# DIGITAL MAPPING TECHNIQUES 2023

The following was presented at DMT'23
May 21 - 24, 2023

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2023)

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

**Contracting out geologic map digitization and attribution using the GeMS standard, Version 2.0**

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Alaska Division of Geological and Geophysical Surveys
Digital Mapping Techniques 2023 – Anchorage, AK – May 22, 2023
Conference Presentation – Extended Slide Descriptions

Slide 1 – At the Alaska Division of Geological and Geophysical Surveys (DGGS) we are contracting out the digitization and partial attribution of our GeMS conversions of historical maps to partially fulfill our STATEMAP requirements. This presentation covers the lessons learned from the previous year's digitization contract and the procedure changes made for the upcoming second contract to streamline the process.

Slide 2 – Approximately half of the geologic maps for GeMS conversion from our FY22 STATEMAP grant do not have any available GIS data; therefore, those maps will have to be digitized in order to be converted to the GeMS standard.

Slide 3 – The process for obtaining a digitizing contract starts with the State of Alaska Informal Request for Proposals. This is a document that lays out all of the provided resources and contract stipulations for a successful proposal. Contractors will use this document to put together bidding proposals to accomplish this work. The proposals are then ranked and selected through the State of Alaska procurement office.

Slide 4 – For last year's project implementation the contractor received more of a "bare-bones" package of data to start the project. They were provided with a blank AK GeMS database with generic feature templates, style file, tools, scripts, and PDF copies of the maps to be digitized. Basic training on GeMS, digitization and tool use were given. Project kick off and weekly meetings were conducted through Microsoft Teams.

Slide 5 – The contractor had to set up the ArcGIS project and georeference the PDF map. They would then fill out the DMU and choose how to represent the colors, patterns, and symbols used on the map. Linework would be digitized into map_unit_points, contacts_and_faults, structure_lines, and orientation_points. Any map features that did not fit into those feature classes would be digitized into generic cartographic points, lines, or polys; DGGS would then later reclassify these items into the correct feature class and add attribution. Map_unit_polys would then be produced using a python script from the toolbox.

Slide 6 – The DGGS implemented a QA/AC process that would investigate both the linework geometry and the attribution of the features. Many emails went back and forth between the contactor and the DGGS. Attribution issues were the most common.

Slide 7 – A QC review layer was created within ArcGIS Online and could easily be shared amongst the teams. Errors could be marked and categorized with review and producer notes to make sure they were acknowledged and fixed.

Slide 8 – Review of lessons learned from the first year of contracting out the digitization and attribution of geologic maps.

Slide 9 – The current year's contract will have 11 different map projects that are a mixture of bedrock, surficial, engineering, and hazards maps. They are a mixture of full color and greyscale maps scanned at 300 dpi.

Slide 10 – Representative map with wide range of marginalia information included. Could be confusing for the contractor to know what is necessary for digitization and where to focus their efforts.

Slide 11 – Example of a DMU entry with a wide range of different lithologic units, which could make filling out the DMU especially the geologic materials field difficult for the contractor.

Slide 12 – To simplify and streamline the process we must shift our procedures and the resources that are supplied to the contractor by focusing on the strengths of each team.

Slide 13 – The contractor will focus on digitization with only essential feature attribution, while DGGS will focus on completing the attribution and full conversion to the complaint GeMS database standard. The following slides will detail the resources supplied to the contractor for the upcoming contract. Each project will have a tailor-made package specific to the geology of each map that should allow for efficiency.

Slide 14 – Geodatabases are set up and include only necessary feature classes.

Slide 15 – ArcGIS Pro projects are already set up and include correct map projections with georeferenced scanned maps supplied by the DGGS web image service.

Slide 16 – product_info polygon (thick black line around map) provides are boundary for digitization snapping; shows the extent of the needed digitization.

Slide 17 – Fully attributed DMU. No confusion by contractor in how to fill out some of the trickier fields that need extensive geologic knowledge (i.e. hierarchy_key, age fields, geo_materials, or color and patterns).

Slide 18 – Fully populate the data_sources tables from the given reference list on the map. Also allows for us to check if the sources are listed within the DGGS publications database.

Slide 19 – Introduction to feature templates that the contractor will use to digitize the map features.

Slide 20 – Use the map symbols in the legend of the “paper” geologic map to understand what features will be seen and how they will be symbolized. Using the symbology pane, add the appropriate map features by FGDC symbol code for each of the feature classes in the geologic map dataset. I changed the label to the FGDC symbol description so it will be displayed in the map contents pane later.

Slide 21 – Feature templates are managed in the Manage Template pane. You are able to set default values and mark specific fields that should prompt the user for attribution.

Slide 22 – Features are digitized using the create features pane where the templates now reside. A default tool can be set for each type of feature.

Slide 23 – Every map project has the legend digitized and symbolized, so the contractor will know which symbol is representative of each feature. Some of the older map symbols are not present within our style file, so some of them have changed.

Slide 24 – A simplified topology has been implemented to only check for errors within the contacts_and_faults feature class. The aforementioned review layer is also added to the project.

Slide 25 – DGGS will create the map_unit_polys layer after the contractor has finished digitization. The contactor is responsible for creating the contacts_and_faults linework and then putting a map_unit_points inside each bounded lithology with the map_unit name.

Slide 26 – Provided files and resources for the contractor.

Slide 27 – Each project will contain a map specific document with digitizing notes. These notes contain tips and what to look for in each map, the feature classes, the features present in the map with their DGDC style code, and guides on filling out the essential attributes.

Slide 28 – A project was built with scanned map images for all of the maps included within the digitizing proposal. Maps are sourced from the DGGS web service.

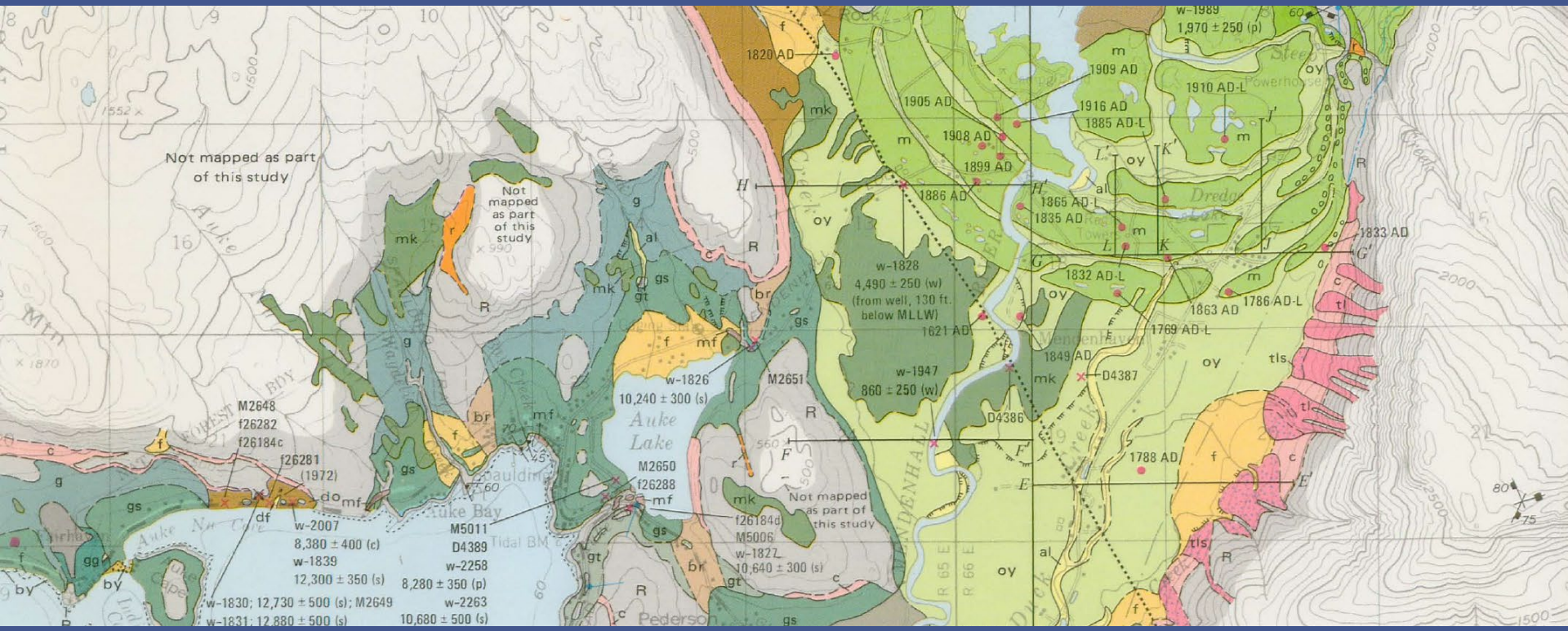
Slide 29 – Web Map provided on AGOL during the contract bidding process.

Slide 30 – Resources provided to the contractor during the first digitization contract trial.

Slide 31 – Resources provided to the contractor in the upcoming year's digitization contract. More resources and upfront planning provided based on last year's feedback.

Slide 32 – General overall summary of the project.

# Contracting out geologic map digitization and attribution using the GeMS standard, Version 2.0





## Wes Buchanan and Chris Wyatt

Alaska Division of Geological and Geophysical Surveys


Digital Mapping Techniques 2023

Anchorage, AK

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# FY22 STATEMAP GeMS Conversions

22 GeMS conversion projects from previous publications

50/50 – **Has** legacy GIS data versus **No** GIS data available

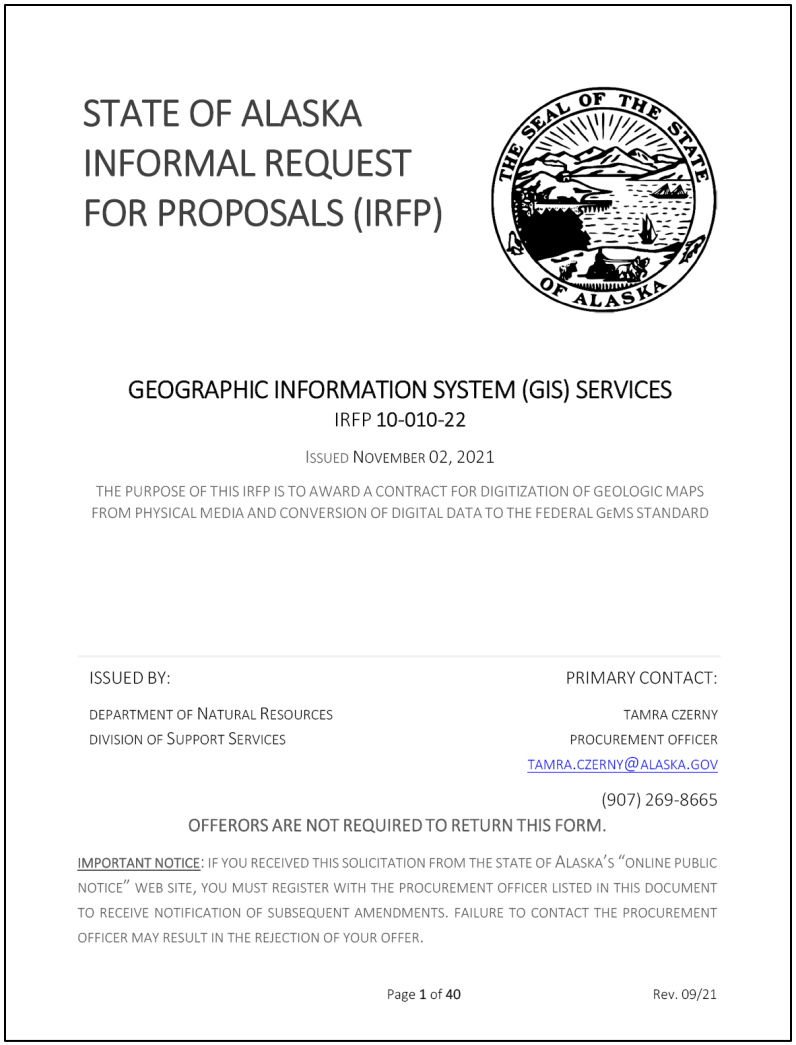

Digitization of map features needed for conversion to GeMS standard

Elected to contract out digitization – 2nd year changes in approach

# Version 1.0/2.0 – Starting the Process

Request for Proposals

- Bidding procedures
- Billing details
- Minimum experience: 6 months of geoscience position working with maps and 2 years of GIS
- Technology requirements
- Documentation and available data
- Completion timetables
- Deliverables
- Communication expectations



STATE OF ALASKA
INFORMAL REQUEST
FOR PROPOSALS (IRFP)

GEOGRAPHIC INFORMATION SYSTEM (GIS) SERVICES
IRFP 10-010-22

ISSUED NOVEMBER 02, 2021

THE PURPOSE OF THIS IRFP IS TO AWARD A CONTRACT FOR DIGITIZATION OF GEOLOGIC MAPS FROM PHYSICAL MEDIA AND CONVERSION OF DIGITAL DATA TO THE FEDERAL GEMS STANDARD

ISSUED BY:
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF SUPPORT SERVICES

PRIMARY CONTACT:
TAMRA CZERNY
PROCUREMENT OFFICER
TAMRA.CZERNY@ALASKA.GOV
(907) 269-8665

OFFERORS ARE NOT REQUIRED TO RETURN THIS FORM.

