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

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June 9, 2020

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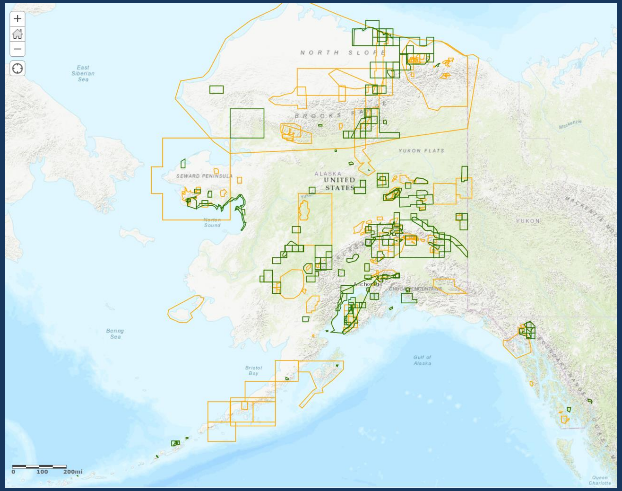
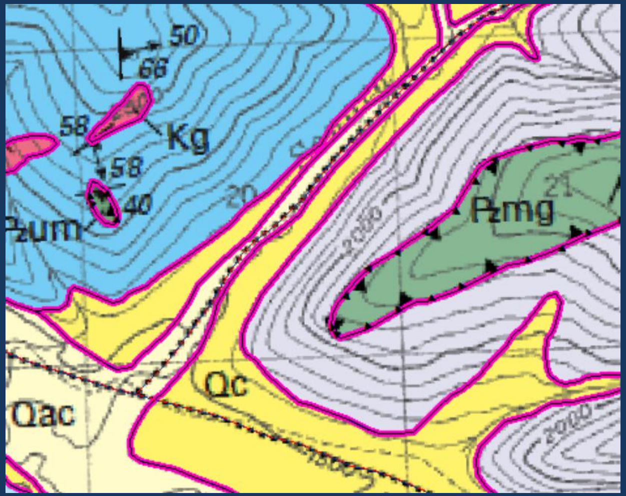
Lessons From Converting Alaska Maps to GeMS

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

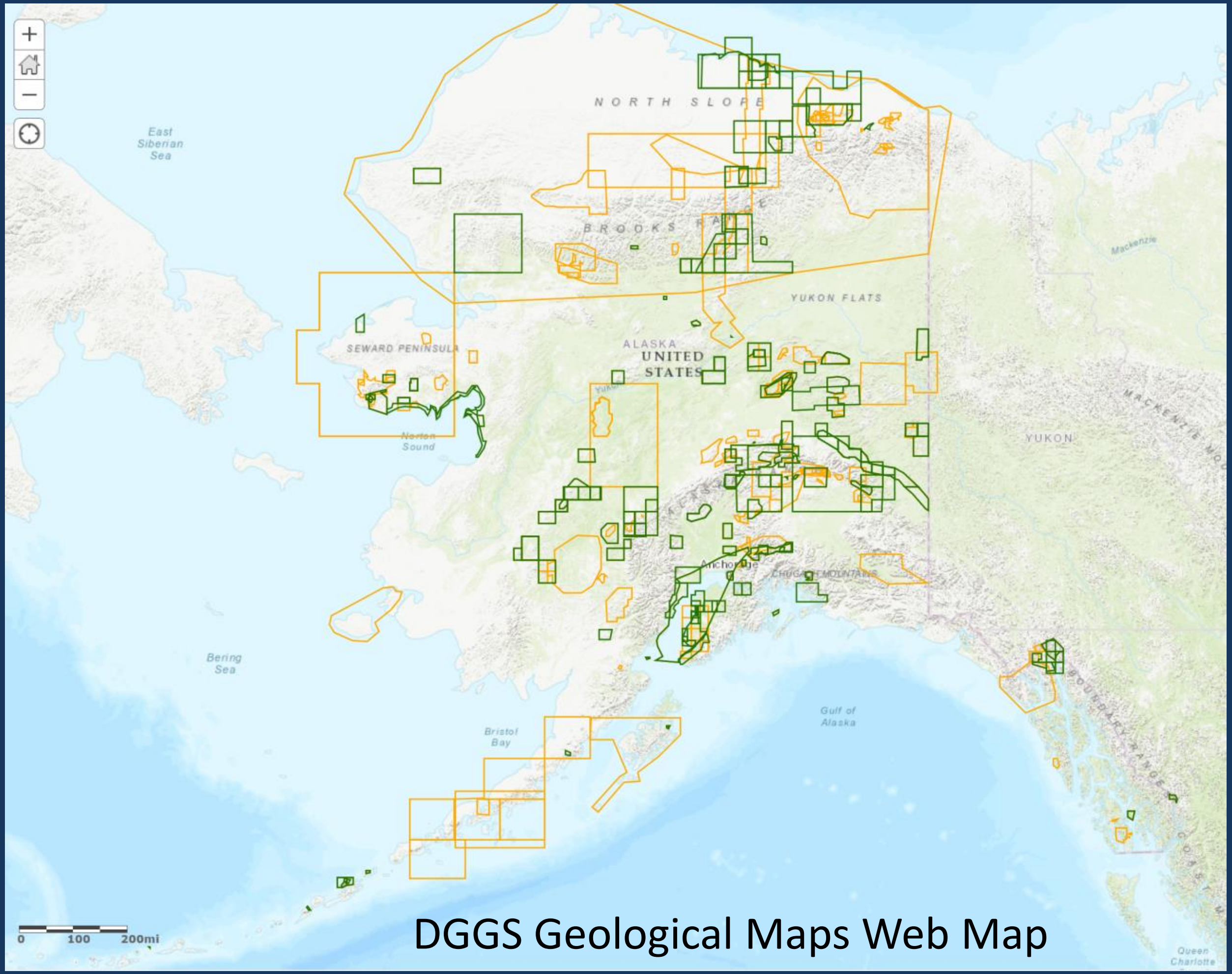


www.newsiner.com

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**



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

Converting Alaska Maps: Where to begin?

- **Bedrock and surficial maps published by DGGS**

- **Includes:**
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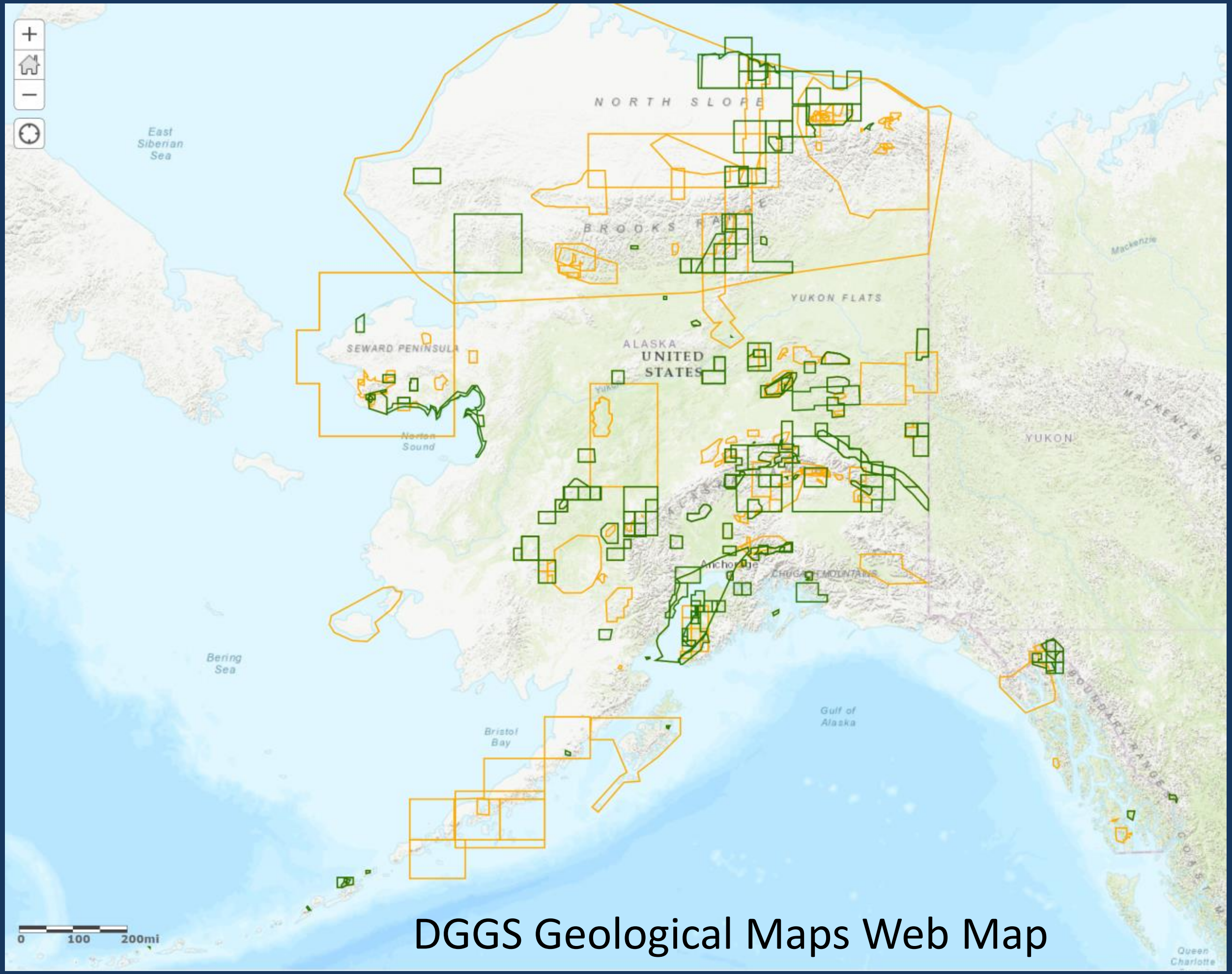
- **GeMS versions/conversions across the state**
  - **Aleutian Islands**
  - **North Slope**



