	03-01
19 Kgsp		Shawnee Peak intrusion	03-02
11 Kgs		Granite of Swede Peak	03-03
12 Kg		Granite stock	03-04
10 Kgb		Goodpastor batholith	03-05
14 Kgcd		Granitoid dike	03-06
15 Kgru		Granodiorite to granite, undivided	03-07
24 <Null>		PALEOZOIC AND OLDER METAMORPHIC UNITS	04
2 Dag		Augen gneiss	04-01
9 Ddg		Dioritic orthogneiss	04-02
6 Dog		Granodioritic orthogneiss	04-03
16 Pzmg		Mafic gneiss	04-04
20 Pzum		Ultramafic schist	04-05
18 Pzq		Quartzite and metapelite	04-06
17 Pzpg		Paragneiss	04-07
5 Pzg		Biotite gneiss	04-08
4 Pzgn		Biotite-sillimanite gneiss	04-09



# Special cases: GeMS contacts\_and\_faults

Table		
geology0_arc_z6		
FID *	Shape *	CONT_TYPE
236	Polyline	Contact, Coincident with Fault
247	Polyline	Contact, Coincident with Fault
248	Polyline	Contact, Coincident with Fault
257	Polyline	Contact, Coincident with Fault
264	Polyline	Contact, Coincident with Fault
269	Polyline	Contact, Coincident with Fault
272	Polyline	Contact, Coincident with Fault
282	Polyline	Contact, Coincident with Fault

Resolution: identify and manually edit coincident contacts and faults to comply with GeMS topology rules



Contacts and faults are coincident but not congruent

# Special cases: “compound” orientation\_points

Table

strucplot0\_point\_z6

	S1_STRIKE	S1_DIP	L2_TREND	L2_PLUNGE	F2_TREND	F2_PLUNGE	F3_TREND	F3_PLUNGE	POINT_TYPE
	0	0	115	26	0	0	150	12	Lineation and F3 fold
	0	0	85	22	0	0	85	22	Lineation and F3 fold
	0	0	120	33	0	0	75	38	Lineation and F3 fold
	300	56	0	0	0	0	290	26	Strike and dip of foliation and F3 fold
	72	48	135	43	0	0	0	0	Strike and dip of foliation with lineation
	15	54	100	35	0	0	0	0	Strike and dip of foliation with lineation
					0	0	0	0	Strike and dip of foliation with lineation
					0	0	0	0	Strike and dip of foliation with lineation
	62	42	100	40	0	0	0	0	Strike and dip of foliation with lineation
	15	42	125	42	0	0	0	0	Strike and dip of foliation with lineation
	30	30	170	28	0	0	0	0	Strike and dip of foliation with lineation
	5	32	120	28	0	0	0	0	Strike and dip of foliation with lineation
	58	32	85	18	0	0	0	0	Strike and dip of foliation with lineation
	50	50	110	45	0	0	0	0	Strike and dip of foliation with lineation
	30	35	100	30	0	0	0	0	Strike and dip of foliation with lineation
	12	28	68	22	0	0	0	0	Strike and dip of foliation with lineation
	12	35	100	35	0	0	0	0	Strike and dip of foliation with lineation
	7	32	140	22	0	0	0	0	Strike and dip of foliation with lineation
	30	22	110	18	0	0	0	0	Strike and dip of foliation with lineation
	282	44	80	25	0	0	0	0	Strike and dip of foliation with lineation
	345	42	100	35	0	0	0	0	Strike and dip of foliation with lineation

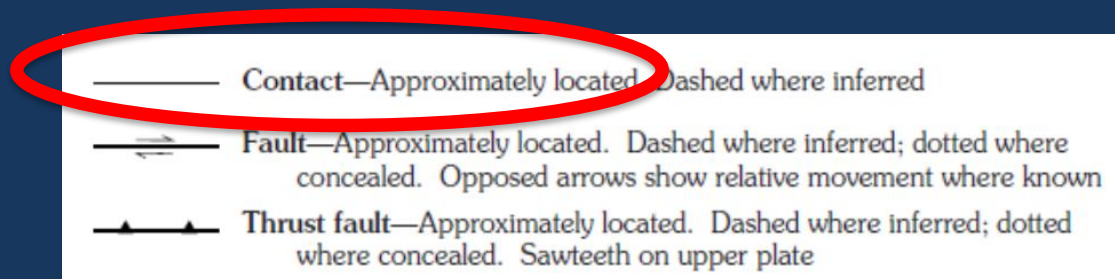
four pairs of azimuth/inclination attributes

Resolution: replicate original compound features to represent single orientation\_points, and edit GeMS attributes (type, azimuth, inclination, etc. ) for each as needed



# Special cases: location\_confidence vs map symbol

In GeMS, solid lines will represent “location accurate” according to the FGDC symbol standards



Resolution: code the GeMS version as “approximate” to agree with the legend description and GIS data





# Lessons From Converting Alaska Digital Geologic Maps to the USGS Geologic Map Schema (GeMS)

- Useful to have a prioritized list of maps in your GeMS conversion queue
- Helpful to be familiar with different ESRI data structures and how to migrate from them
- Expect to encounter features that require modest editing to be GeMS-compliant