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# Version 1.0 – Project Implementation

Documentation

- GeMS and AK GeMS docs
- FGDC cartographic standard

Resources and Data

- Blank GeMS Geodatabase
- Link to map's DGGS citation page
- General feature templates
- Style file
- Tools and scripts

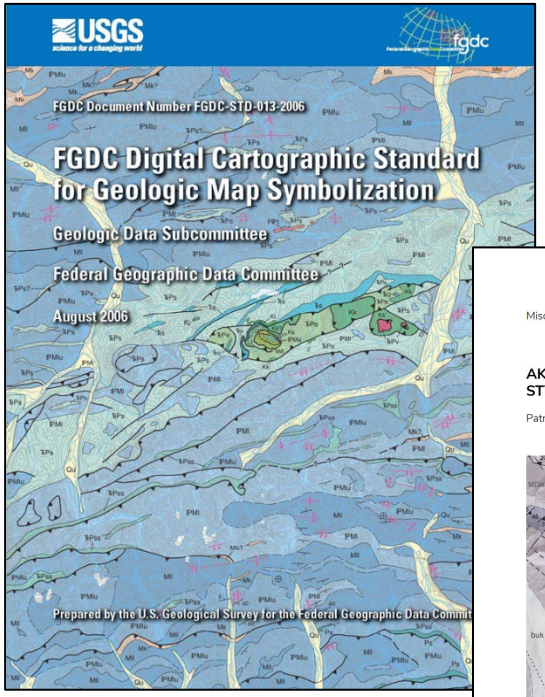
Training

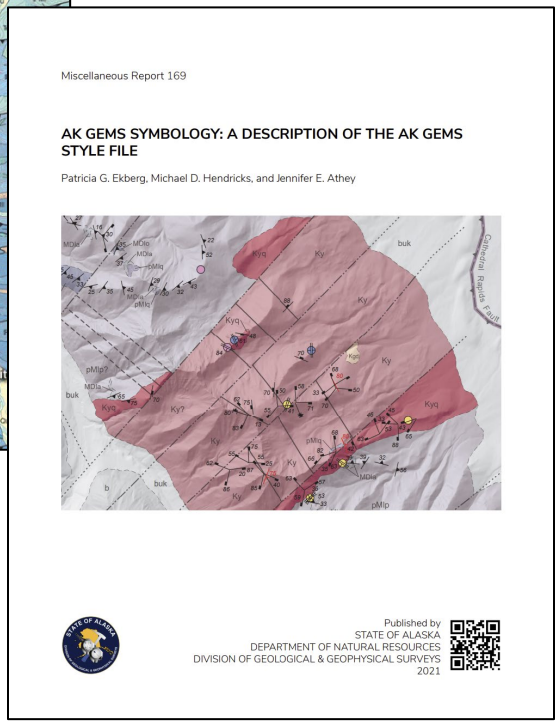
- 2 hours of GeMS basics
- Digitizing tips/tool use

Communication

- MS Teams meetings

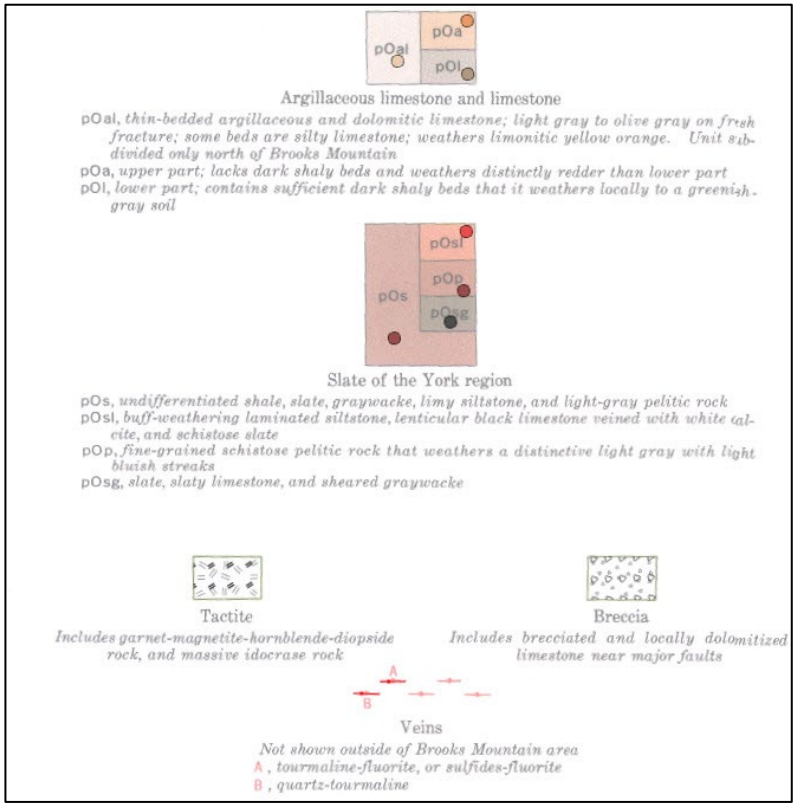
***AK GeMS – Extension to the GeMS standard with additional attribute fields and feature classes***



# Version 1.0 – Digitizing Process

- Color/Patterns/Symbols – Figure out how to represent map features
- Fit data into generalized feature templates
- Contacts and faults linework
- Map unit points
- Build Polygons – toolbox script




**Simplified AK GeMS**

Heads-up digitized linework into AK GeMS feature classes:

- map unit points
- contacts and faults
- structure lines
- orientation points

- cartographic points
- cartographic lines
- cartographic polys

# Version 1.0 – DGGS Quality Control Process

Map Geometry QC

- Visual scan/inspection at 2-3 times scale
- Topology Error Inspector

Attribute QC

- Every field in every table gets, at least, a glance
- Sort by different fields/attributes and spot check. Multiple errors lead to more thorough investigation

**From:** Wyatt, Chris (DNR)
**Sent:** Thursday, April 28, 2022 2:21 PM
**To:** Lars Arneson
**Subject:** council_surficial .gdb review notes

Hi Lars-- Here are some notes for the council_surficial map .gdb"
A few of these are marked on the review_items_point layer, too, attribute issues mostly.

Some of these might apply to big_hurrah_surficial as well? I'll start looking at that .gdb next.

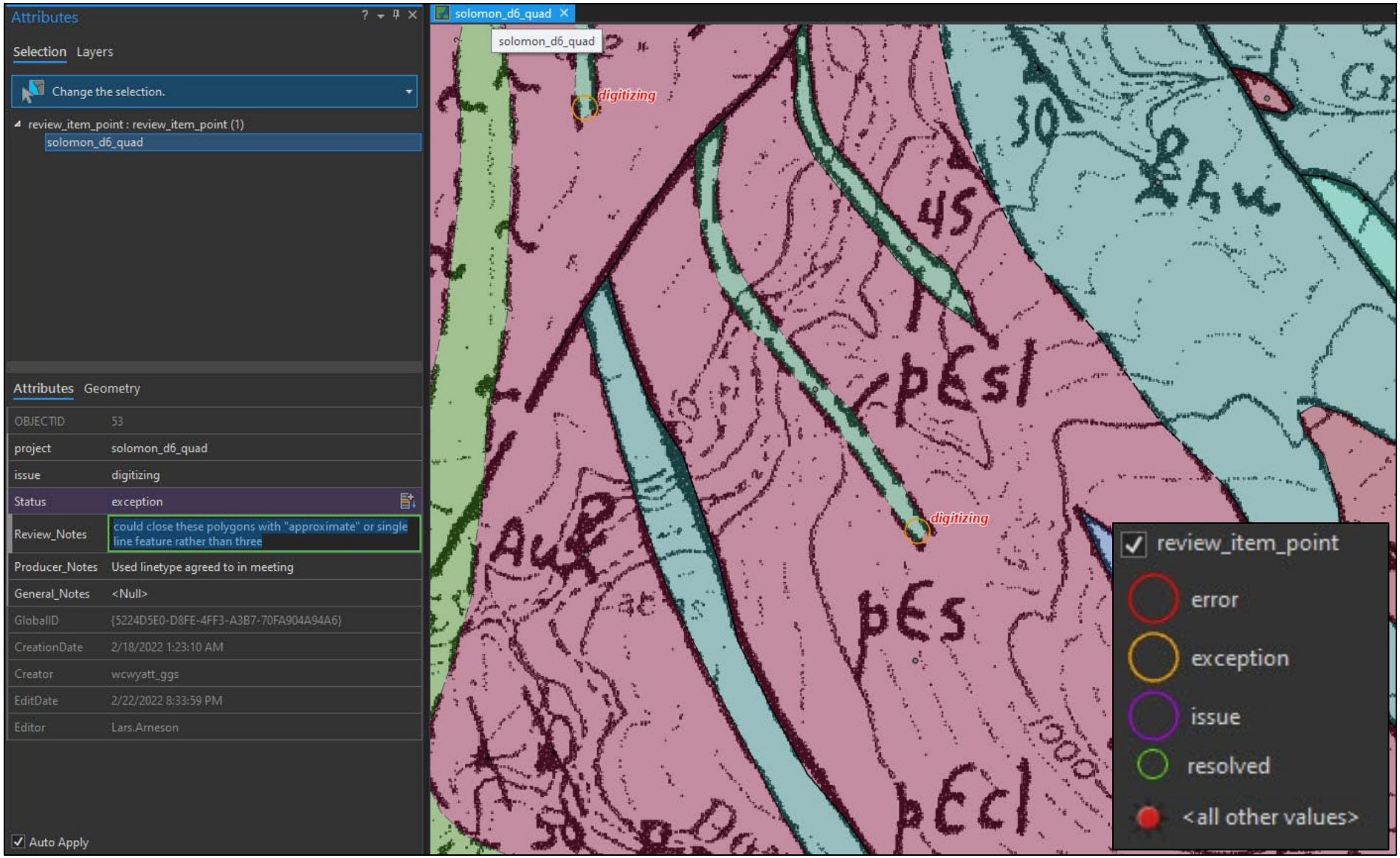
contacts_and_faults
typo in 'notes' field: "approximate"
set the notes field to match the raster PDF "MAP SYMBOL" description for these, since it's not clear from the FGDC symbol or category/type: "Photointerpreted contact – Approximately located"
'layer' field: contacts/faults that touch surficial polygons are layer = 1
contacts/faults that touch only bedrock polygons are layer = -1
faults are almost always a bedrock feature, or layer = -1
boundary = 0
This is a little tricky to assign, with a series of select-by steps to separate the surficial and bedrock features; I can populate 'layer' or show you how I do it.

map_unit_polys
'layer' field: surficial polygons are layer = 1
bedrock polygons are layer = -1
water is layer = 1
Where map_unit_polys 'label' is queried with "?", set map_unit_polys 'identity_confidence' to "questionable"

geologic_lines
flow direction indicators are missing attributes

# Version 1.0 – QC Review Layer - AGOL

Pre-Cambrian slivers digitized as parallel lines instead of polygons – lacking geologic knowledge

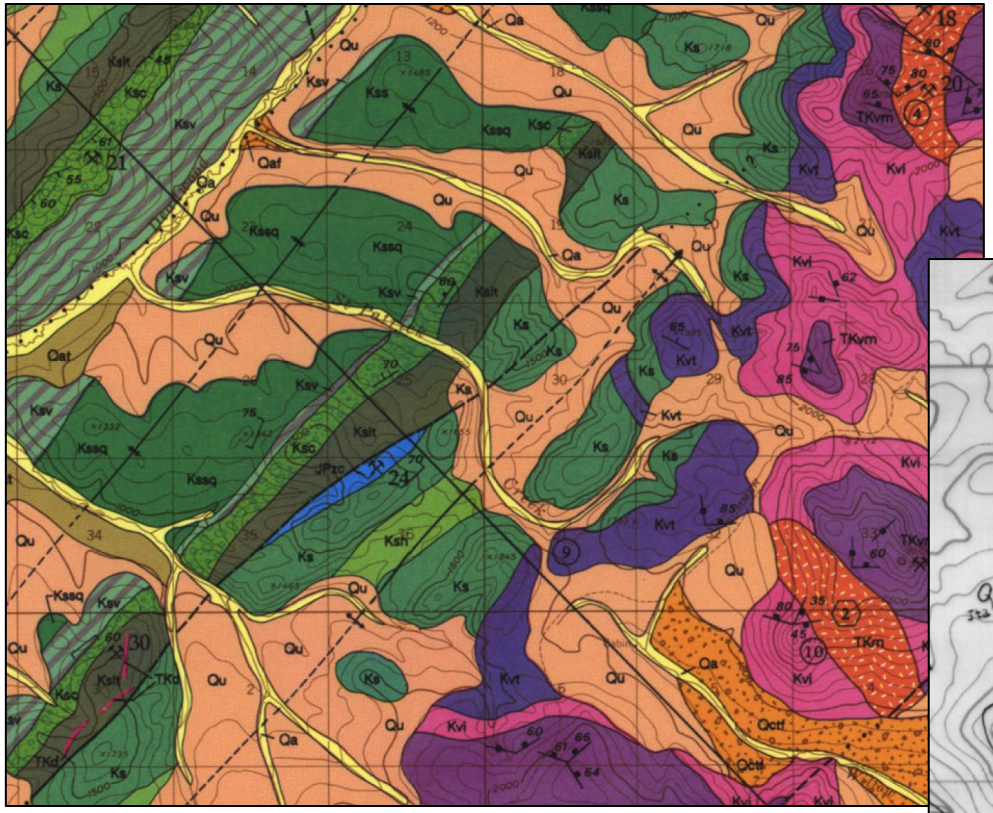


# Version 1.0 – Lessons Learned

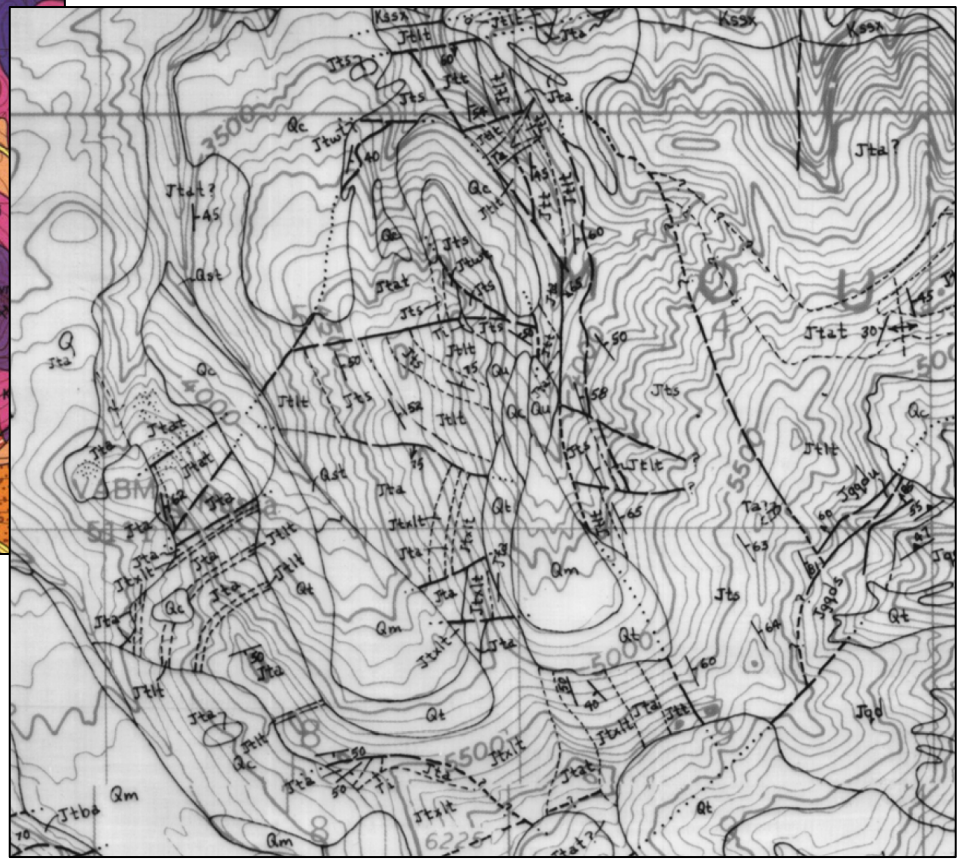
- Several map projects needed to understand categorizing/symbolizing features
- GIS proficiency is a must for the contractor (digitizing basics/portal use/data sharing)
- Geologic knowledge and map aptitude requirements could be stronger
- General feature templates provided were very helpful
- Contractor spent a lot of time digging through documentation
- Provided trainings could be broken down and progressively move into deeper topics
- Need standards for digitizing linework (vertex density)
- QC review layer on AGOL was very effective
- Communication with MS Teams was efficient

# Version 2.0 – Geologic "Paper" Map to Geodatabase

Digitization of 11 map projects (13 total sheets)
Mixture of bedrock, surficial, engineering, and hazard maps