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

Map Conversion Target Area: YTU

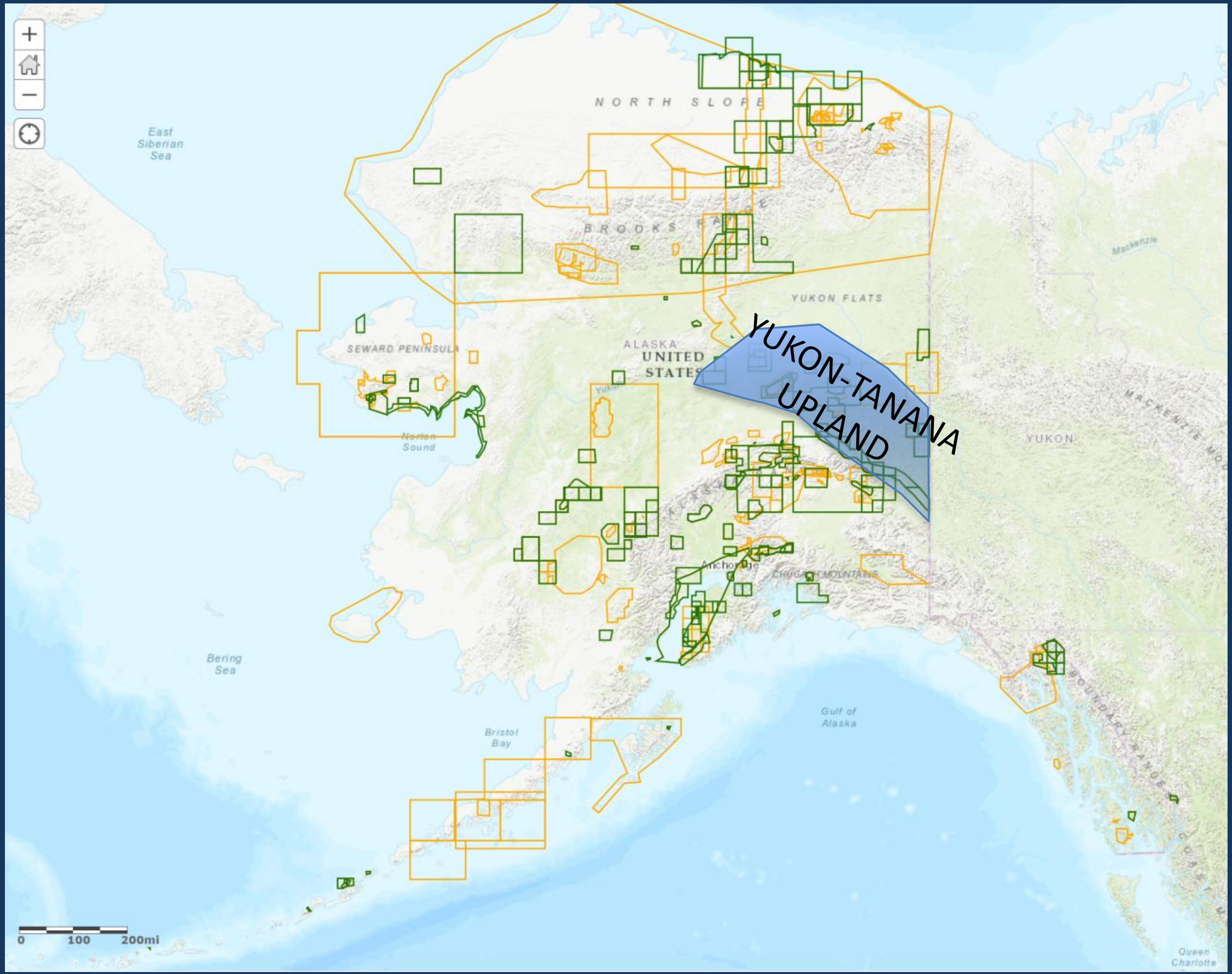
- <u>**Yukon-Tanana Uplands**</u>

- **“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**

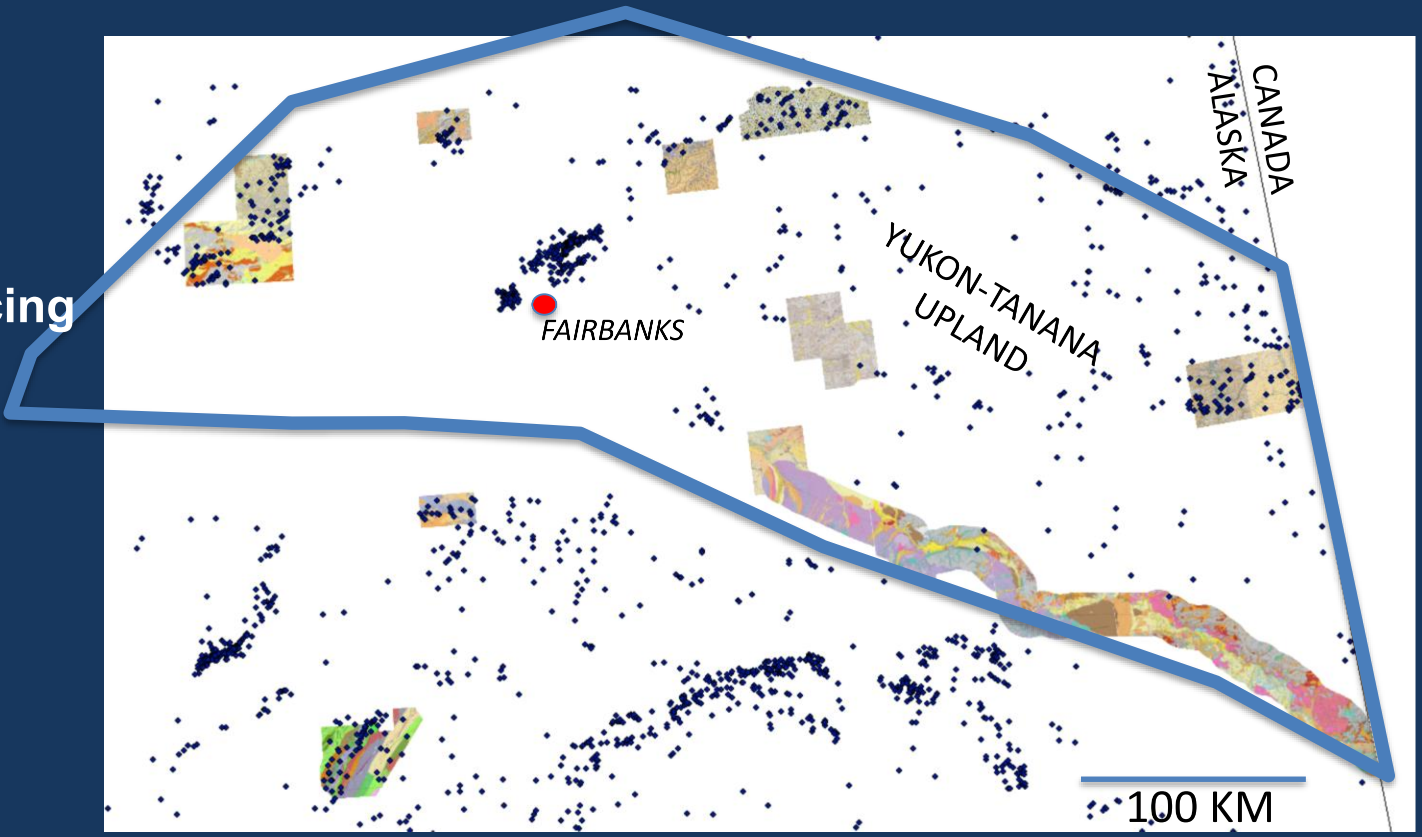


Image Service of Alaska Key Geologic Map Images
https://geoportal.dggs.dnr.alaska.gov/portal/home/