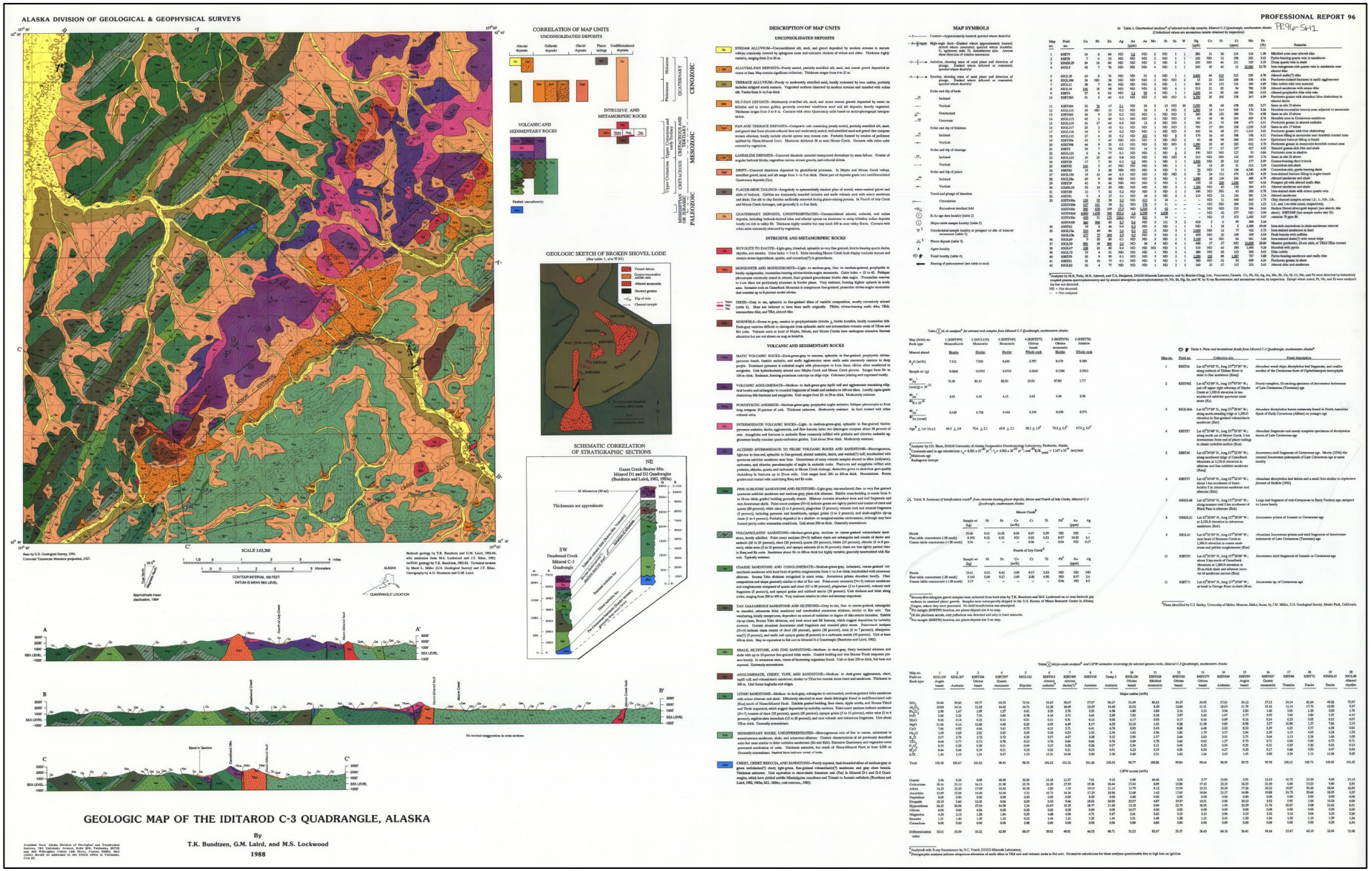


Full color and greyscale

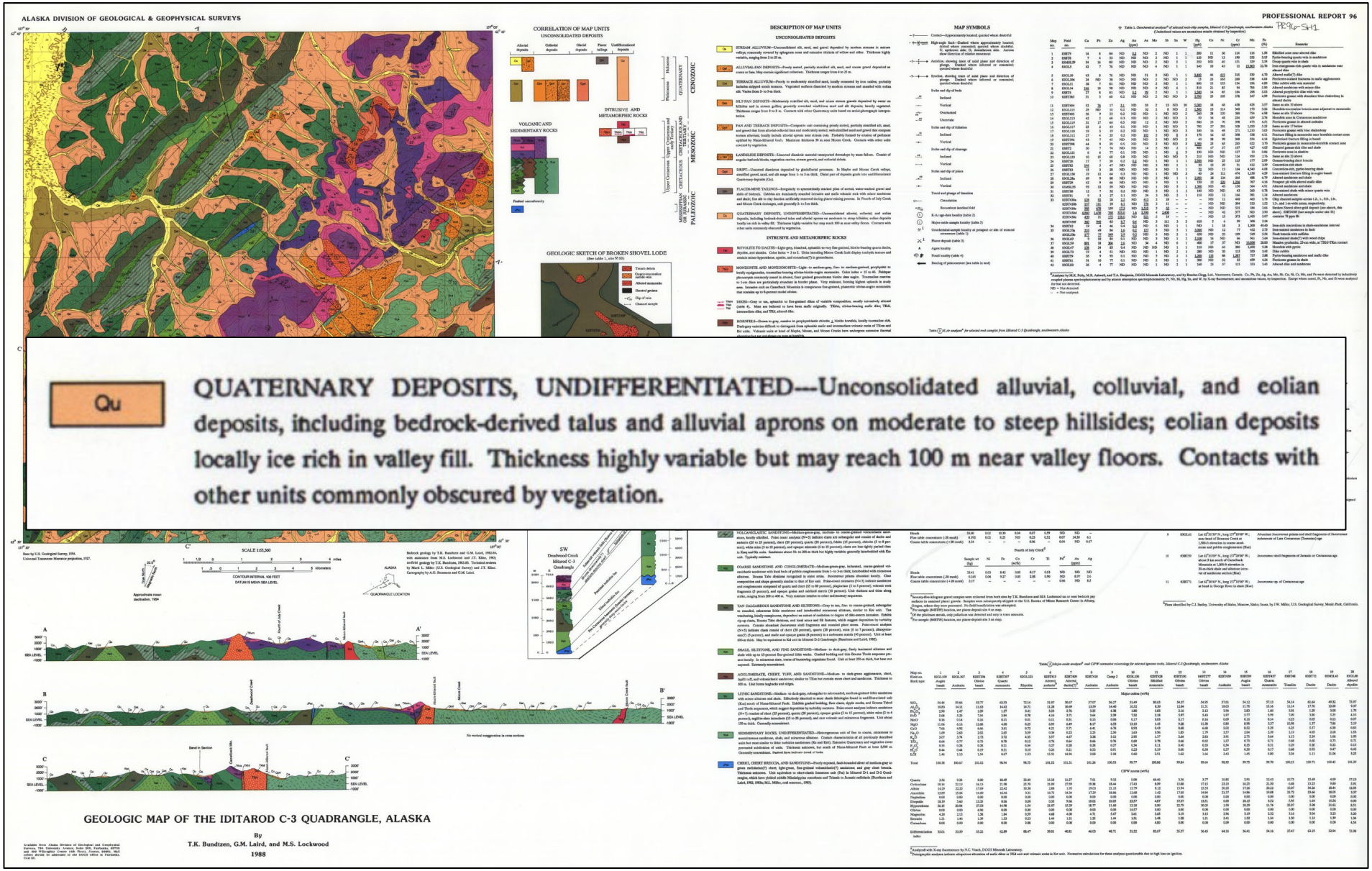


300 DPI resolution scans

# Representative Map for Digitization/Conversion



# Representative Map for Digitization/Conversion



# Version 2.0 – Shift in Procedures

Play to the strengths of the teams involved

**DGGS Strengths**

- Experienced with GeMS (56 GeMS compliant publications to date)
- Knowledge of Alaskan geology
- Understanding of geodatabase structure
- Quicker problem solving for categorizing and attributing feature data

**Contractor Strengths (hopeful)**

- ArcGIS proficiency
- Ability for narrower task focusing (DGGS can be a hectic/busy place)
- Precise and accurate digitizing skills

# Version 2.0 – Digitization/Conversion Streamlining

Project Design Aspirations

- Remove ambiguity for the contractor and reduce GeMS learning curve
- Create procedures to capitalize on strengths and maximize efficiency in order to reduce costs, project timelines, and DGGS time commitments (clarifications/QC)

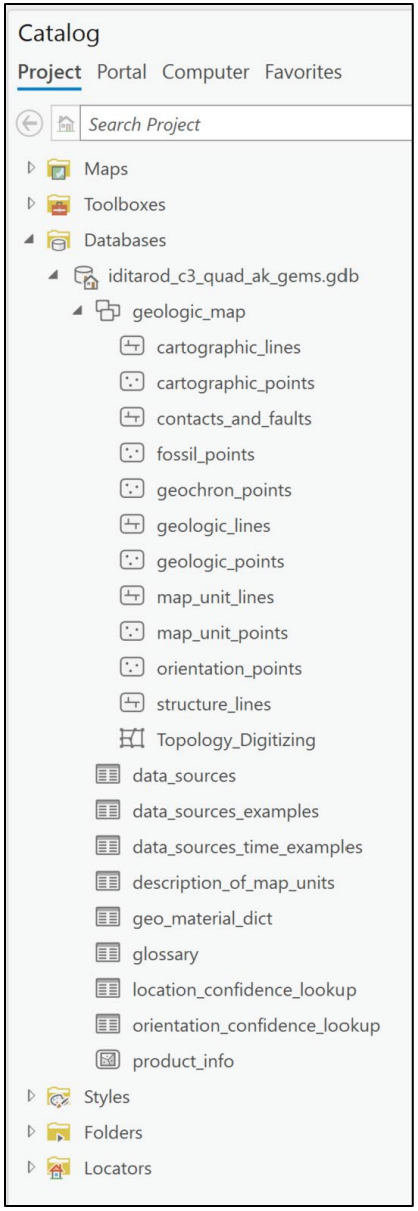
Implementation Plan

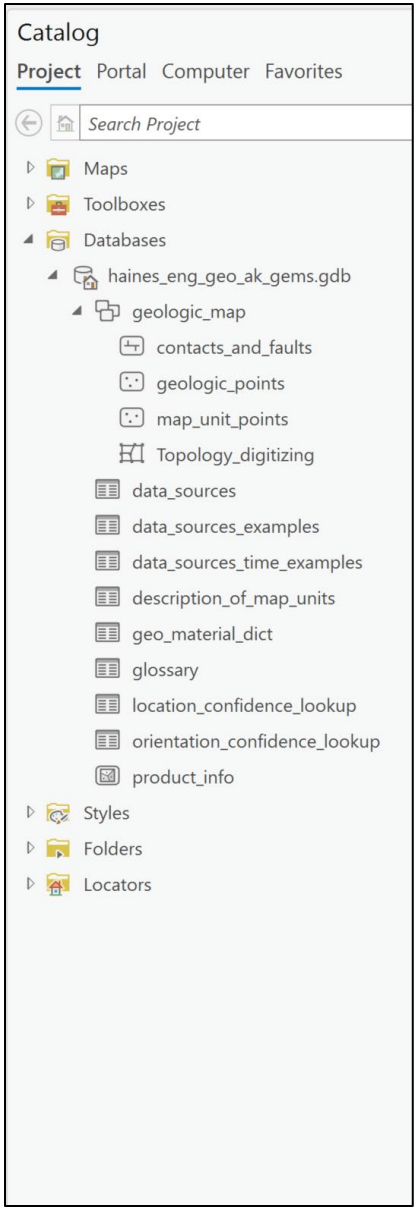
- The contractor will focus on the digitization with only essential feature attribution
- DGGS will focus on complete feature attribution and full map conversion
- Tailor make map specific packages for each conversion project based on geology
- Provide upfront the resources needed for the project - from **bidding** to **completion**

# Version 2.0 - Geodatabase

Each project has an associated geodatabase

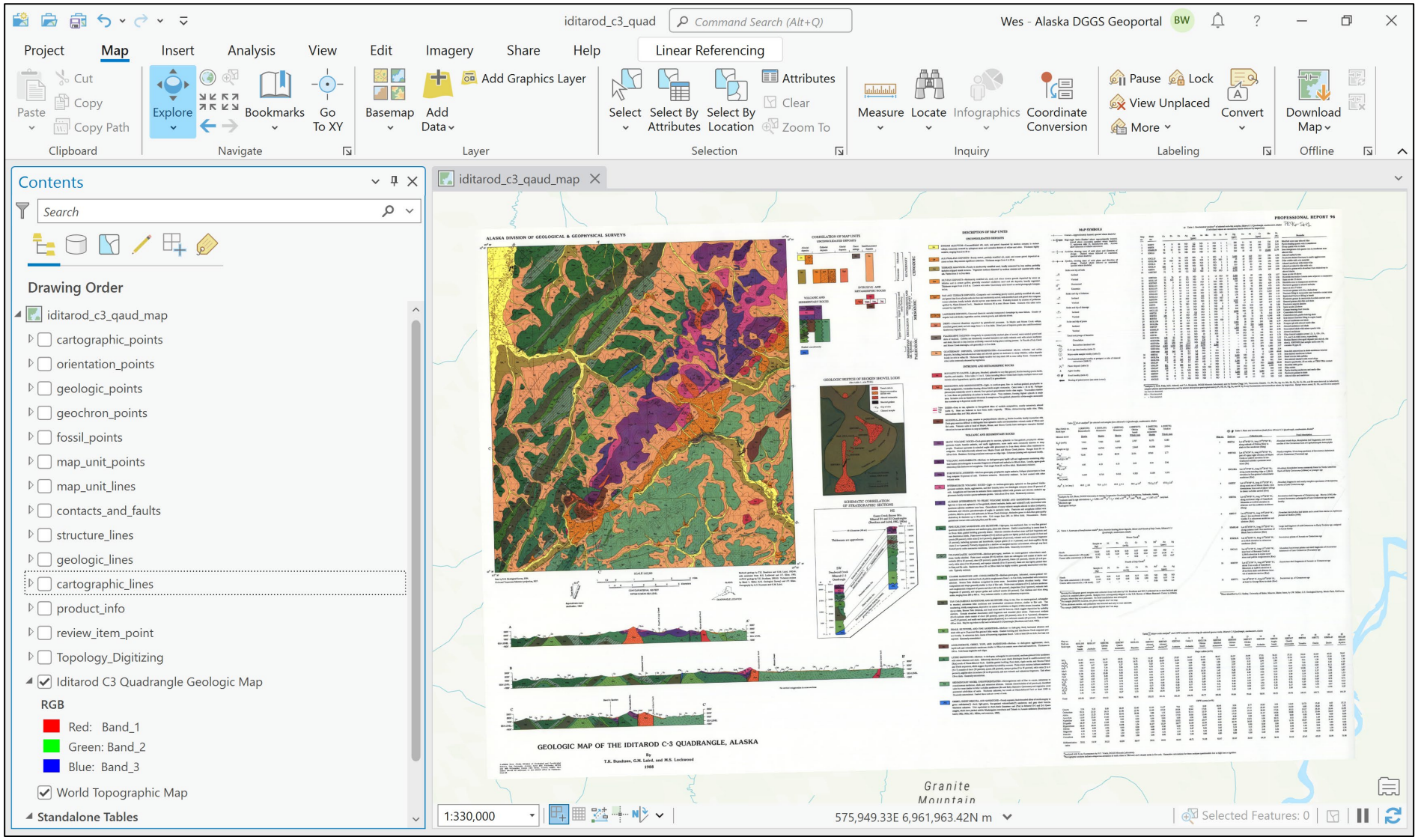
- Geodatabase has project “nickname”
- Geologic map feature dataset has correctly projected coordinate system
- Only needed feature classes are present
- Digitization directly into appropriate AK GeMS feature class
- Editor tracking enabled