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

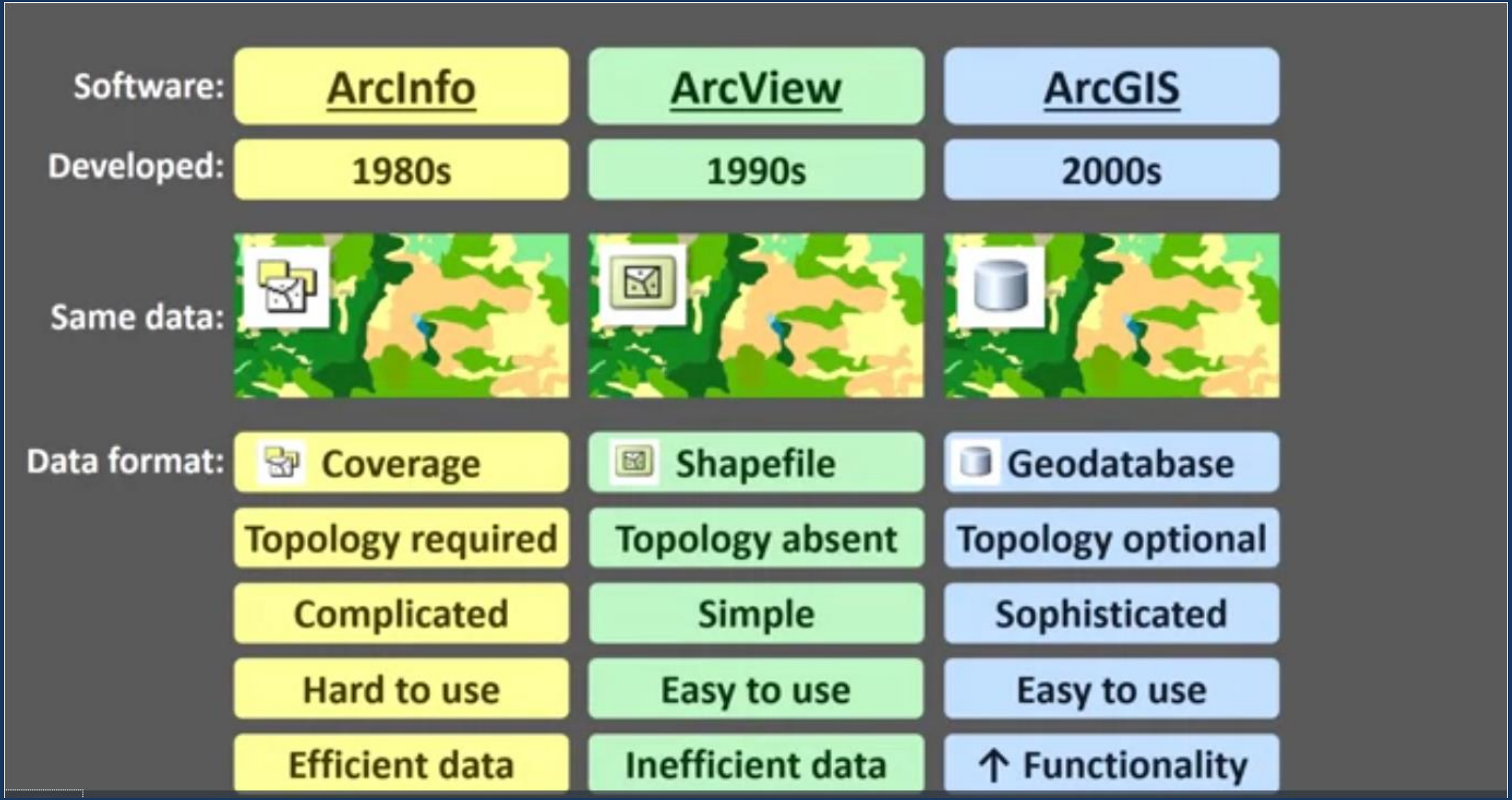
Fortymile District area placer mine
near the US-Canada border

- 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**

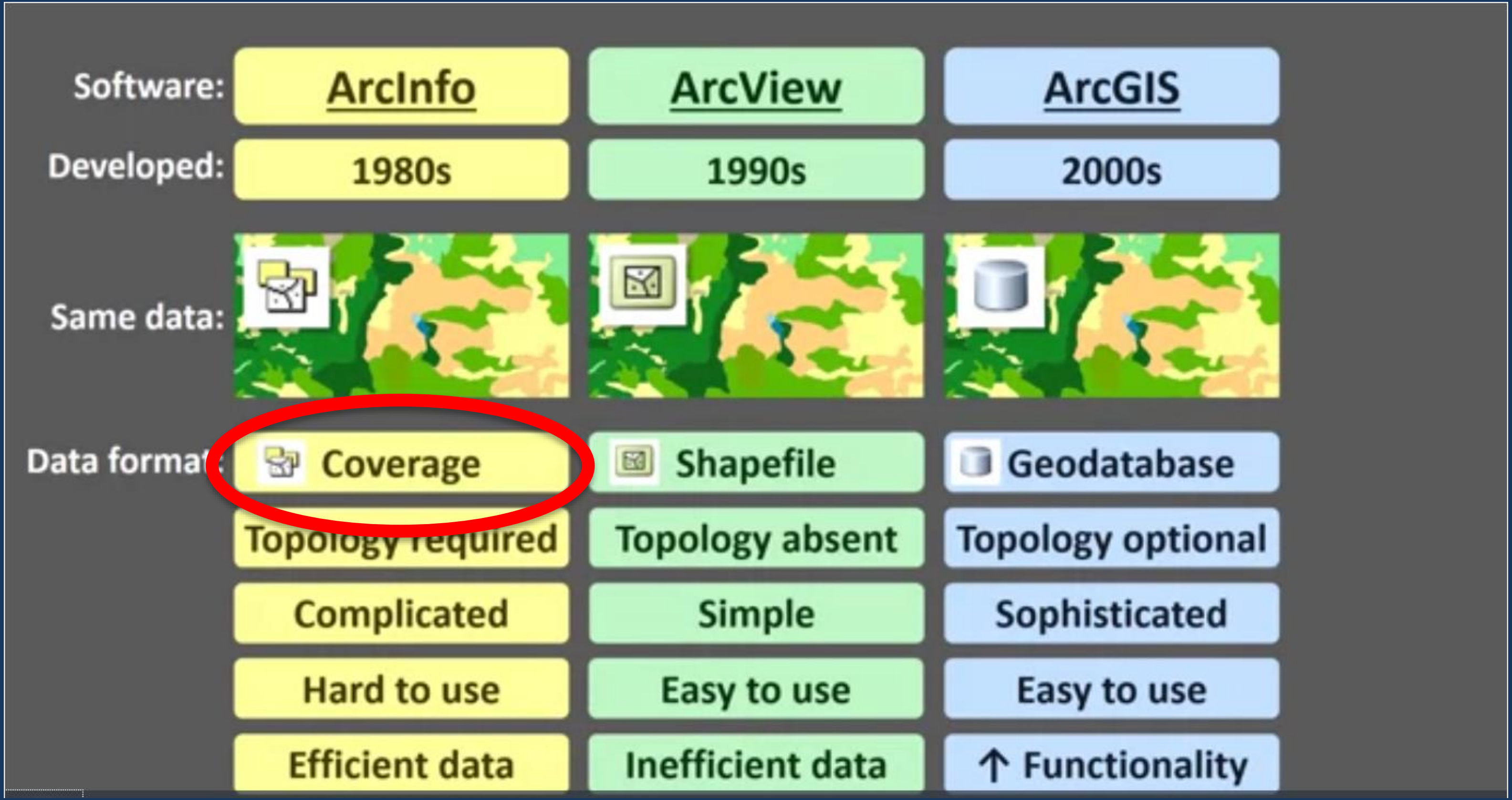


Software:	ArcInfo	ArcView	ArcGIS
Developed:	1980s	1990s	2000s
Same data:			
Data format:	Coverage	Shapefile	Geodatabase
	Topology required	Topology absent	Topology optional
	Complicated	Simple	Sophisticated
	Hard to use	Easy to use	Easy to use
	Efficient data	Inefficient data	↑ Functionality

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

Map Conversion: Legacy Map Input Data

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



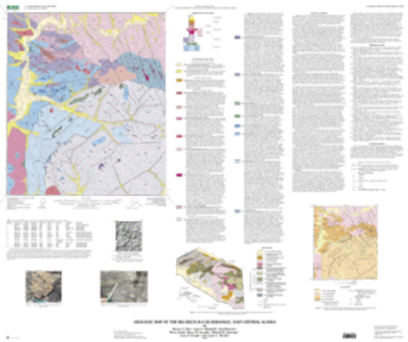
(Figure from: University of Toronto and Coursera, https://www.coursera.org)

Map Conversion: Download legacy data

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

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

Version 1.0



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

[1]U.S. Geological Survey
[2]Teck Cominco Limited, #600-200 Burrard Street, Vancouver, B.C., Canada V6C3L9
[3]Alaska Department of Natural Resources, Division of Mining and Water Management, Anchorage, AK 99501

The text of this report is presented here in Portable Document Format. The latest version of Adobe Acrobat Reader or similar software is required to view it. If you wish to download the latest version of Acrobat Reader free of charge, click here.

I-2788 PDF file (2.85 MB)

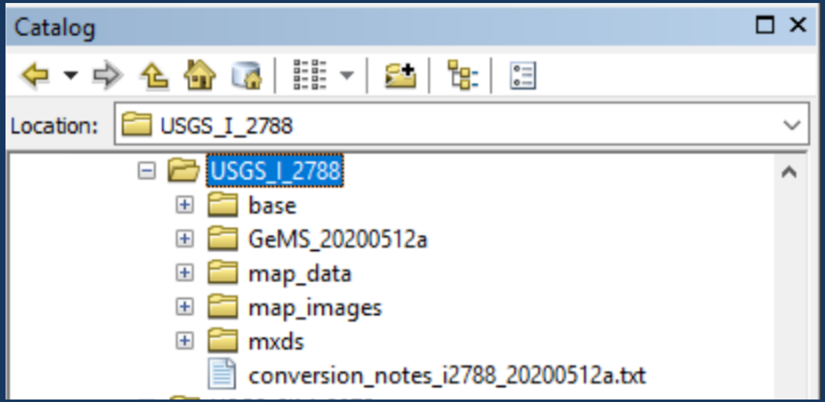
I-2788 text only PDF file (57 KB) (This version of the report is accessible as defined in Section 508.)