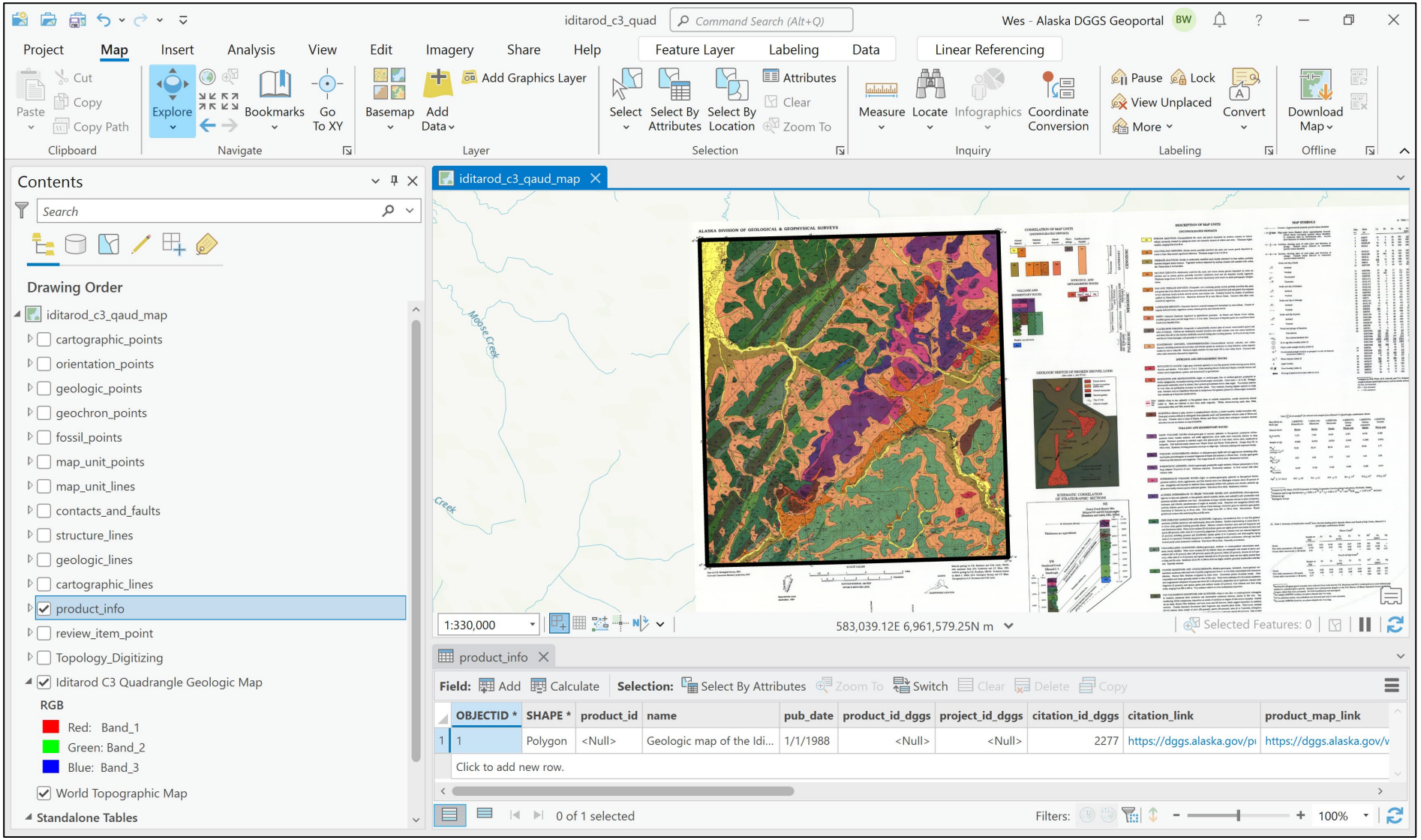
# Version 2.0 – Prebuilt ArcGIS Pro Projects

- Correctly projected map frame
- Georeferenced scanned map from DGGS web service



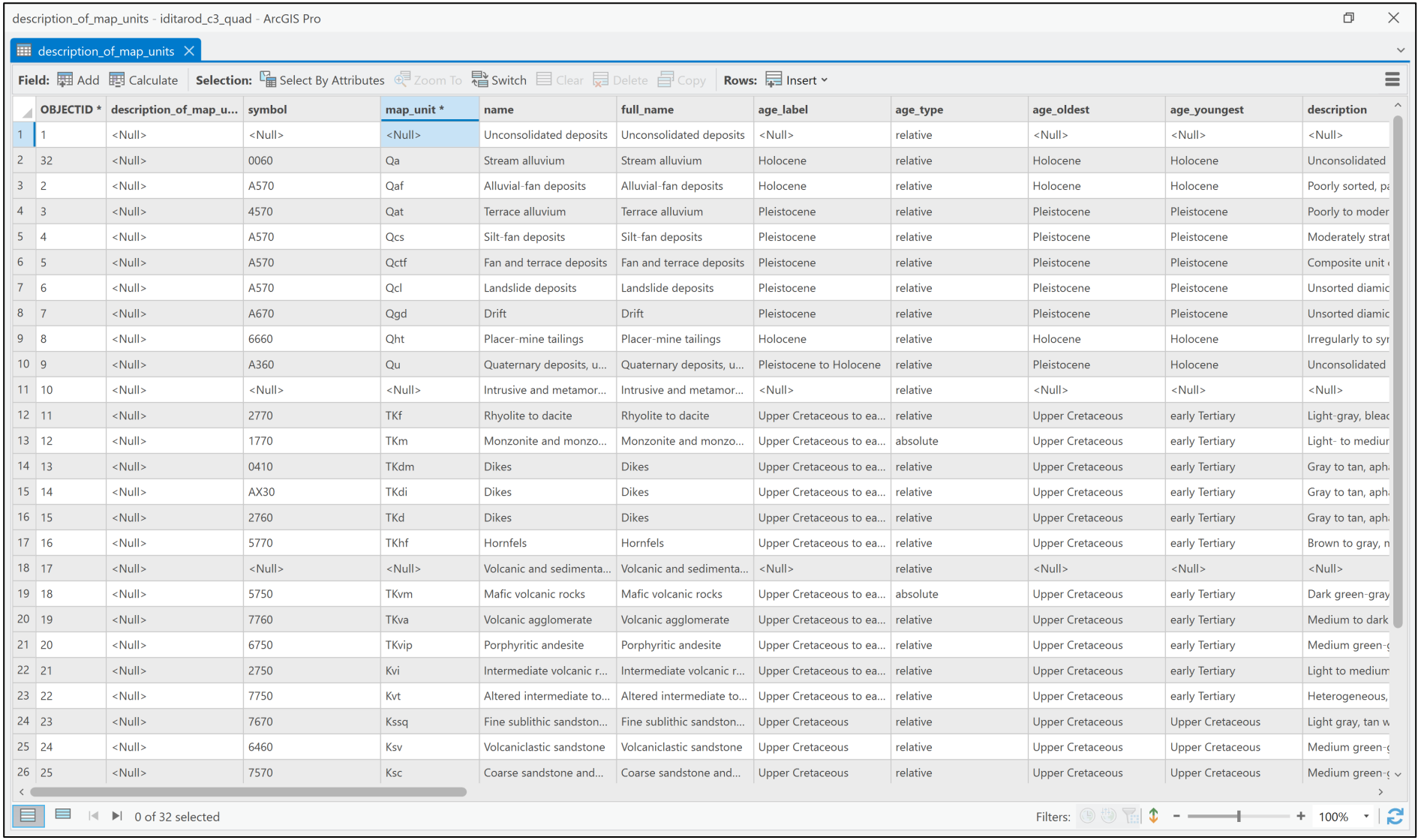
# Version 2.0 – product_info (AK GeMS specific)

- Digitized and attributed
- Provides map boundary for line digitization snapping



# Version 2.0 – description_of_map_units

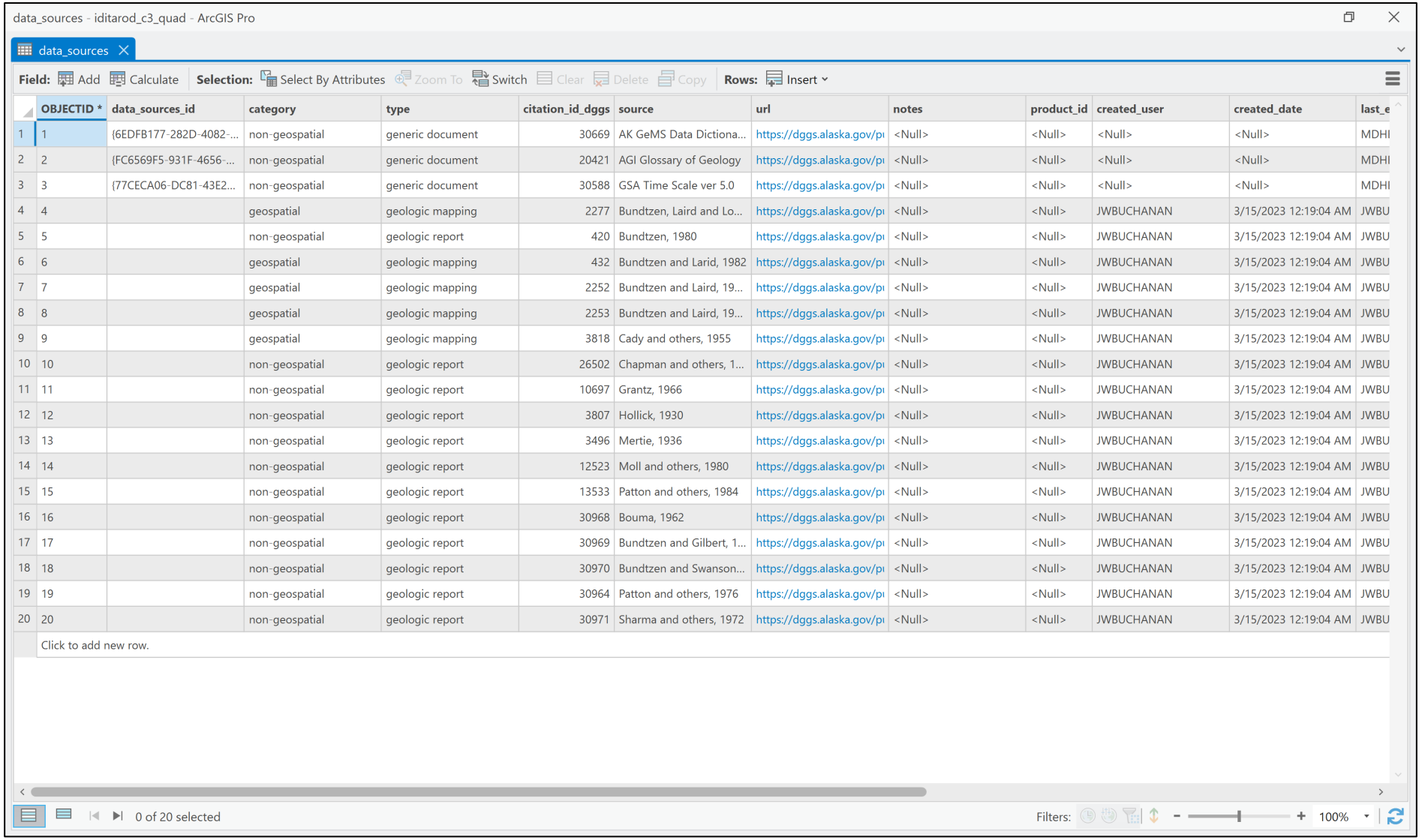
- Fully attributed
- Issues avoided: hierarchy_key, age fields, geo_materials, colors/patterns




| | OBJECTID * | description_of_map_u... | symbol | map_unit * | name | full_name | age_label | age_type | age_oldest | age_youngest | description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | <Null> | <Null> | <Null> | Unconsolidated deposits | Unconsolidated deposits | <Null> | relative | <Null> | <Null> | <Null> |
| 2 | 32 | <Null> | 0060 | Qa | Stream alluvium | Stream alluvium | Holocene | relative | Holocene | Holocene | Unconsolidated |
| 3 | 2 | <Null> | A570 | Qaf | Alluvial-fan deposits | Alluvial-fan deposits | Holocene | relative | Holocene | Holocene | Poorly sorted, pa |
| 4 | 3 | <Null> | 4570 | Qat | Terrace alluvium | Terrace alluvium | Pleistocene | relative | Pleistocene | Pleistocene | Poorly to moder |
| 5 | 4 | <Null> | A570 | Qcs | Silt-fan deposits | Silt-fan deposits | Pleistocene | relative | Pleistocene | Pleistocene | Moderately strat |
| 6 | 5 | <Null> | A570 | Qctf | Fan and terrace deposits | Fan and terrace deposits | Pleistocene | relative | Pleistocene | Pleistocene | Composite unit ( |
| 7 | 6 | <Null> | A570 | Qcl | Landslide deposits | Landslide deposits | Pleistocene | relative | Pleistocene | Pleistocene | Unsorted diamic |
| 8 | 7 | <Null> | A670 | Qgd | Drift | Drift | Pleistocene | relative | Pleistocene | Pleistocene | Unsorted diamic |
| 9 | 8 | <Null> | 6660 | Qht | Placer-mine tailings | Placer-mine tailings | Holocene | relative | Holocene | Holocene | Irregularly to syr |
| 10 | 9 | <Null> | A360 | Qu | Quaternary deposits, u... | Quaternary deposits, u... | Pleistocene to Holocene | relative | Pleistocene | Holocene | Unconsolidated |
| 11 | 10 | <Null> | <Null> | <Null> | Intrusive and metamor... | Intrusive and metamor... | <Null> | relative | <Null> | <Null> | <Null> |
| 12 | 11 | <Null> | 2770 | TKf | Rhyolite to dacite | Rhyolite to dacite | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Light-gray, bleac |
| 13 | 12 | <Null> | 1770 | TKm | Monzonite and monzo... | Monzonite and monzo... | Upper Cretaceous to ea... | absolute | Upper Cretaceous | early Tertiary | Light- to mediur |
| 14 | 13 | <Null> | 0410 | TKdm | Dikes | Dikes | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Gray to tan, aph |
| 15 | 14 | <Null> | AX30 | TKdi | Dikes | Dikes | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Gray to tan, aph |
| 16 | 15 | <Null> | 2760 | TKd | Dikes | Dikes | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Gray to tan, aph |
| 17 | 16 | <Null> | 5770 | TKhf | Hornfels | Hornfels | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Brown to gray, n |
| 18 | 17 | <Null> | <Null> | <Null> | Volcanic and sedimenta... | Volcanic and sedimenta... | <Null> | relative | <Null> | <Null> | <Null> |
| 19 | 18 | <Null> | 5750 | TKvm | Mafic volcanic rocks | Mafic volcanic rocks | Upper Cretaceous to ea... | absolute | Upper Cretaceous | early Tertiary | Dark green-gray |
| 20 | 19 | <Null> | 7760 | TKva | Volcanic agglomerate | Volcanic agglomerate | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Medium to dark |
| 21 | 20 | <Null> | 6750 | TKvip | Porphyritic andesite | Porphyritic andesite | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Medium green-( |
| 22 | 21 | <Null> | 2750 | Kvi | Intermediate volcanic r... | Intermediate volcanic r... | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Light to medium |
| 23 | 22 | <Null> | 7750 | Kvt | Altered intermediate to... | Altered intermediate to... | Upper Cretaceous to ea... | relative | Upper Cretaceous | early Tertiary | Heterogeneous, |
| 24 | 23 | <Null> | 7670 | Kssq | Fine sublithic sandston... | Fine sublithic sandston... | Upper Cretaceous | relative | Upper Cretaceous | Upper Cretaceous | Light gray, tan w |
| 25 | 24 | <Null> | 6460 | Ksv | Volcaniclastic sandstone | Volcaniclastic sandstone | Upper Cretaceous | relative | Upper Cretaceous | Upper Cretaceous | Medium green-( |
| 26 | 25 | <Null> | 7570 | Ksc | Coarse sandstone and... | Coarse sandstone and... | Upper Cretaceous | relative | Upper Cretaceous | Upper Cretaceous | Medium green-( |

# Version 2.0 – data_sources

- Completed data_sources table taken from map reference list


data_sources - iditarod_c3_quad - ArcGIS Pro

data_sources

Field: Add Calculate | Selection: Select By Attributes Zoom To Switch Clear Delete Copy | Rows: Insert

| | OBJECTID * | data_sources_id | category | type | citation_id_dggs | source | url | notes | product_id | created_user | created_date | last_e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | {6EDFB177-282D-4082-... | non-geospatial | generic document | 30669 | AK GeMS Data Dictiona... | https://dggs.alaska.gov/pı | <Null> | <Null> | <Null> | <Null> | MDHI |
| 2 | 2 | {FC6569F5-931F-4656-... | non-geospatial | generic document | 20421 | AGI Glossary of Geology | https://dggs.alaska.gov/pı | <Null> | <Null> | <Null> | <Null> | MDHI |
| 3 | 3 | {77CECA06-DC81-43E2... | non-geospatial | generic document | 30588 | GSA Time Scale ver 5.0 | https://dggs.alaska.gov/pı | <Null> | <Null> | <Null> | <Null> | MDHI |
| 4 | 4 | | geospatial | geologic mapping | 2277 | Bundtzen, Laird and Lo... | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 5 | 5 | | non-geospatial | geologic report | 420 | Bundtzen, 1980 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 6 | 6 | | geospatial | geologic mapping | 432 | Bundtzen and Larid, 1982 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 7 | 7 | | geospatial | geologic mapping | 2252 | Bundtzen and Laird, 19... | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 8 | 8 | | geospatial | geologic mapping | 2253 | Bundtzen and Laird, 19... | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 9 | 9 | | geospatial | geologic mapping | 3818 | Cady and others, 1955 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 10 | 10 | | non-geospatial | geologic report | 26502 | Chapman and others, 1... | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 11 | 11 | | non-geospatial | geologic report | 10697 | Grantz, 1966 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 12 | 12 | | non-geospatial | geologic report | 3807 | Hollick, 1930 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 13 | 13 | | non-geospatial | geologic report | 3496 | Mertie, 1936 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 14 | 14 | | non-geospatial | geologic report | 12523 | Moll and others, 1980 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 15 | 15 | | non-geospatial | geologic report | 13533 | Patton and others, 1984 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 16 | 16 | | non-geospatial | geologic report | 30968 | Bouma, 1962 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 17 | 17 | | non-geospatial | geologic report | 30969 | Bundtzen and Gilbert, 1... | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 18 | 18 | | non-geospatial | geologic report | 30970 | Bundtzen and Swanson... | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 19 | 19 | | non-geospatial | geologic report | 30964 | Patton and others, 1976 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |
| 20 | 20 | | non-geospatial | geologic report | 30971 | Sharma and others, 1972 | https://dggs.alaska.gov/pı | <Null> | <Null> | JWBUCHANAN | 3/15/2023 12:19:04 AM | JWBU |

Click to add new row.

0 of 20 selected

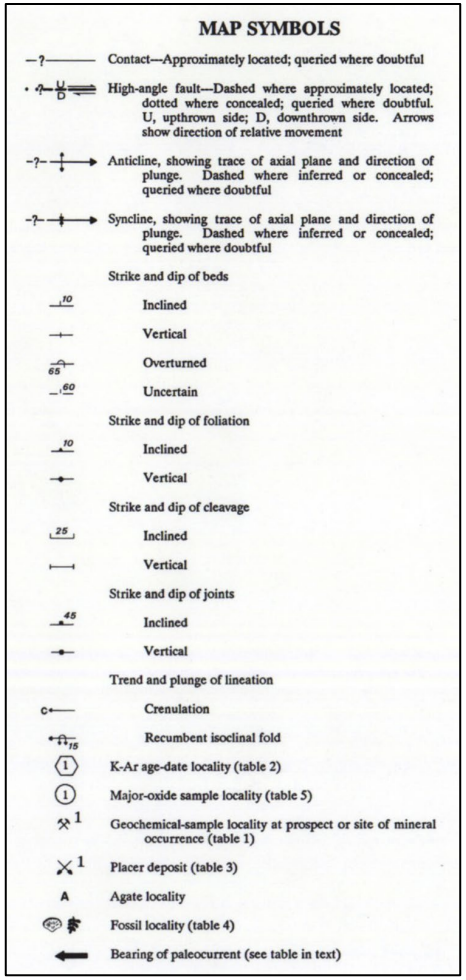
Filters: 100%

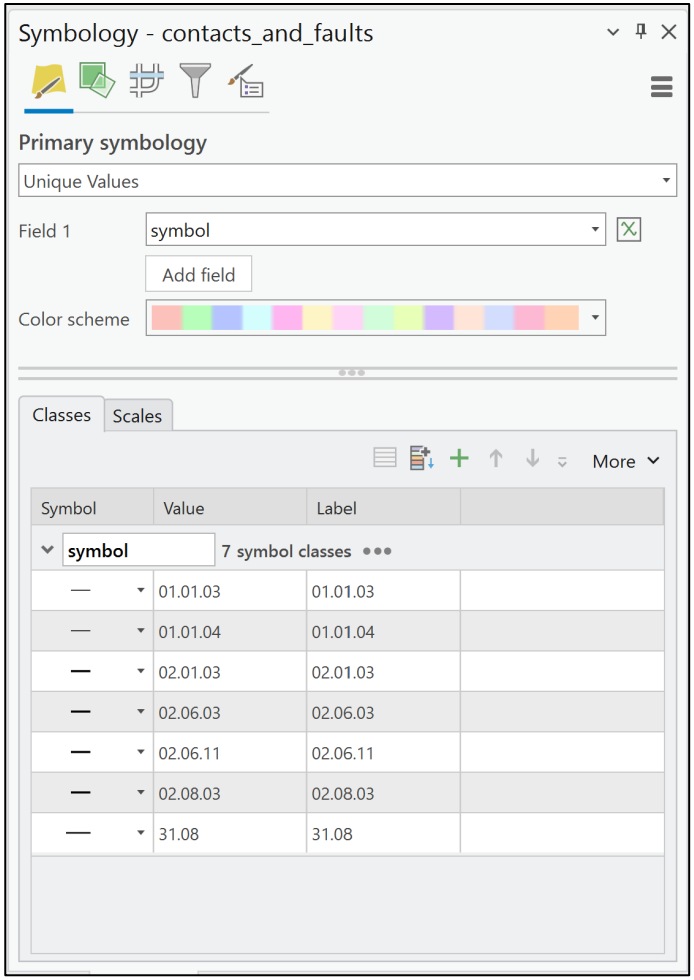
# Version 2.0 – Feature Templates

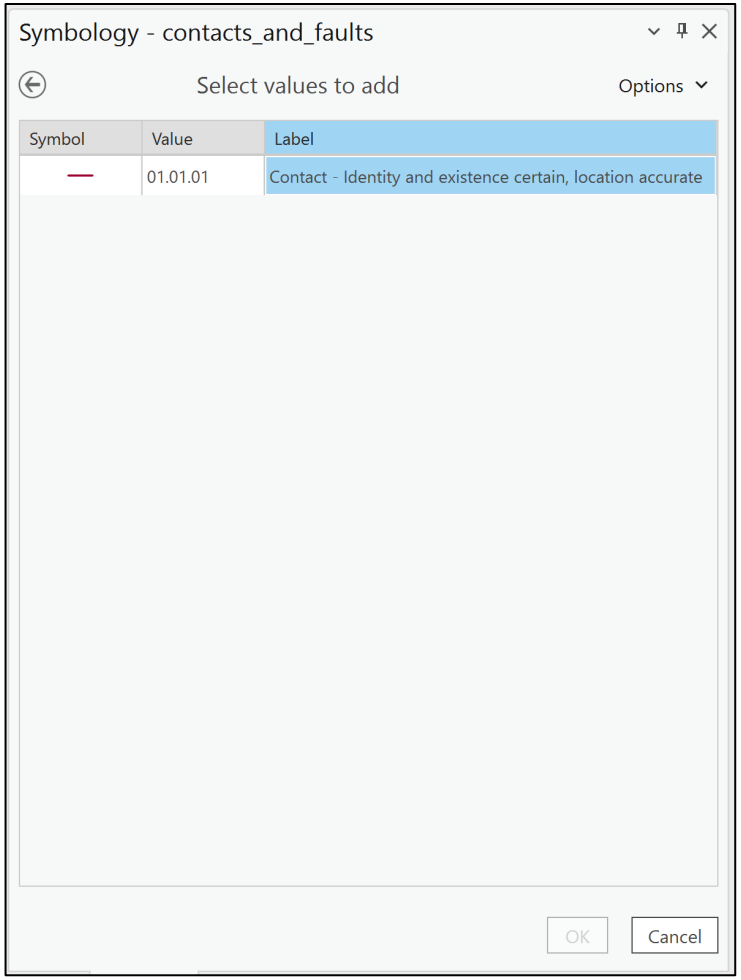
- Simply stated - feature templates create features
- They comprise a set of construction tools, default attribute values, source layer information, and other properties for creating features on specific layers
- Feature templates were created for every feature class in the geodatabase to represent all data within the geologic map
- Uses the style file to correctly symbolize each feature with respect to the FGDC standard
- When creating features, essential fields are prompted for contractor attributing

# Version 2.0 – Feature Templates – Set Up

Use Symbology pane to add map features with symbol code

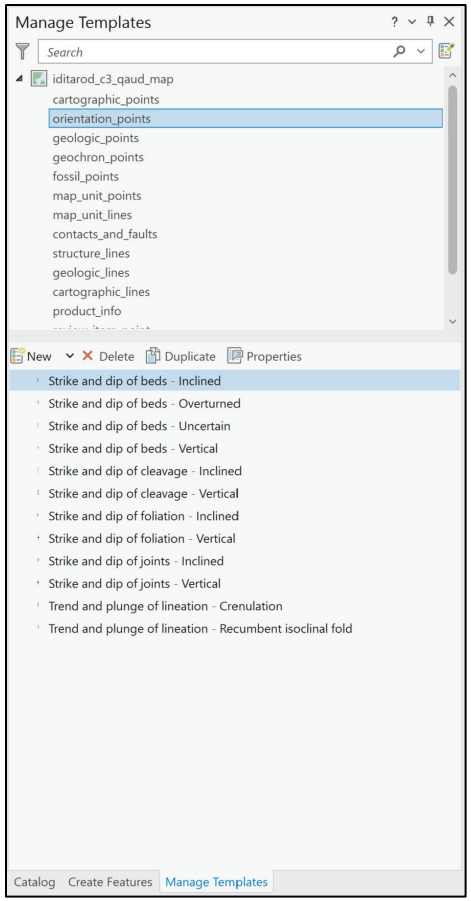


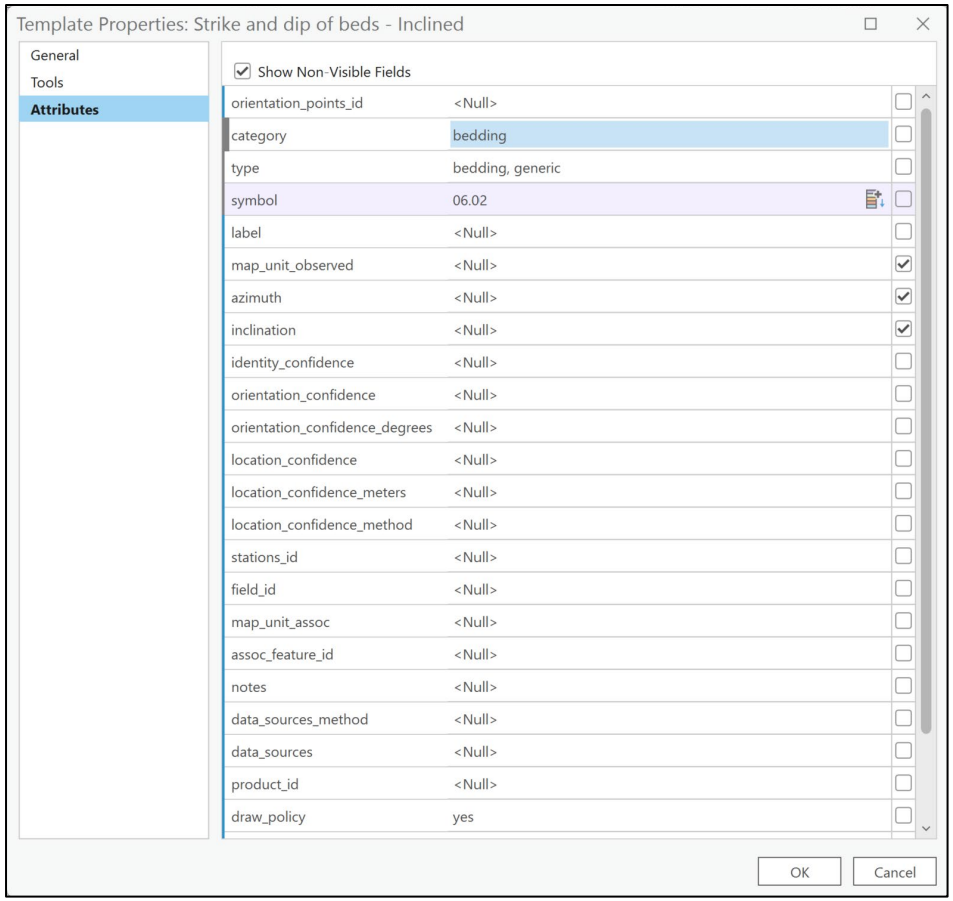



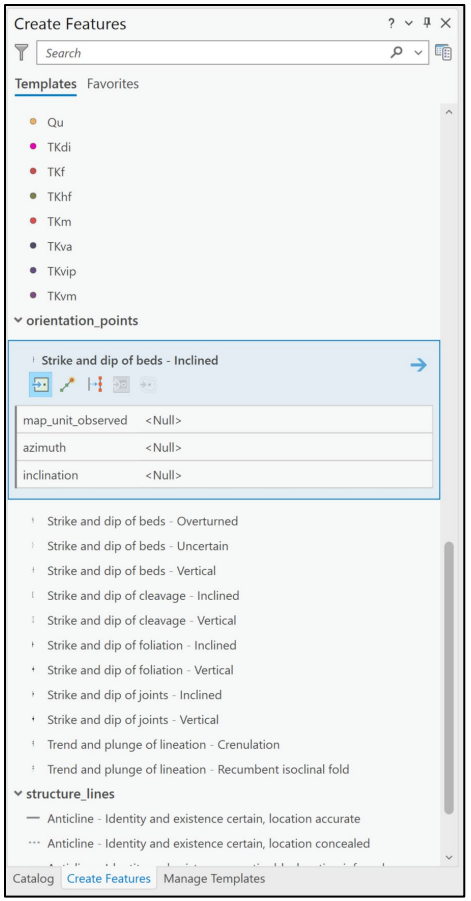



# Version 2.0 – Feature Templates – Set Up

- Feature templates are managed in the Manage Template pane
- Clicking on New will add templates for all values added from the Symbology pane
- Ability to change the template properties
- When creating features, user is prompted for specified attributes