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)

Map Conversion: Download legacy data

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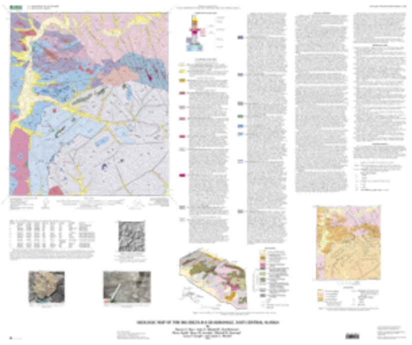

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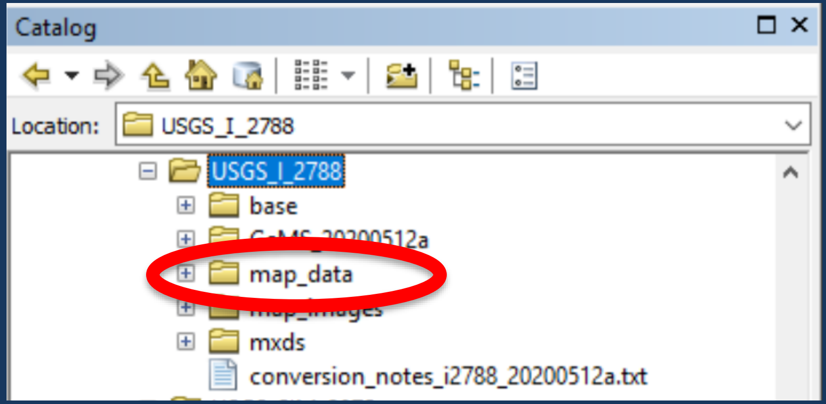
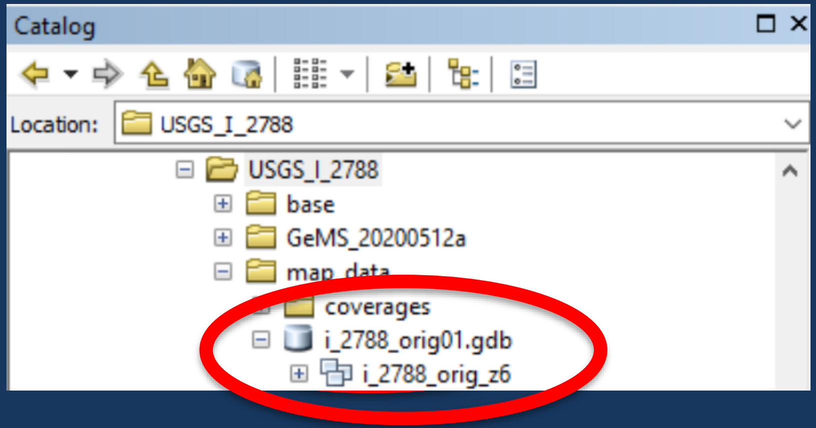
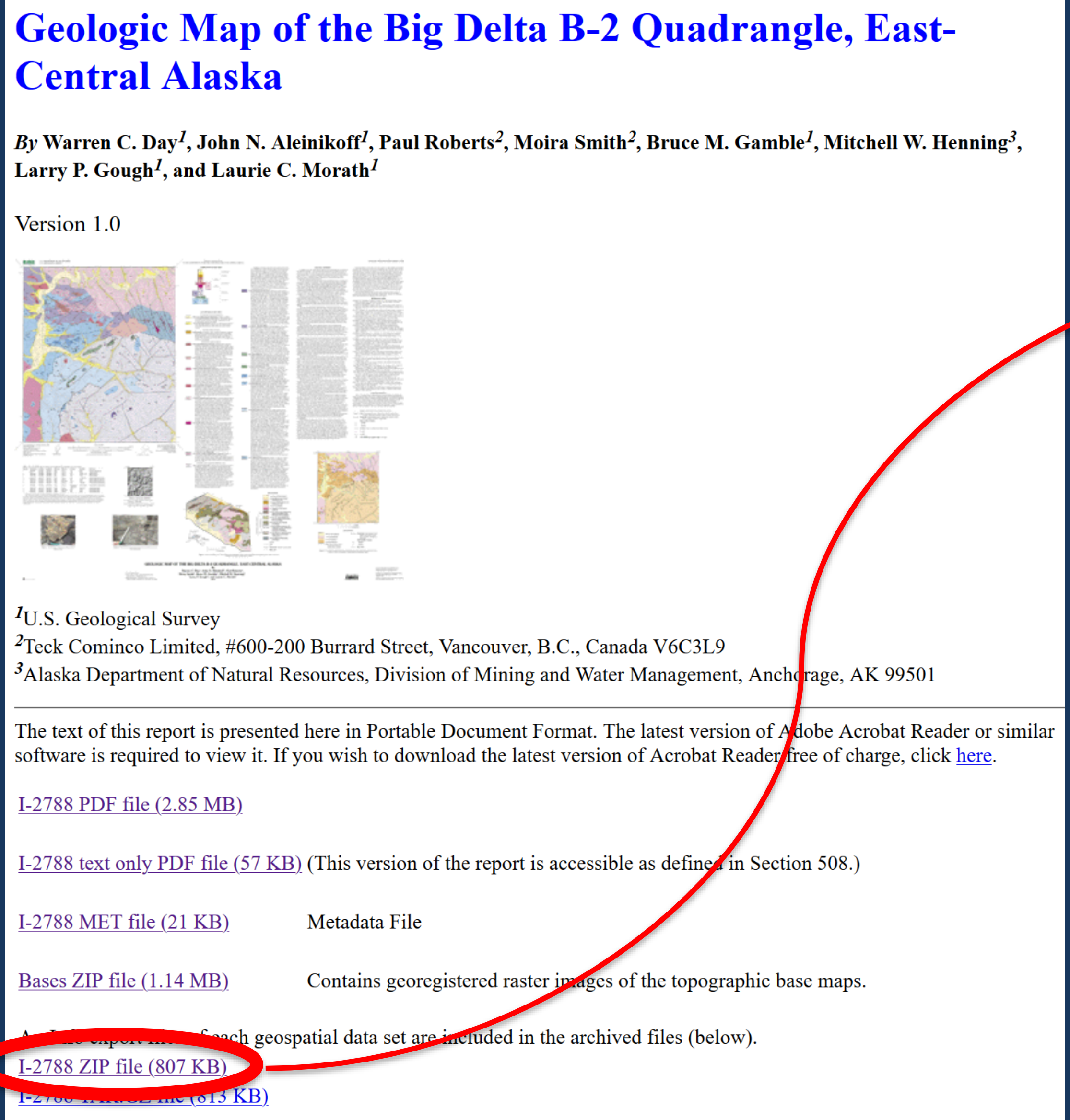
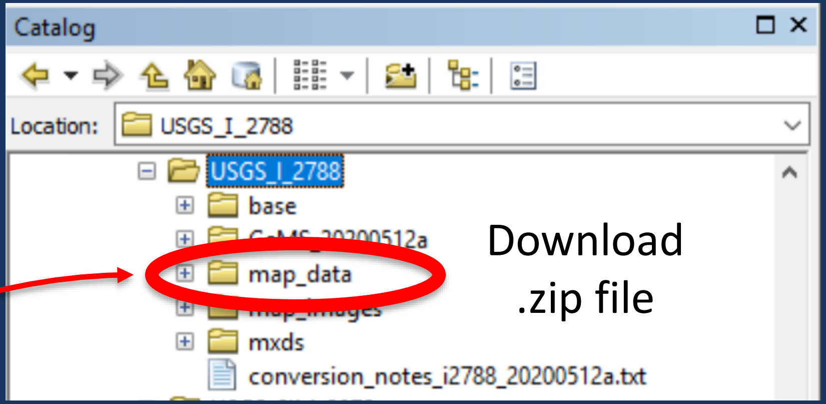