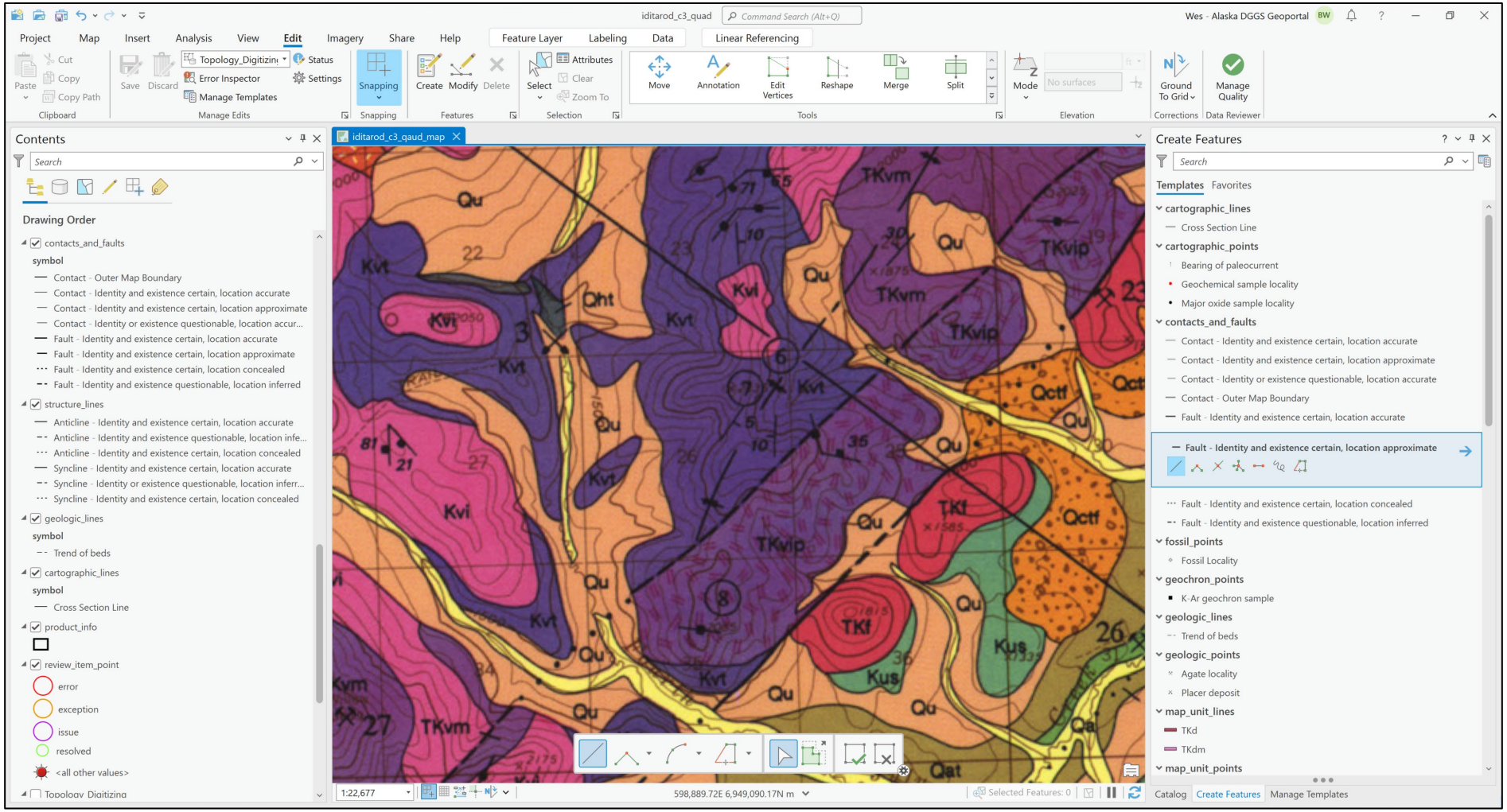


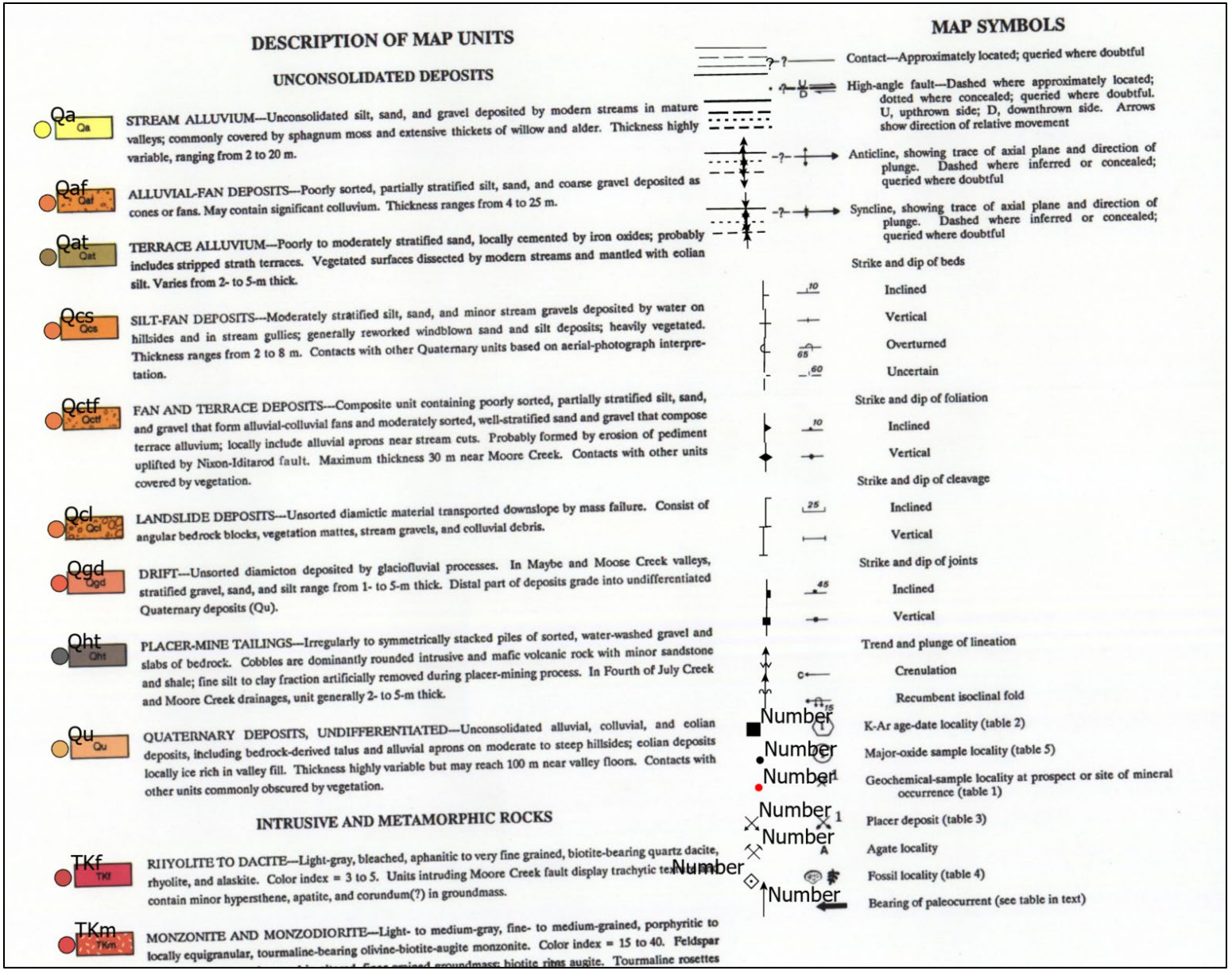



# Version 2.0 – Creating Features from Templates

Contents pane contains symbols with FGDC descriptions



# Version 2.0 – Digitized Legend



## DESCRIPTION OF MAP UNITS

### UNCONSOLIDATED DEPOSITS

**Qa** — STREAM ALLUVIUM—Unconsolidated silt, sand, and gravel deposited by modern streams in mature valleys; commonly covered by sphagnum moss and extensive thickets of willow and alder. Thickness highly variable, ranging from 2 to 20 m.

**Qaf** — ALLUVIAL-FAN DEPOSITS—Poorly sorted, partially stratified silt, sand, and coarse gravel deposited as cones or fans. May contain significant colluvium. Thickness ranges from 4 to 25 m.

**Qat** — TERRACE ALLUVIUM—Poorly to moderately stratified sand, locally cemented by iron oxides; probably includes stripped strath terraces. Vegetated surfaces dissected by modern streams and mantled with eolian silt. Varies from 2- to 5-m thick.

**Qcs** — SILT-FAN DEPOSITS—Moderately stratified silt, sand, and minor stream gravels deposited by water on hillsides and in stream gullies; generally reworked windblown sand and silt deposits; heavily vegetated. Thickness ranges from 2 to 8 m. Contacts with other Quaternary units based on aerial-photograph interpretation.

**Qctf** — FAN AND TERRACE DEPOSITS—Composite unit containing poorly sorted, partially stratified silt, sand, and gravel that form alluvial-colluvial fans and moderately sorted, well-stratified sand and gravel that compose terrace alluvium; locally include alluvial aprons near stream cuts. Probably formed by erosion of pediment uplifted by Nixon-Iditarod fault. Maximum thickness 30 m near Moore Creek. Contacts with other units covered by vegetation.

**Qcl** — LANDSLIDE DEPOSITS—Unsorted diamictic material transported downslope by mass failure. Consist of angular bedrock blocks, vegetation mattes, stream gravels, and colluvial debris.

**Qgd** — DRIFT—Unsorted diamicton deposited by glaciofluvial processes. In Maybe and Moose Creek valleys, stratified gravel, sand, and silt range from 1- to 5-m thick. Distal part of deposits grade into undifferentiated Quaternary deposits (Qu).

**Qht** — PLACER-MINE TAILINGS—Irregularly to symmetrically stacked piles of sorted, water-washed gravel and slabs of bedrock. Cobbles are dominantly rounded intrusive and mafic volcanic rock with minor sandstone and shale; fine silt to clay fraction artificially removed during placer-mining process. In Fourth of July Creek and Moore Creek drainages, unit generally 2- to 5-m thick.

**Qu** — QUATERNARY DEPOSITS, UNDIFFERENTIATED—Unconsolidated alluvial, colluvial, and eolian deposits, including bedrock-derived talus and alluvial aprons on moderate to steep hillsides; eolian deposits locally ice rich in valley fill. Thickness highly variable but may reach 100 m near valley floors. Contacts with other units commonly obscured by vegetation.

### INTRUSIVE AND METAMORPHIC ROCKS

**TKf** — RHYOLITE TO DACITE—Light-gray, bleached, aphanitic to very fine grained, biotite-bearing quartz dacite, rhyolite, and alaskite. Color index = 3 to 5. Units intruding Moore Creek fault display trachytic texture; contain minor hypersthene, apatite, and corundum(?) in groundmass.

**TKm** — MONZONITE AND MONZODIORITE—Light- to medium-gray, fine- to medium-grained, porphyritic to locally equigranular, tourmaline-bearing olivine-biotite-augite monzonite. Color index = 15 to 40. Feldspar [illegible] groundmass; biotite rims augite. Tourmaline rosettes

## MAP SYMBOLS

- Contact—Approximately located; queried where doubtful
- High-angle fault—Dashed where approximately located; dotted where concealed; queried where doubtful. U, upthrown side; D, downthrown side. Arrows show direction of relative movement
- Anticline, showing trace of axial plane and direction of plunge. Dashed where inferred or concealed; queried where doubtful
- Syncline, showing trace of axial plane and direction of plunge. Dashed where inferred or concealed; queried where doubtful