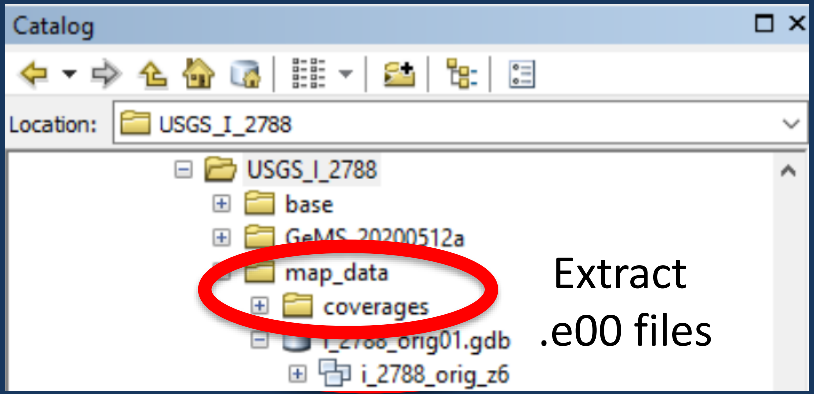


Map Conversion: Download legacy data



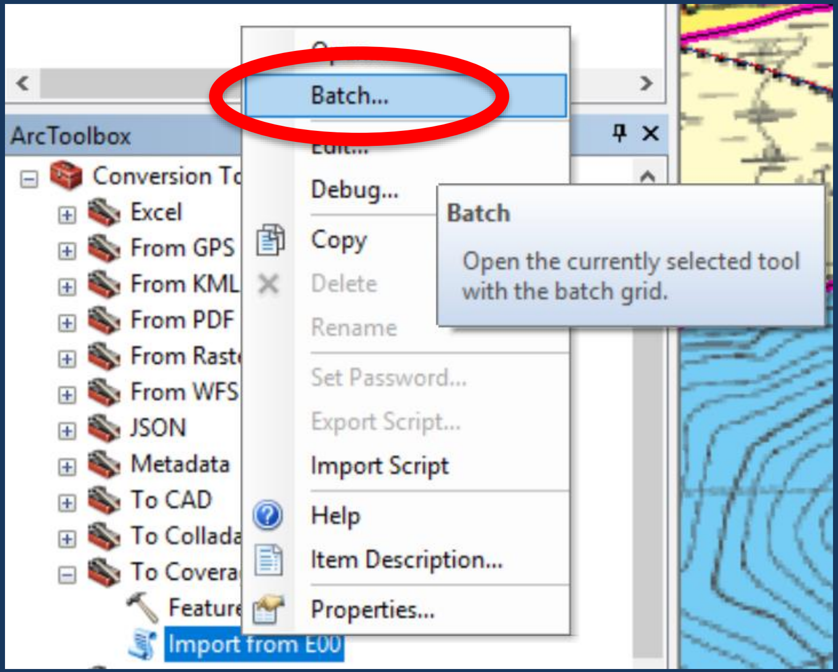


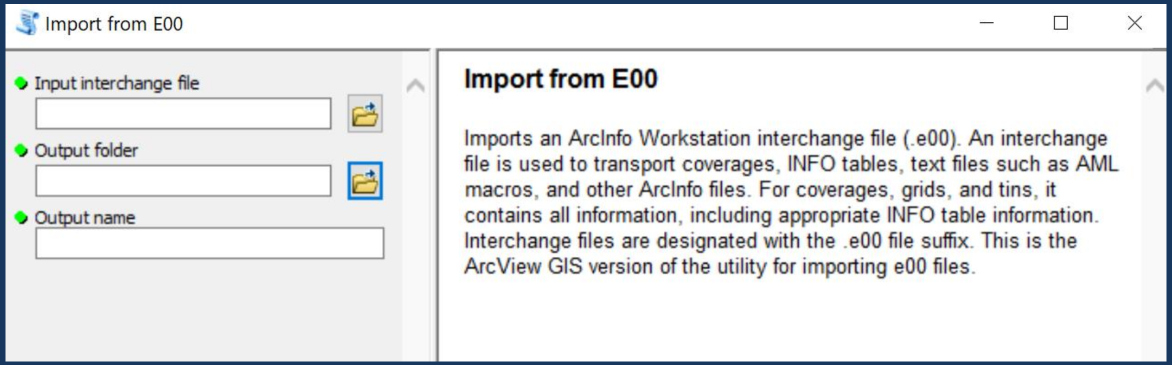
Download .zip file

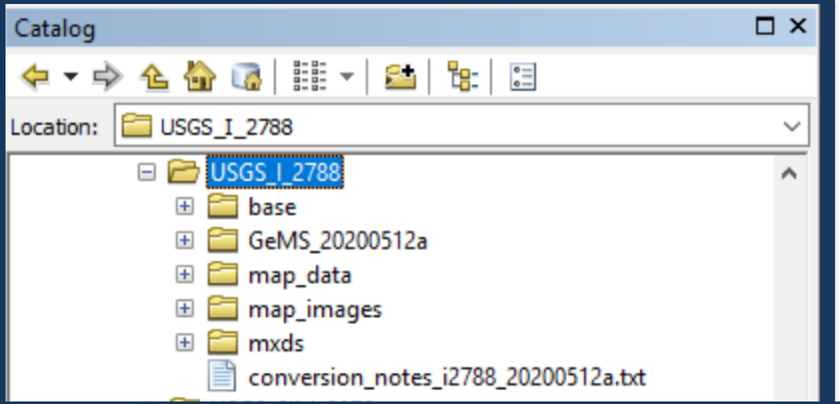


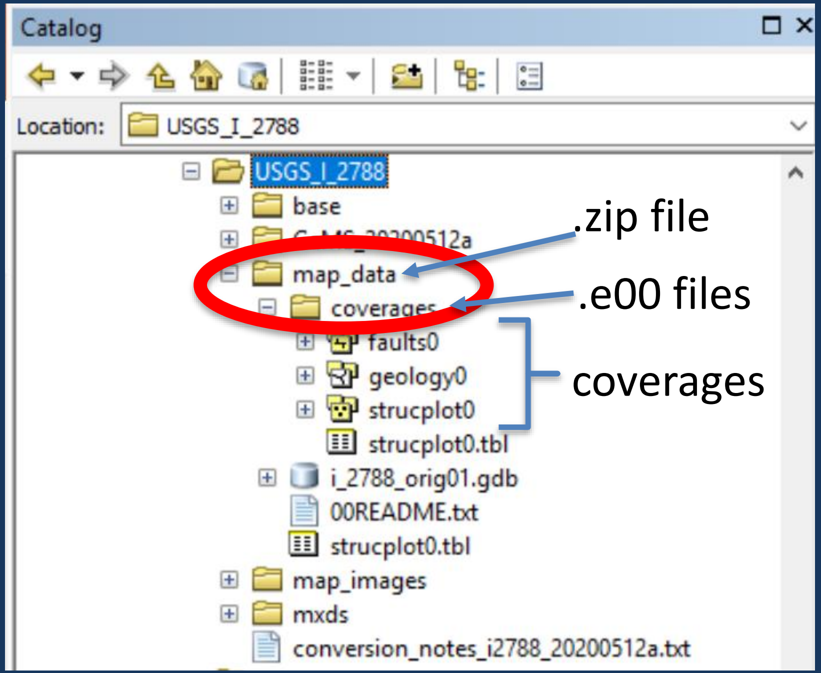
Extract .e00 files

Map Conversion: .e00 to coverage

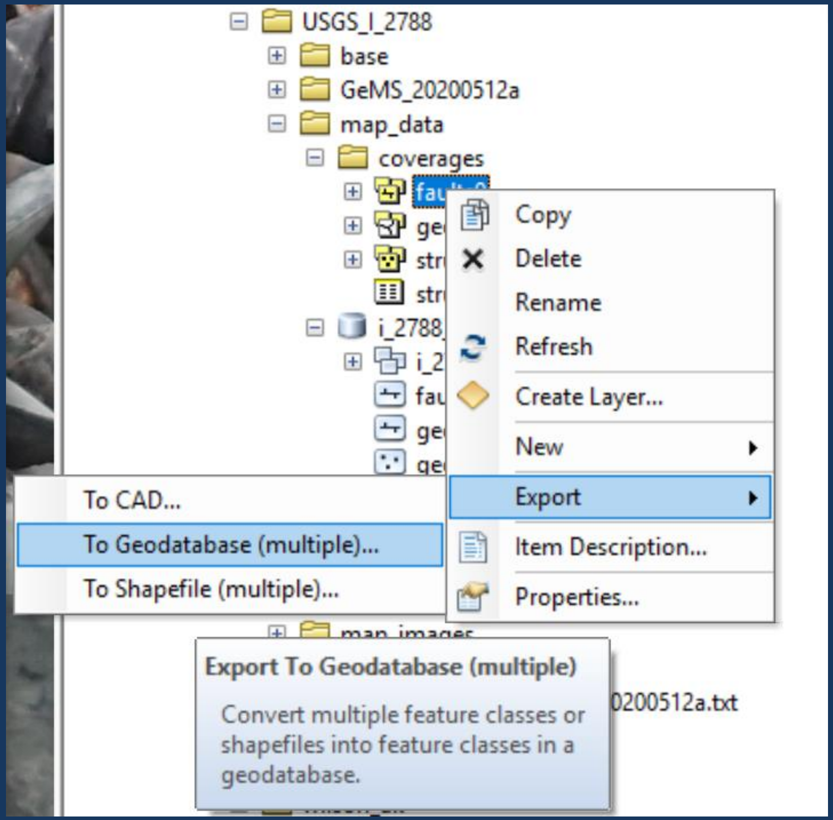


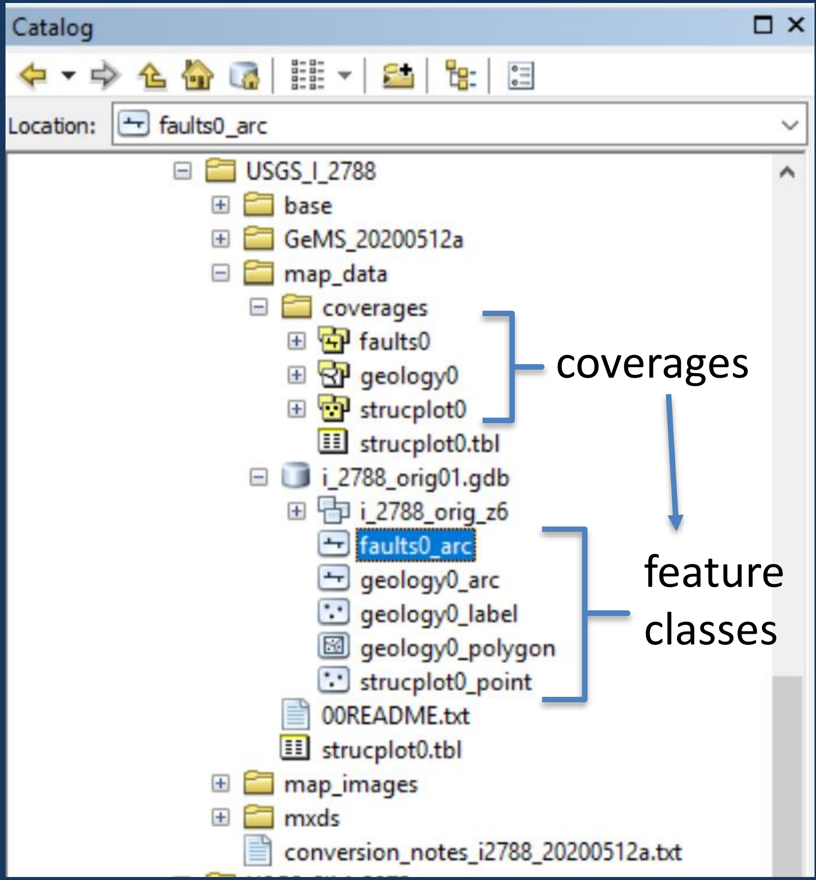




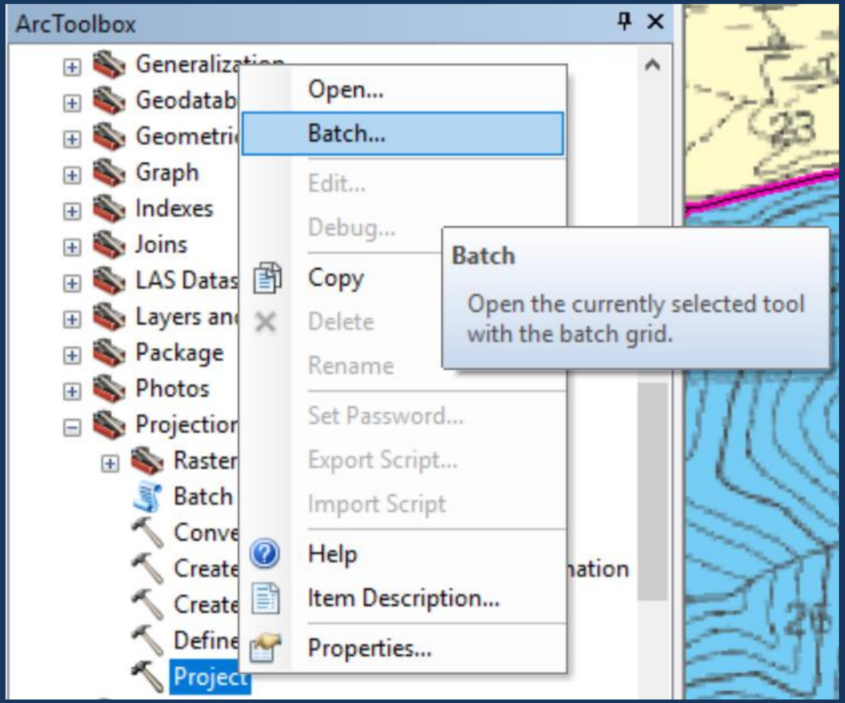


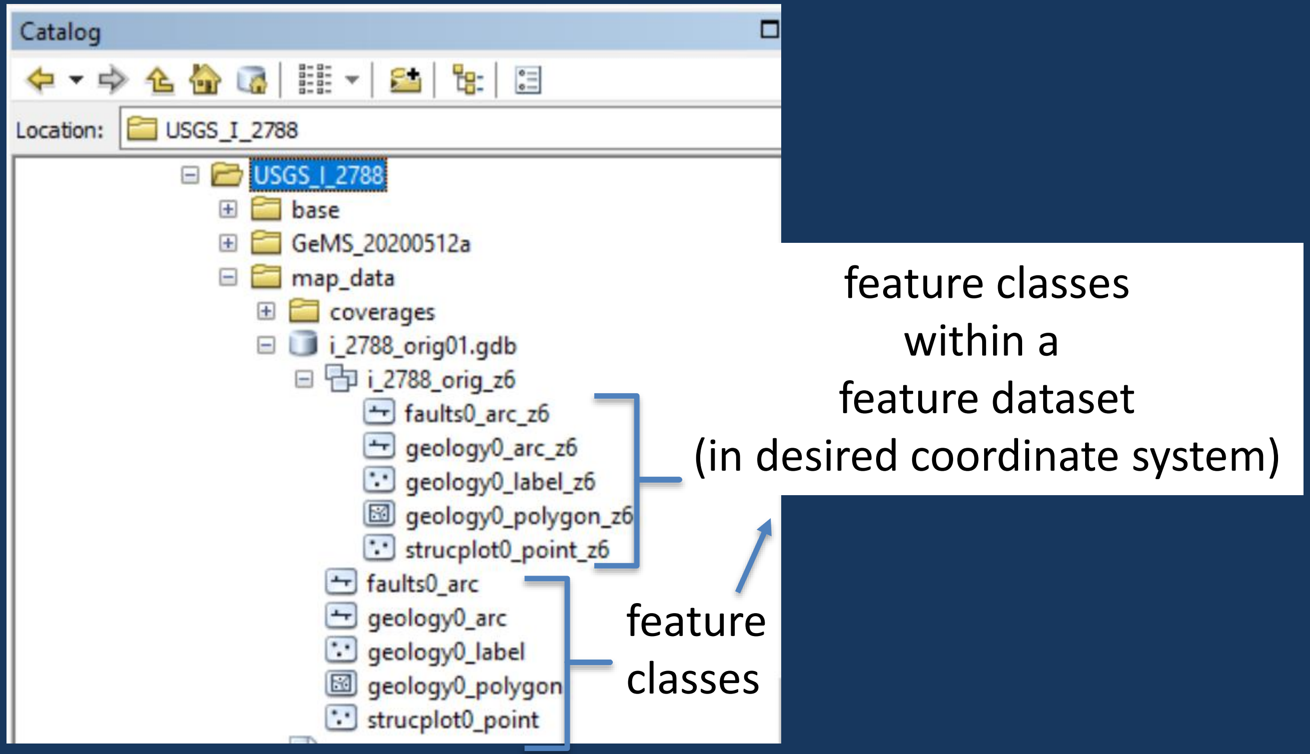
Map Conversion: coverage to .gdb



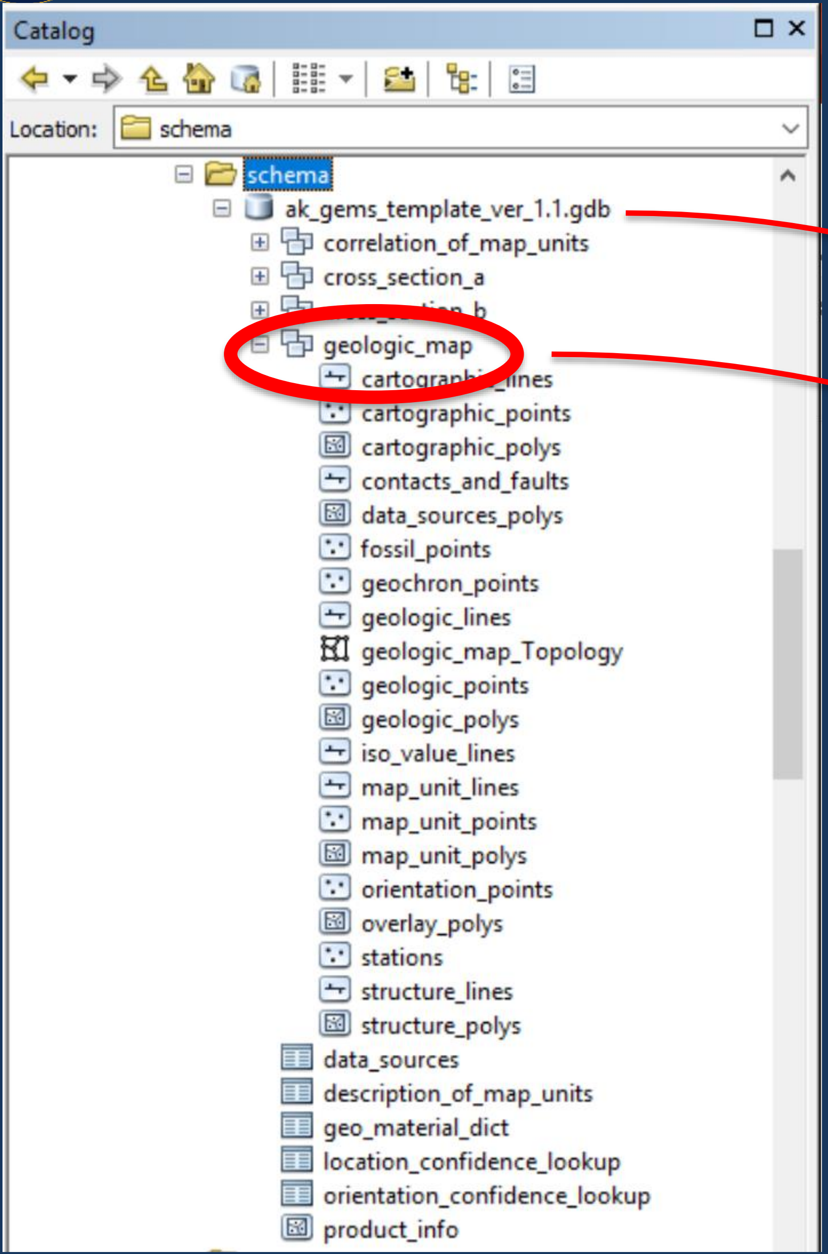


Map Conversion: Feature Class into Feature Dataset

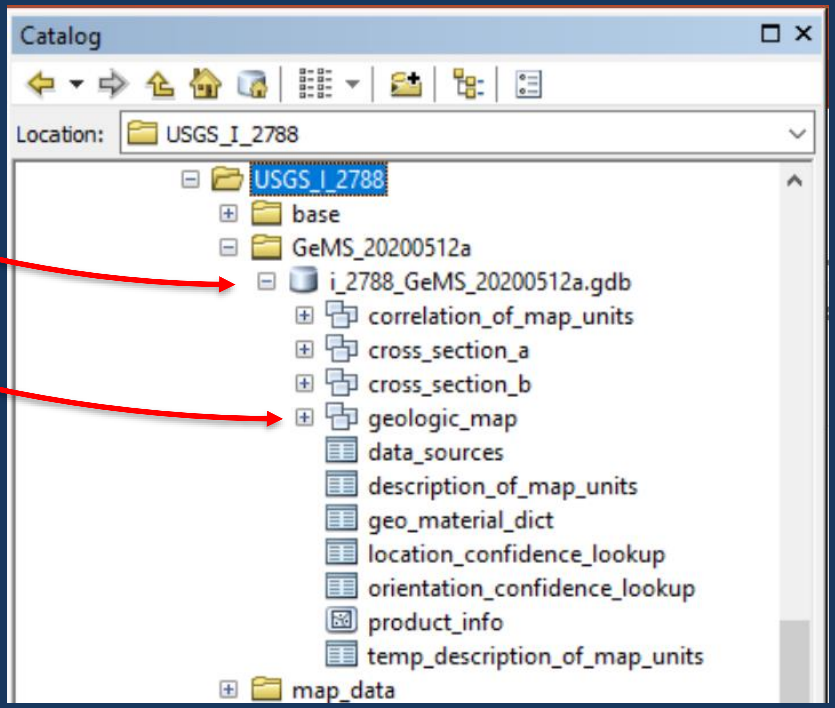