Strike and dip of beds
- Inclined
- Vertical
- Overturned
- Uncertain

Strike and dip of foliation
- Inclined
- Vertical

Strike and dip of cleavage
- Inclined
- Vertical

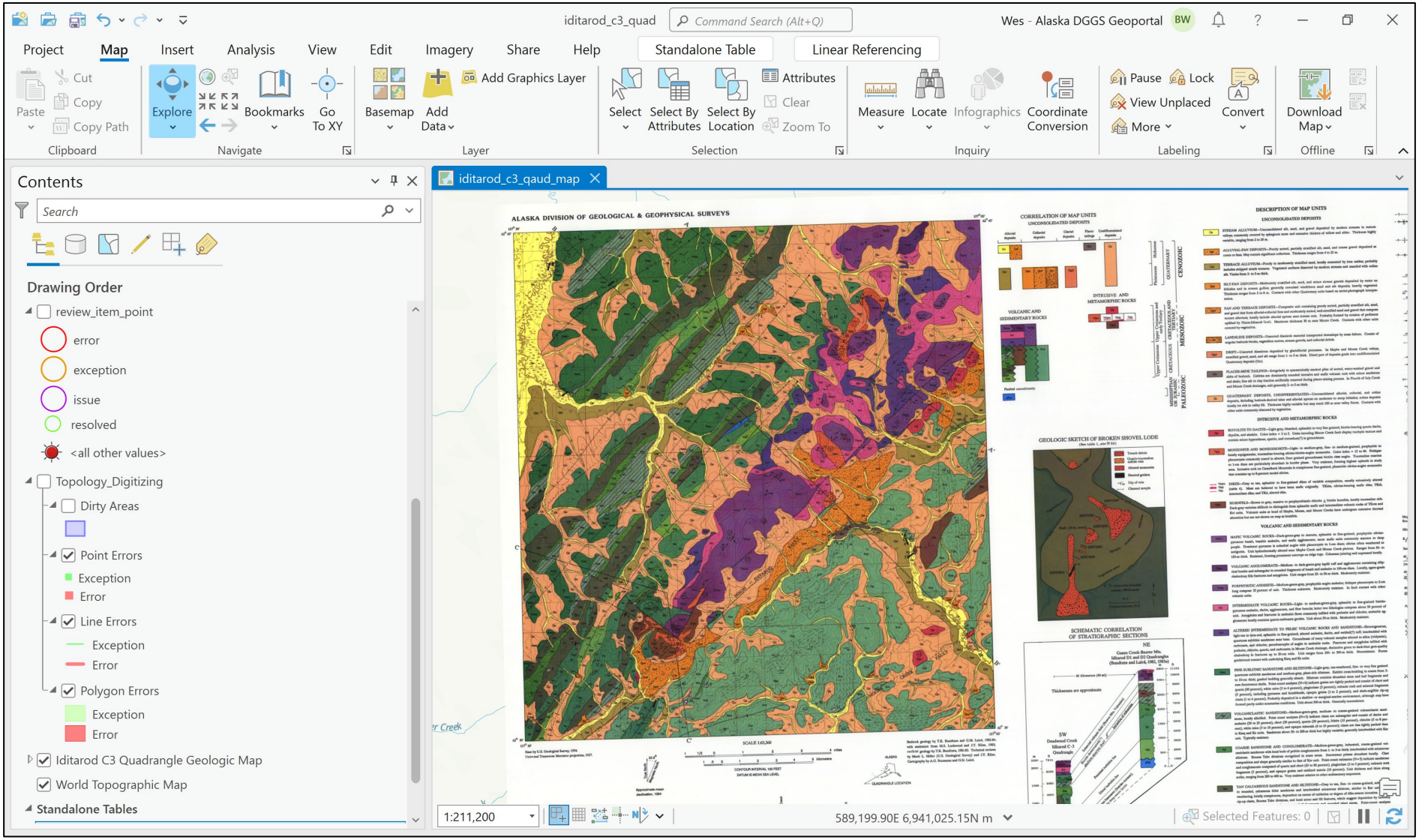
Strike and dip of joints
- Inclined
- Vertical

Trend and plunge of lineation
- Crenulation
- Recumbent isoclinal fold

- Number — K-Ar age-date locality (table 2)
- Number — Major-oxide sample locality (table 5)
- Number — Geochemical-sample locality at prospect or site of mineral occurrence (table 1)
- Number — Placer deposit (table 3)
- Number — Agate locality
- Number — Fossil locality (table 4)
- Number — Bearing of paleocurrent (see table in text)

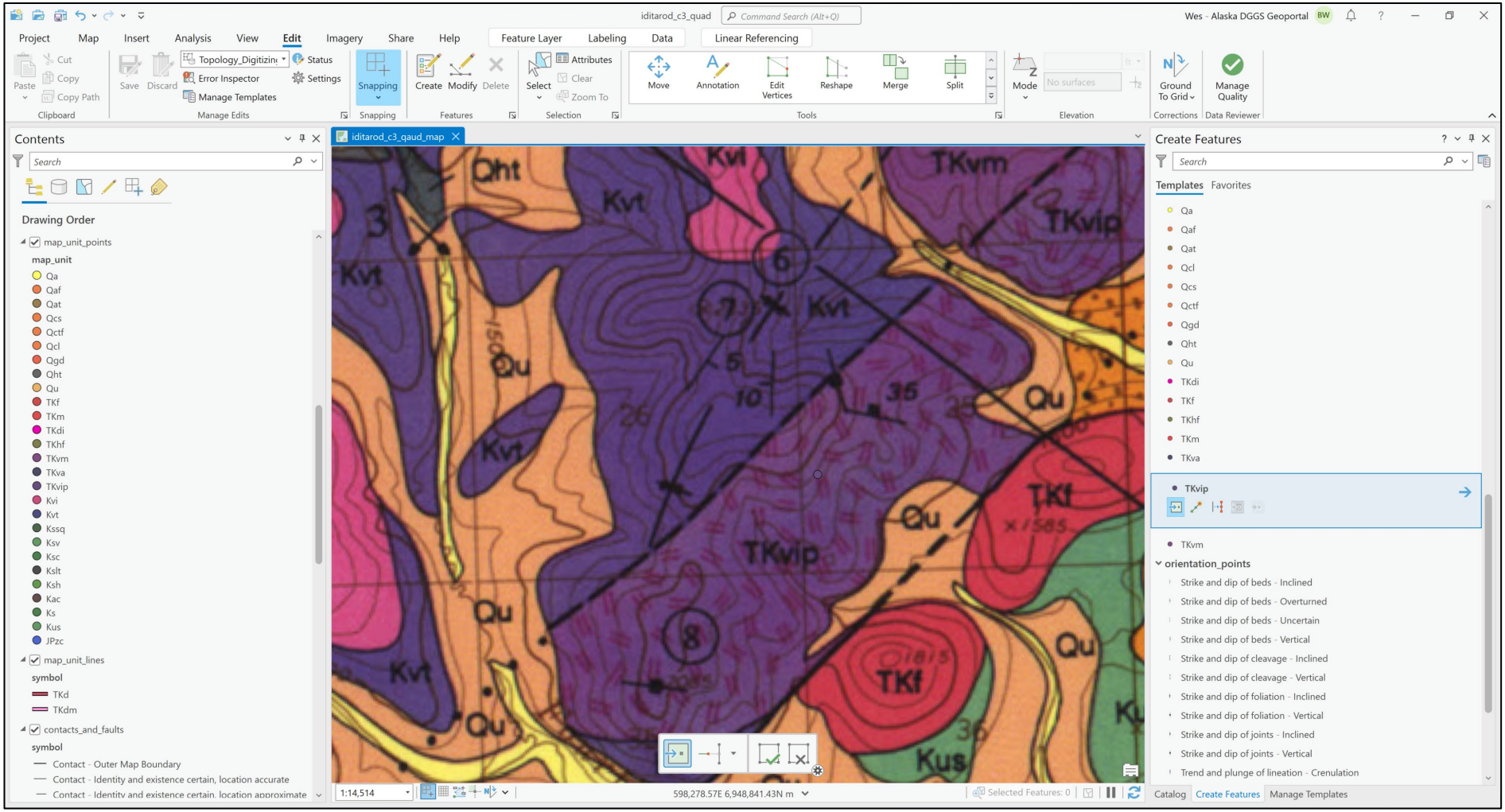
# Version 2.0 – Topology & QC Review

Simplified topology layer based only on contacts and faults – no dangles or self intersections



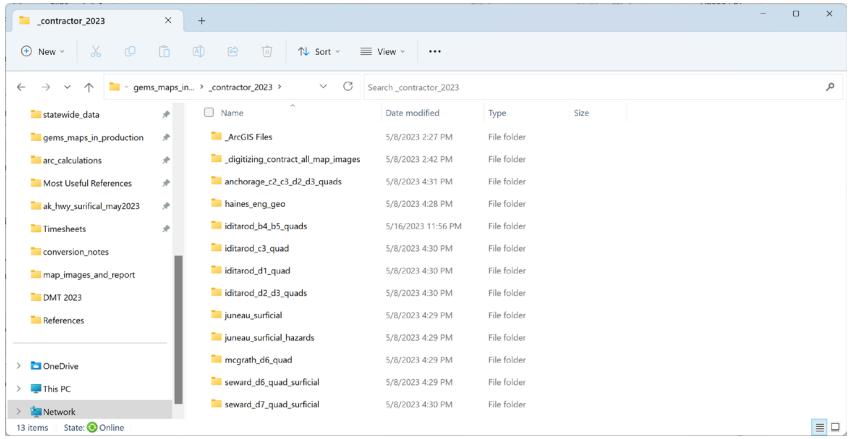
# Version 2.0 – Creating map_unit_polys

- Drop map_unit_point inside contacts_and_faults boundary
- Script run by DGGS

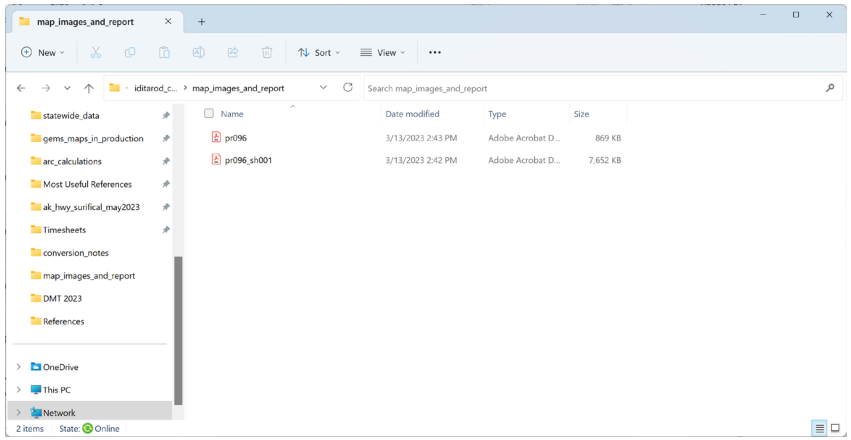


# Version 2.0 – Provided Files

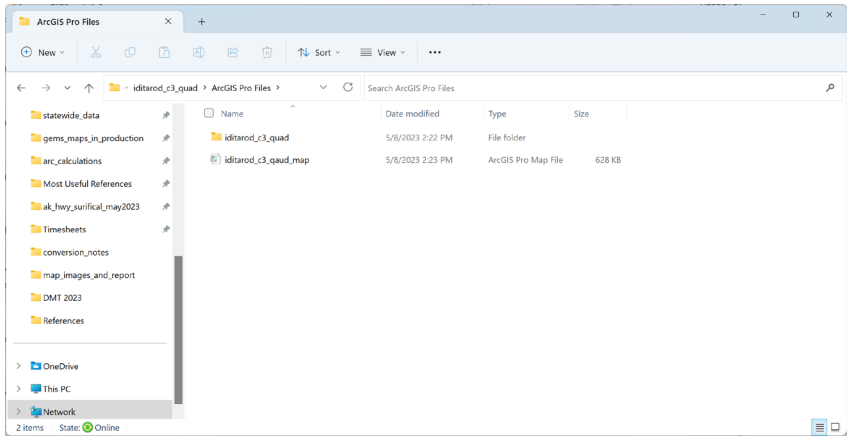
## Project folders; with styles, fonts, and toolboxes



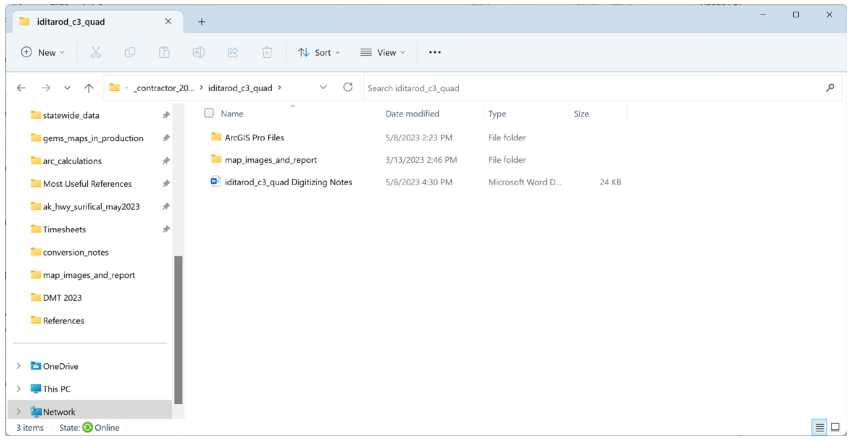

## Map and report PDF




## Geodatabase, project file, and map file

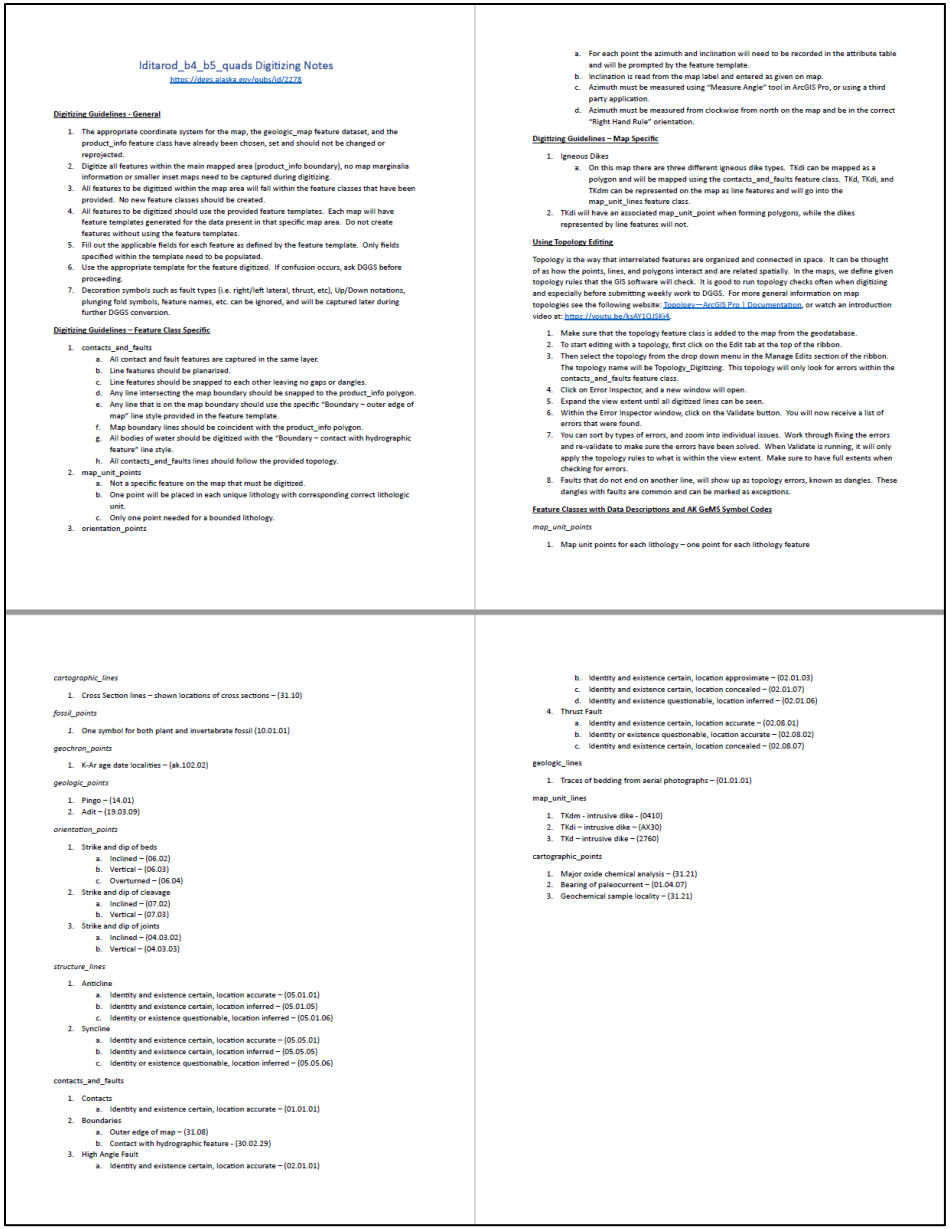



## Map specific digitizing notes



# Version 2.0 – Digitizing Notes

Each project has digitizing notes specific to the features on the geologic map



## Iditarod_b4_b5_quads Digitizing Notes

https://dggs.alaska.gov/pubs/id/2278

**Digitizing Guidelines - General**

1. The appropriate coordinate system for the map, the geologic_map feature dataset, and the product_info feature class have already been chosen, set and should not be changed or reprojected.
2. Digitize all features within the main mapped area (product_info boundary), no map marginalia information or smaller inset maps need to be captured during digitizing.
3. All features to be digitized within the map area will fall within the feature classes that have been provided. No new feature classes should be created.
4. All features to be digitized should use the provided feature templates. Each map will have feature templates generated for the data present in that specific map area. Do not create features without using the feature templates.
5. Fill out the applicable fields for each feature as defined by the feature template. Only fields specified within the template need to be populated.
6. Use the appropriate template for the feature digitized. If confusion occurs, ask DGGS before proceeding.
7. Decoration symbols such as fault types (i.e. right/left lateral, thrust, etc), Up/Down notations, plunging fold symbols, feature names, etc. can be ignored, and will be captured later during further DGGS conversion.