GeMS: empty schema template



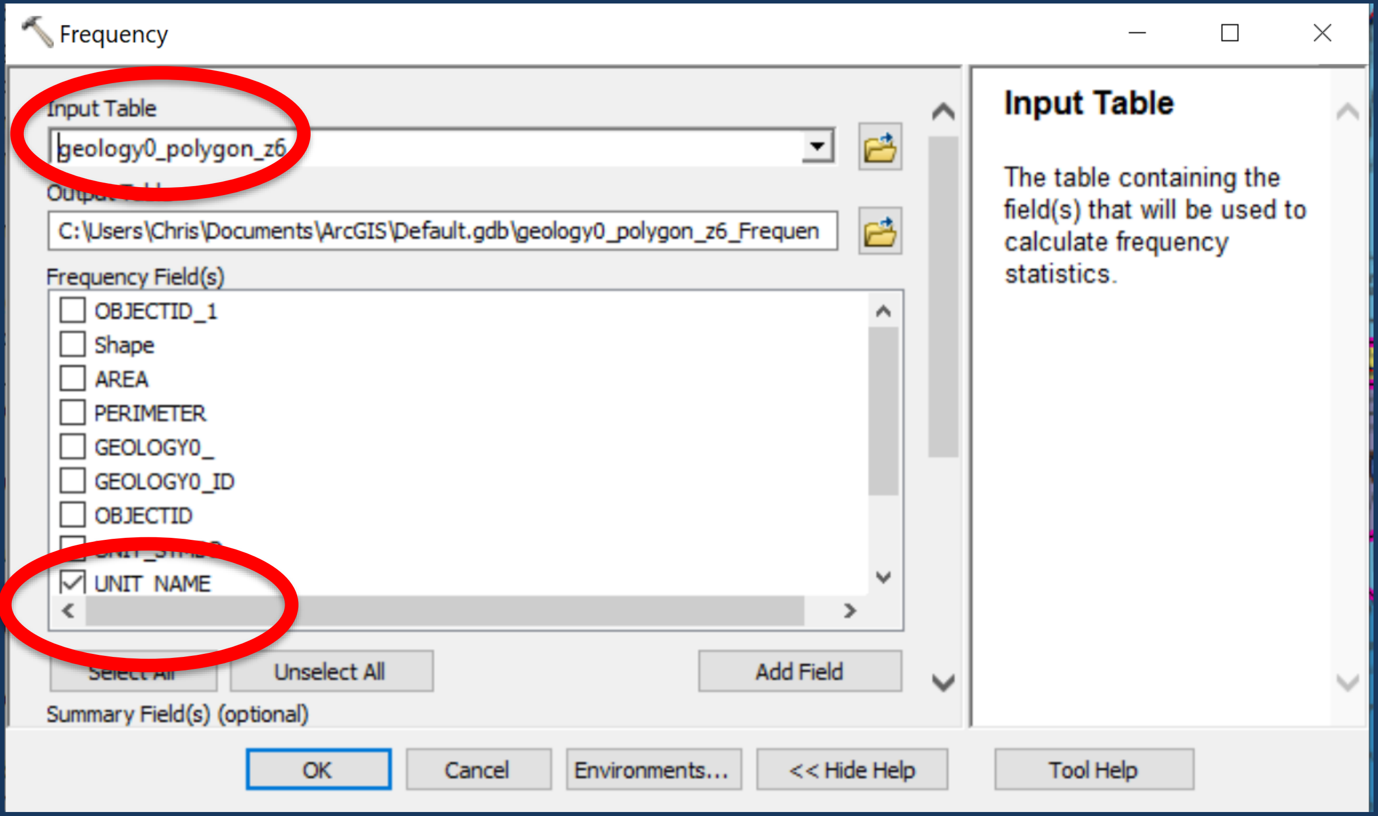
Copy/rename the
empty template geodatabase
to the working folder

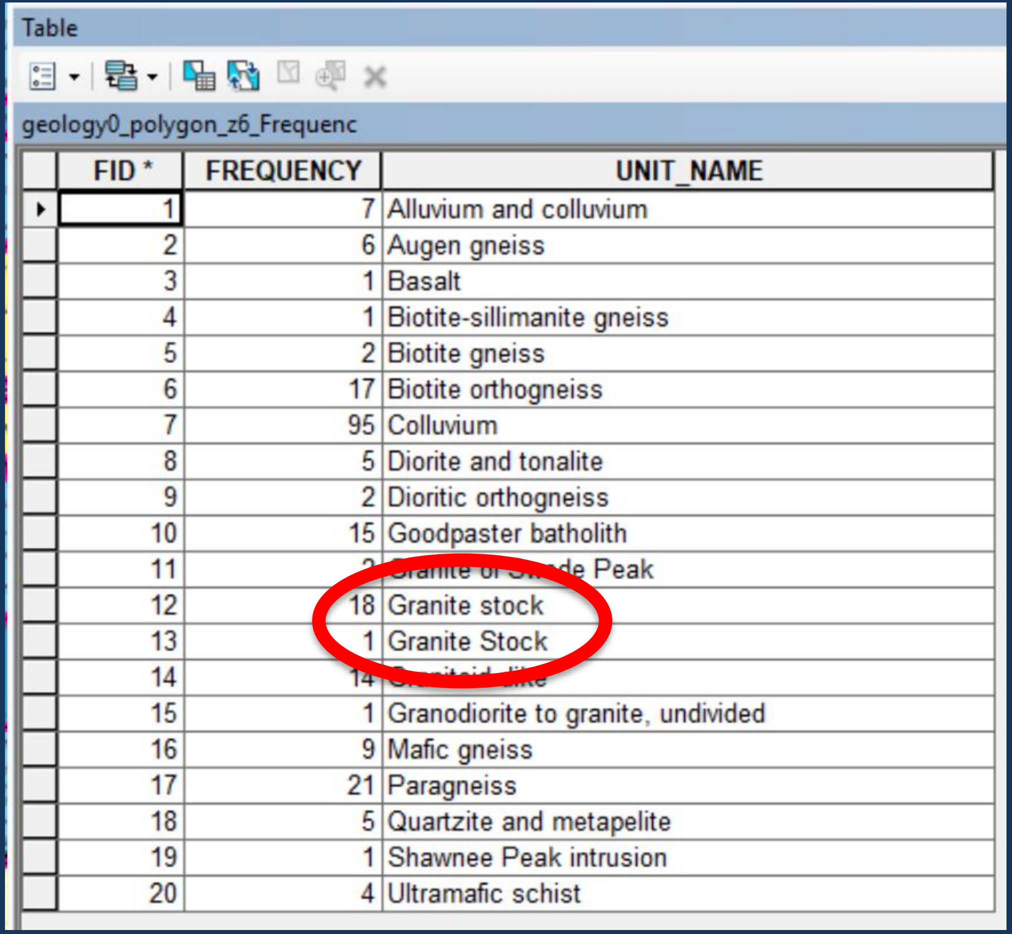


Redefine the coordinate system
of the empty
'geologic_map" feature dataset

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:





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
8	5	Diorite and tonalite
9	2	Dioritic orthogneiss
10	15	Goodpaster batholith
11	2	Granite of S[illegible]de 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

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:

Table

geology0_polygon_z6_Frequenc

FID *	FREQUENCY	UNIT_NAME
1	7	Alluvium and 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

Fields from empty GeMS DMU

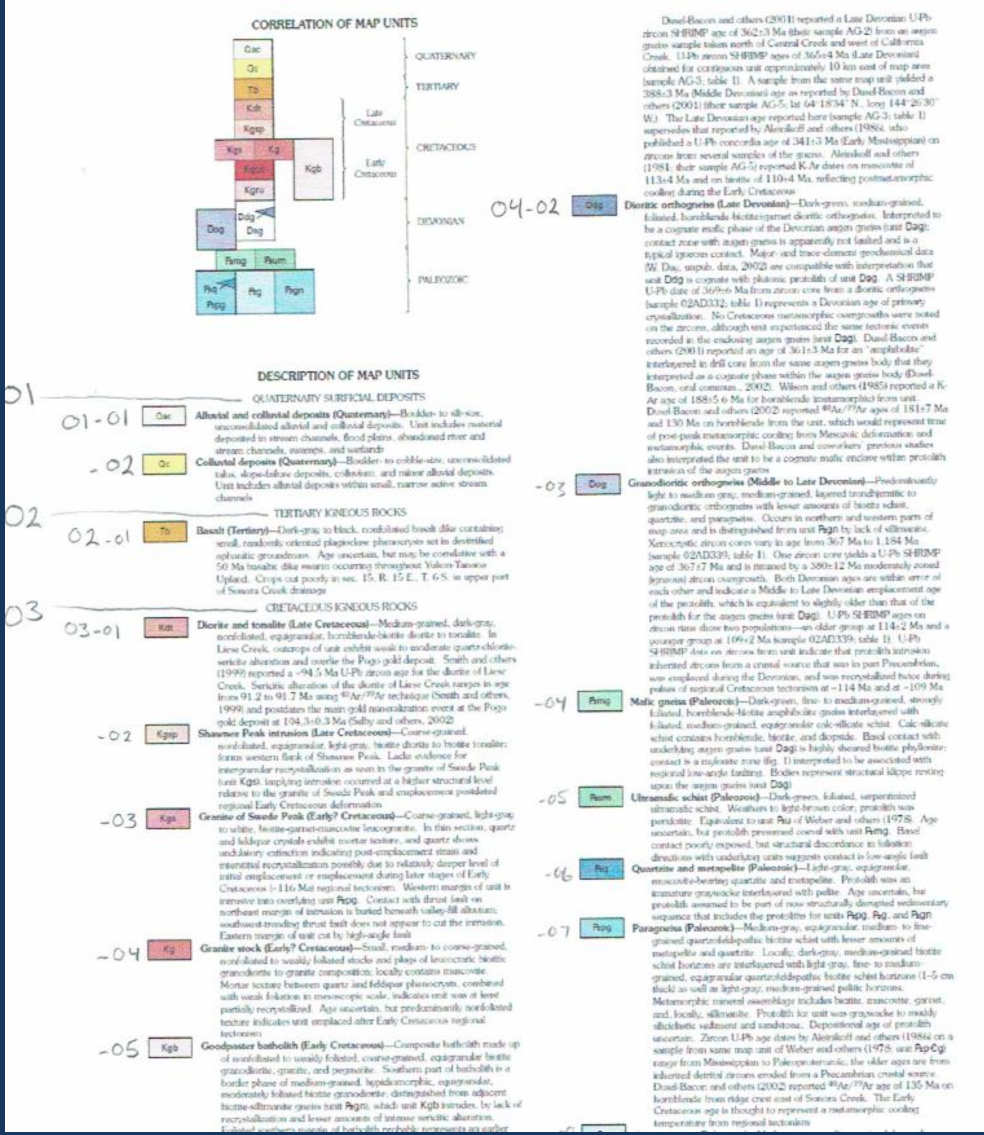
Fields from “Frequency” output table

Table

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



Table

temp_description_of_map_units

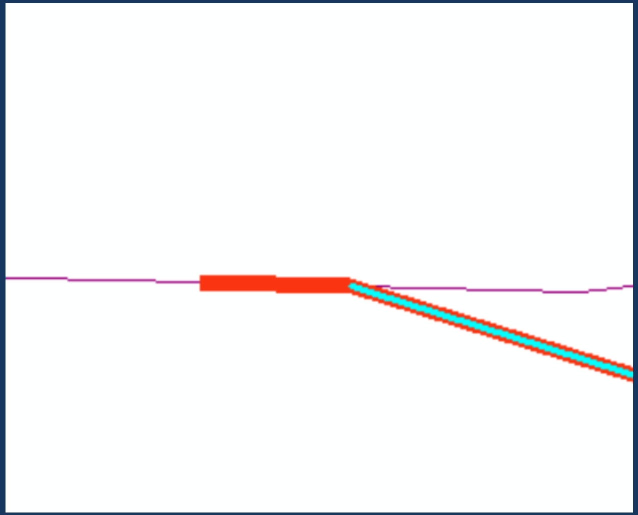
OBJECTID *	map_unit	name	hierarchy_key
21	<Null>	QUATERNARY SURFICIAL UNITS	01
1	Qac	Alluvial and colluvial deposits	01-01
7	Qc	Colluvial deposits	01-02
22	<Null>	TERTIARY IGNEOUS ROCKS	02
3	Tb	Basalt	02-01
23	<Null>	CRETACEOUS IGNEOUS ROCKS	03
8	Kdt	Diorite and tonalite	03-01
19	Kgsp	Shawnee Peak intrusion	03-02
11	Kgs	Granite of Swede Peak	03-03
12	Kg	Granite stock	03-04
10	Kgb	Goodpaster 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

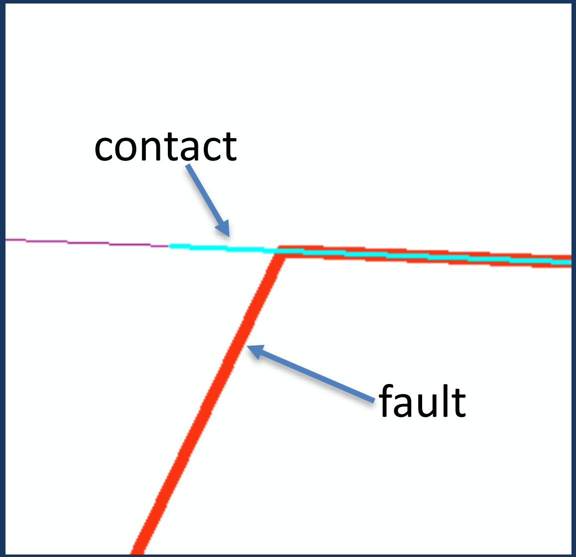
Special cases: GeMS contacts_and_faults

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





Contacts and faults are coincident but not congruent

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

Special cases: “compound” orientation_points

Table

strucplot0_point_z6

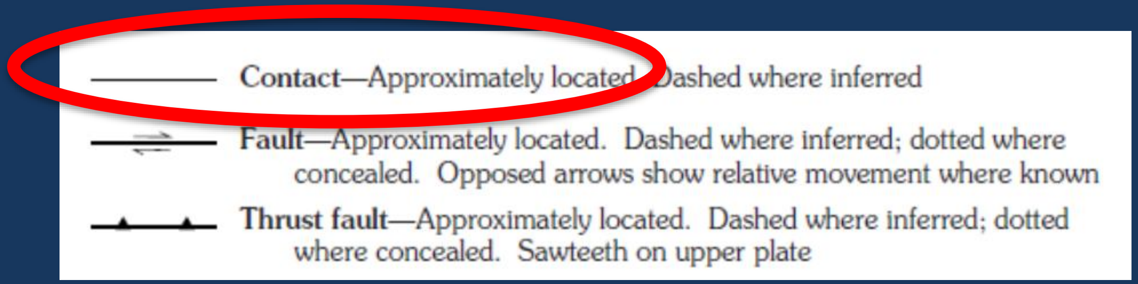
S1_STRIKE	S1_DIP	L2_TREND	L2_PLUNGE	F2_TREND	F2_PLUNGE	F3_TREND	F3_PLUNGE	POINT_TYPE
0	0	115	26	0	0	150	12	Lineation and F3 fold
0	0	85	22	0	0	85	22	Lineation and F3 fold
0	0	120	33	0	0	75	38	Lineation and F3 fold
300	56	0	0	0	0	290	26	Strike and dip of foliation and F3 fold
72	48	135	43	0	0	0	0	Strike and dip of foliation with lineation
15	54	100	35	0	0	0	0	Strike and dip of foliation with lineation
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	Strike and dip of foliation with lineation
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	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