**Digitizing Guidelines – Feature Class Specific**

1. contacts_and_faults
   a. All contact and fault features are captured in the same layer.
   b. Line features should be planarized.
   c. Line features should be snapped to each other leaving no gaps or dangles.
   d. Any line intersecting the map boundary should be snapped to the product_info polygon.
   e. Any line that is on the map boundary should use the specific "Boundary – outer edge of map" line style provided in the feature template.
   f. Map boundary lines should be coincident with the product_info polygon.
   g. All bodies of water should be digitized with the "Boundary – contact with hydrographic feature" line style.
   h. All contacts_and_faults lines should follow the provided topology.
2. map_unit_points
   a. Not a specific feature on the map that must be digitized.
   b. One point will be placed in each unique lithology with corresponding correct lithologic unit.
   c. Only one point needed for a bounded lithology.
3. orientation_points
   a. For each point the azimuth and inclination will need to be recorded in the attribute table and will be prompted by the feature template.
   b. Inclination is read from the map label and entered as given on map.
   c. Azimuth must be measured using "Measure Angle" tool in ArcGIS Pro, or using a third party application.
   d. Azimuth must be measured from clockwise from north on the map and be in the correct "Right Hand Rule" orientation.

**Digitizing Guidelines – Map Specific**

1. Igneous Dikes
   a. On this map there are three different igneous dike types. TKdi can be mapped as a polygon and will be mapped using the contacts_and_faults feature class. TKd, TKdi, and TKdm can be represented on the map as line features and will go into the map_unit_lines feature class.
2. TKdi will have an associated map_unit_point when forming polygons, while the dikes represented by line features will not.

**Using Topology Editing**

Topology is the way that interrelated features are organized and connected in space. It can be thought of as how the points, lines, and polygons interact and are related spatially. In the maps, we define given topology rules that the GIS software will check. It is good to run topology checks often when digitizing and especially before submitting weekly work to DGGS. For more general information on map topologies see the following website: Topology—ArcGIS Pro | Documentation, or watch an introduction video at: https://youtu.be/kcAY1OJSK4.

1. Make sure that the topology feature class is added to the map from the geodatabase.
2. To start editing with a topology, first click on the Edit tab at the top of the ribbon.
3. Then select the topology from the drop down menu in the Manage Edits section of the ribbon. The topology name will be Topology_Digitizing. This topology will only look for errors within the contacts_and_faults feature class.
4. Click on Error Inspector, and a new window will open.
5. Expand the view extent until all digitized lines can be seen.
6. Within the Error Inspector window, click on the Validate button. You will now receive a list of errors that were found.
7. You can sort by types of errors, and zoom into individual issues. Work through fixing the errors and re-validate to make sure the errors have been solved. When Validate is running, it will only apply the topology rules to what is within the view extent. Make sure to have full extents when checking for errors.
8. Faults that do not end on another line, will show up as topology errors, known as dangles. These dangles with faults are common and can be marked as exceptions.

**Feature Classes with Data Descriptions and AK GeMS Symbol Codes**

*map_unit_points*

1. Map unit points for each lithology – one point for each lithology feature

*cartographic_lines*

1. Cross Section lines – shown locations of cross sections – (31.10)

*fossil_points*

1. One symbol for both plant and invertebrate fossil (10.01.01)

*geochron_points*

1. K-Ar age date localities – (ak.102.02)

*geologic_points*

1. Pingo – (14.01)
2. Adit – (19.03.09)

*orientation_points*

1. Strike and dip of beds
   a. Inclined – (06.02)
   b. Vertical – (06.03)
   c. Overturned – (06.04)
2. Strike and dip of cleavage
   a. Inclined – (07.02)
   b. Vertical – (07.03)
3. Strike and dip of joints
   a. Inclined – (04.03.02)
   b. Vertical – (04.03.03)

*structure_lines*

1. Anticline
   a. Identity and existence certain, location accurate – (05.01.01)
   b. Identity and existence certain, location inferred – (05.01.05)
   c. Identity or existence questionable, location inferred – (05.01.06)
2. Syncline
   a. Identity and existence certain, location accurate – (05.05.01)
   b. Identity and existence certain, location inferred – (05.05.05)
   c. Identity or existence questionable, location inferred – (05.05.06)

contacts_and_faults

1. Contacts
   a. Identity and existence certain, location accurate – (01.01.01)
2. Boundaries
   a. Outer edge of map – (31.08)
   b. Contact with hydrographic feature - (30.02.29)
3. High Angle Fault
   a. Identity and existence certain, location accurate – (02.01.01)
   b. Identity and existence certain, location approximate – (02.01.03)
   c. Identity and existence certain, location concealed – (02.01.07)
   d. Identity and existence questionable, location inferred – (02.01.06)
4. Thrust Fault
   a. Identity and existence certain, location accurate – (02.08.01)
   b. Identity or existence questionable, location accurate – (02.08.02)
   c. Identity and existence certain, location concealed – (02.08.07)

geologic_lines

1. Traces of bedding from aerial photographs – (01.01.01)

map_unit_lines

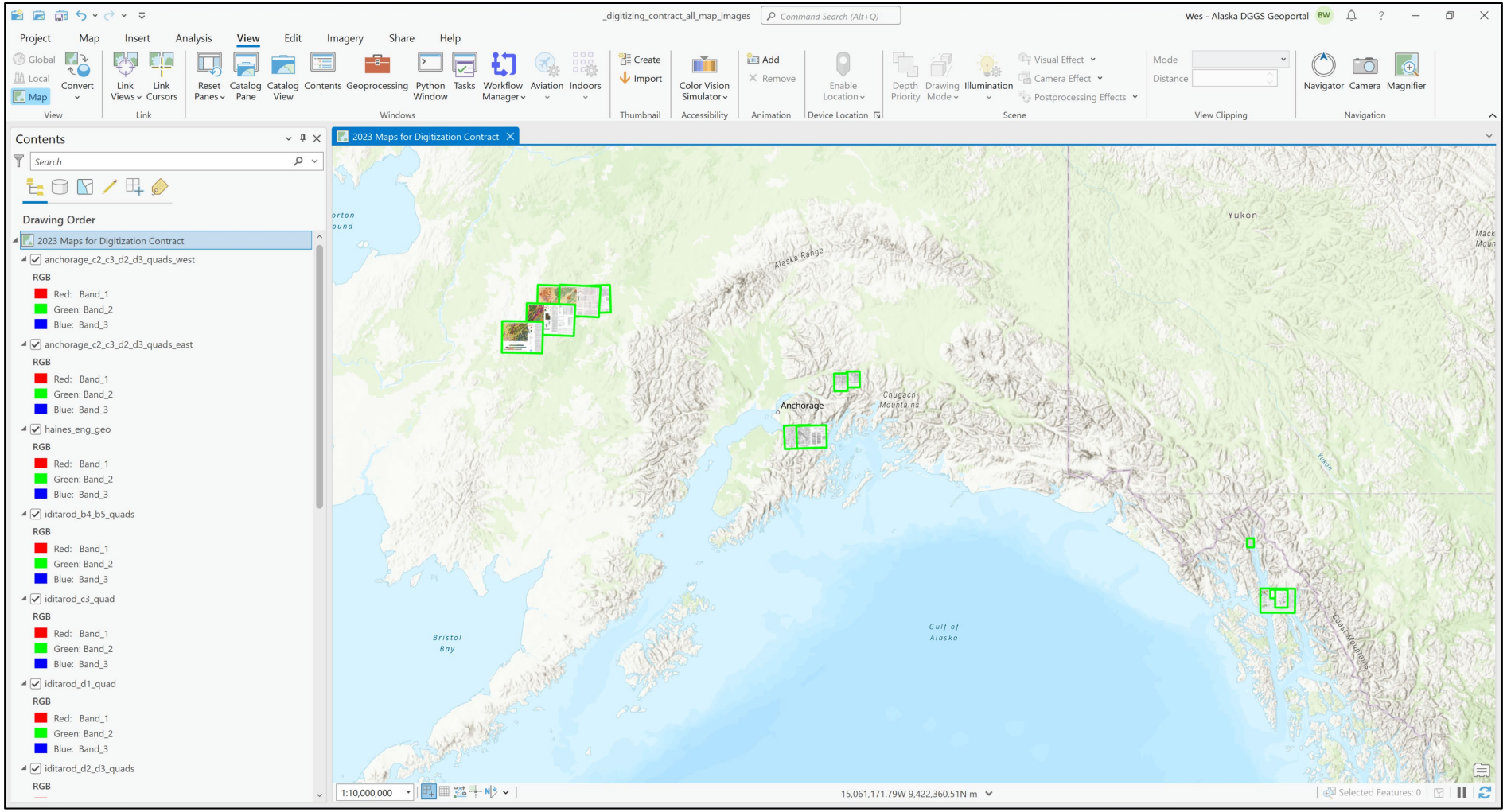
1. TKdm - intrusive dike - (0410)
2. TKdi – intrusive dike – (AX30)
3. TKd – intrusive dike – (2760)

cartographic_points

1. Major oxide chemical analysis – (31.21)
2. Bearing of paleocurrent – (01.04.07)
3. Geochemical sample locality – (31.21)

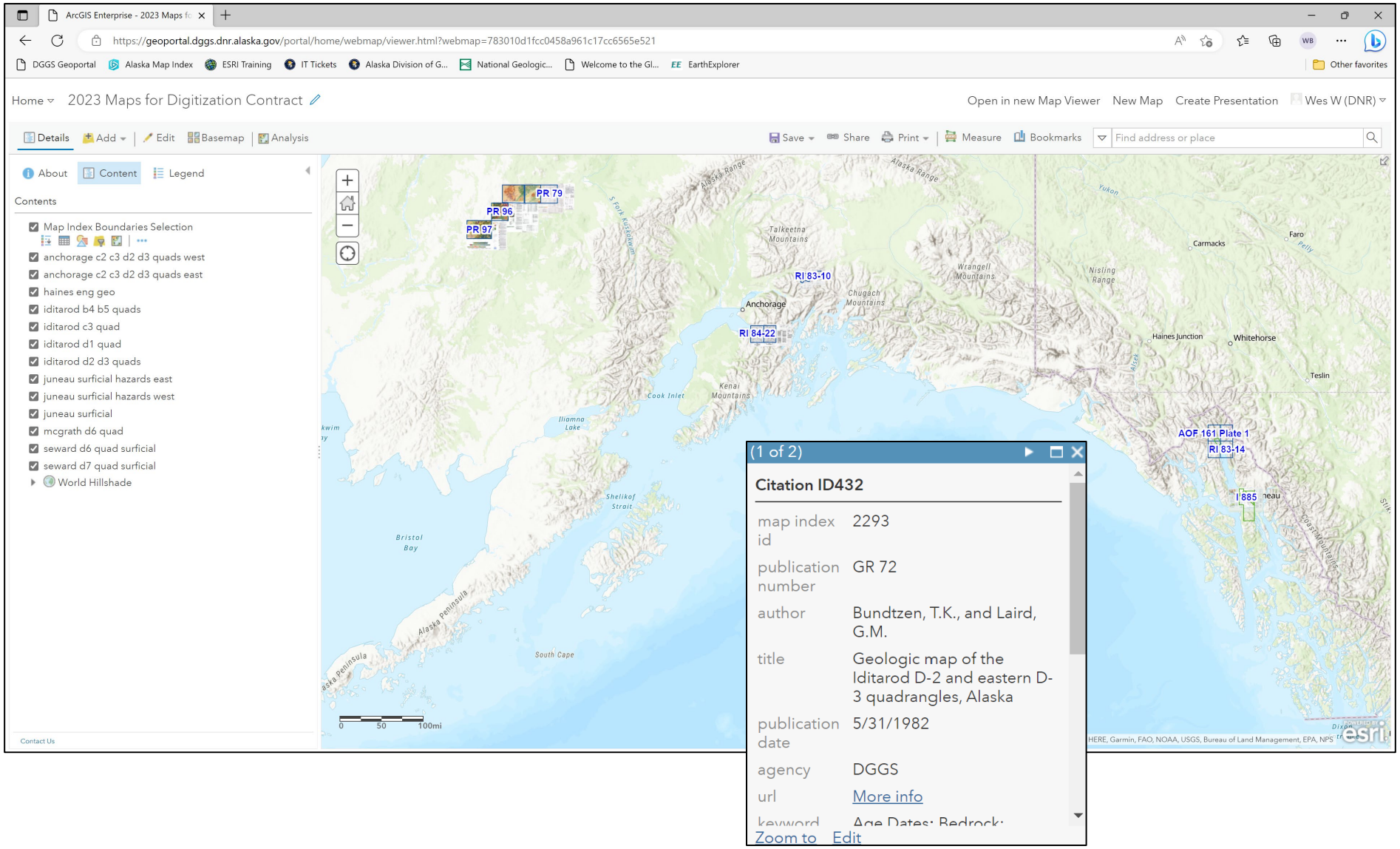
# Version 2.0 – Map Images Project

Individual map image layers from web service, queried and locked



# Version 2.0 – AGOL Web Map

Provided during the contract bidding process



# Resource Comparison – Version 1.0

- Blank GeMS Geodatabase
- Link to map's DGGS citation page
- General feature templates
- Style file

# Resource Comparison – Version 2.0

- GeMS Geodatabase – project specific
- Correctly projected feature dataset
- ArcGIS Pro project and map files
- Correctly projected map frame
- Georeferenced map images
- Completed DMU table
- Completed data sources table
- Completed product info table
- Only pertinent feature classes
- Project specific feature templates
- Digitized legend
- Simplified topology rules
- Project specific digitizing notes

# Contracting Geologic Map Digitization – Summary

- Working with the GeMS standard has a steep learning curve
- Map digitization/conversion requires time/effort and are affected by geologic complexity
- Capitalize on the strengths of the team members
- Simplify the process to remove ambiguity and confusion
- Upfront planning and attention to detail should pay dividends when it comes to the project completion timeline and budget