DIGITAL MAPPING TECHNIQUES 2021

The following was presented at DMT'21
(June 7 - 10, 2021 - A Virtual Event)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2021)

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

A Database Approach to Reviewing a Geologic Map Database: Lessons from the IMW Project

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Samuel A. Johnstone, and Kenzie J. Turner

US Geological Survey, Denver, CO

USGS

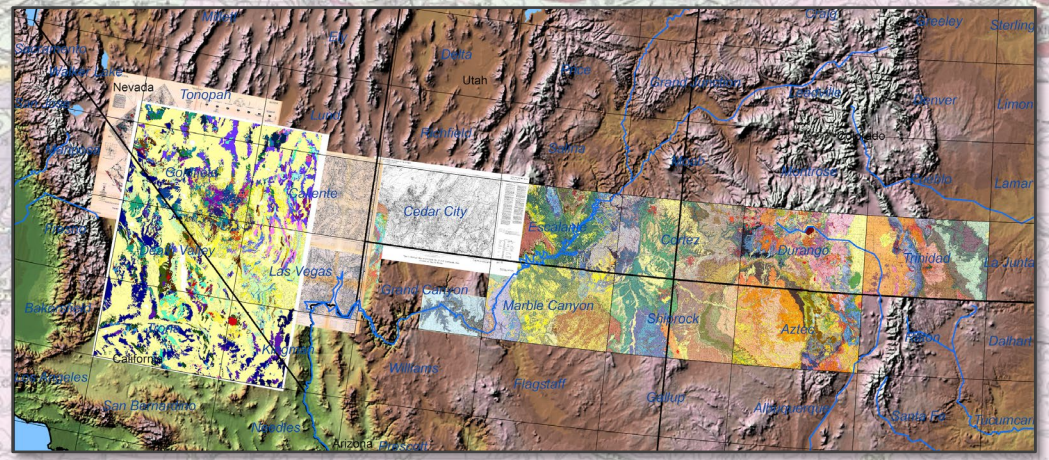
Introduction

The following presentation, given at the ‘21 DMT virtual conference, addresses the process of technical/peer scientific review of geologic maps in the age of standardized database structure. The USGS FedMap Intermountain West project is producing a regional-scale, seamless, integrated geologic map database built upon a modified GeMS schema and is in the process of submitting the multi-authored product for technical review. In order to manage the complexity of the review process for such a large and diverse product, we have turned to the power of the GIS database environment. By migrating the technical review stage into the native data space of the geologic map itself, we create increased functionality for both the reviewers, the authors, and the approving officials.

The review data structure outlined here is a preliminary and basic framework being used provisionally between our project and external state survey partners performing the technical/peer review. The hope is to expand this approach within the NCGMP where formal standards can be built and widespread use can lead to a new and better, more efficient, easily documented process shared across the program. This will facilitate easier collaboration in cross-agency reviews, better data management, and eventual tool development to assist the GeoFramework effort in its goal to create a national, seamless, integrated geologic map database by 2030.

USGS

Intermountain West Project (IMW) & GeoFramework Initiative



IMW: Phase 1—

Seamless geologic mapping centered along 37°N latitude from High Plains to Sierra Nevadas (covering 14x 250k quadrangles) at intermediate scale

Develop technology, data structure, and workflows necessary to create, review, and deliver seamless geologic map databases of large areas

Developmental, project-level FedMap effort within larger NCGMP GeoFramework Initiative

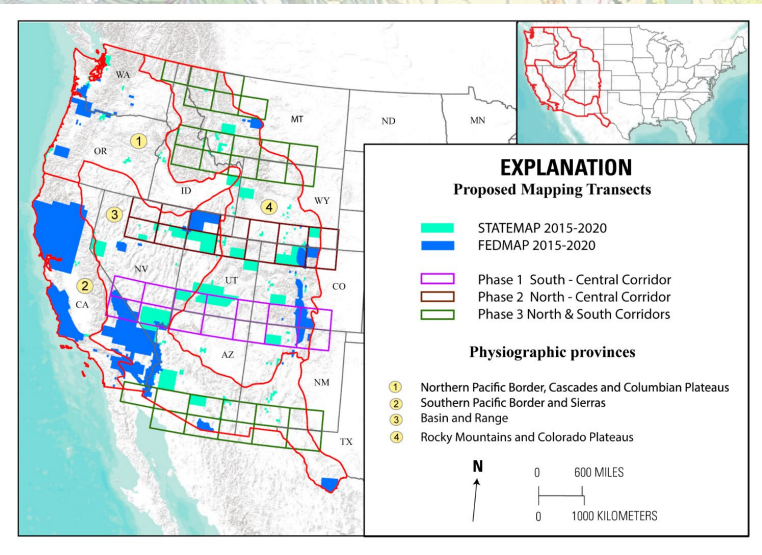
IMW: Phases 2 & 3—

Extend geologic mapping effort north and south across entire intermountain west region following methodologies developed during Phase 1 maintaining a transect based approach

GeoFramework Initiative:

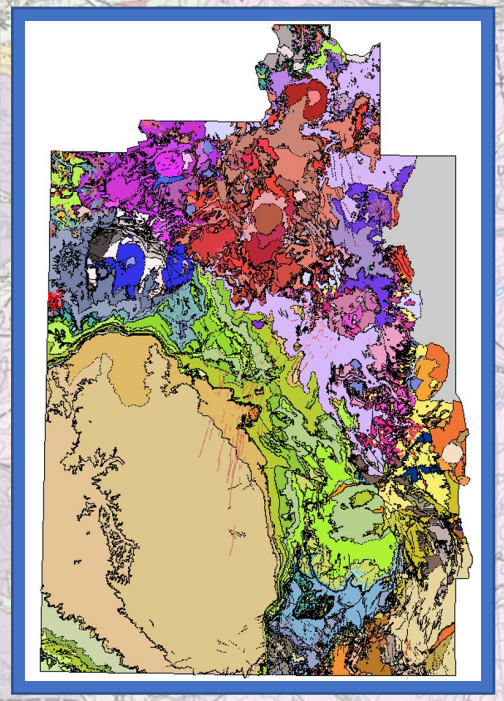
Create an integrated, 3D, digital geologic map of the United States and its territories to address the changing needs of the Nation by the year 2030

Support operational integration of FedMap and StateMap work towards this central goal under “Phase 3” of NGMDB



USGS

Intermountain West Project (IMW)
Geologic Mapping



BEDROCK MAP
FeatureDataset

Developing and using SIGMa extension to GeMS
Seamless Integrated Geologic Mapping extension
(formerly referred to as rGeMS)

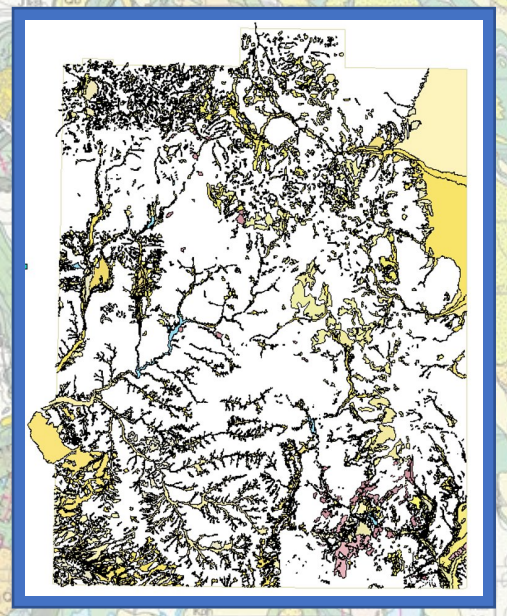
GeMS compliant extension allowing seamless integration of many (100s) source maps and new original mapping into a coherent regional geologic map database

Currently 15+ geologists with various roles and expertise producing map data within an enterprise GIS system

Sliding spectrum between straight compilation/data conversion and complex geologic reinterpretation and new mapping

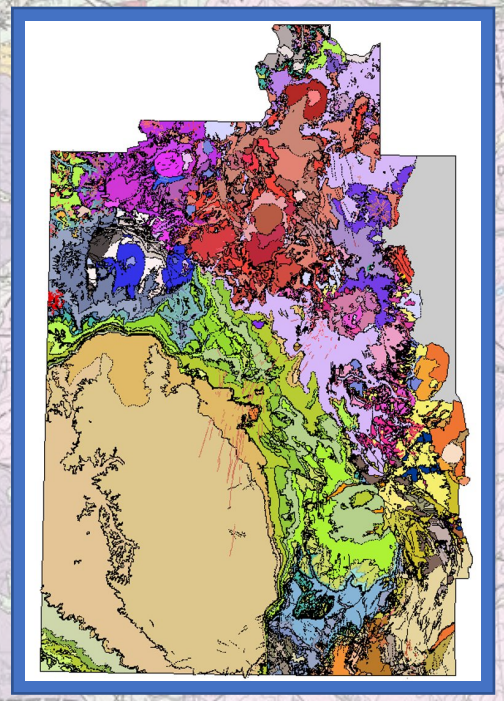
Plans to incorporate data produced by other USGS teams and state survey data produced under Phase3 supplemental contracts

SURFICIAL MAP
FeatureDataset



USGS

Intermountain West Project (IMW)
Geologic Mapping



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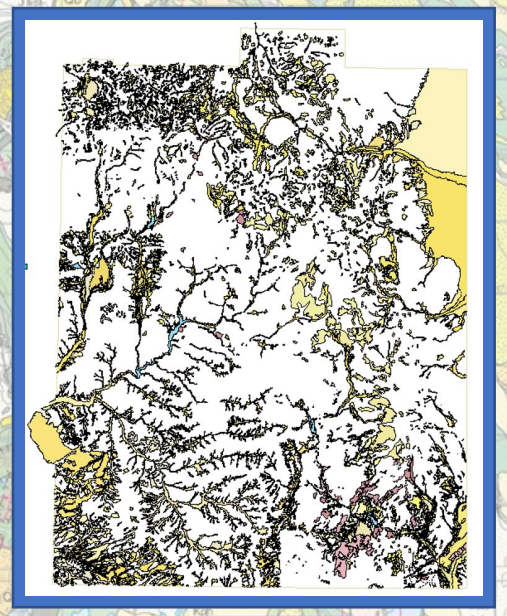

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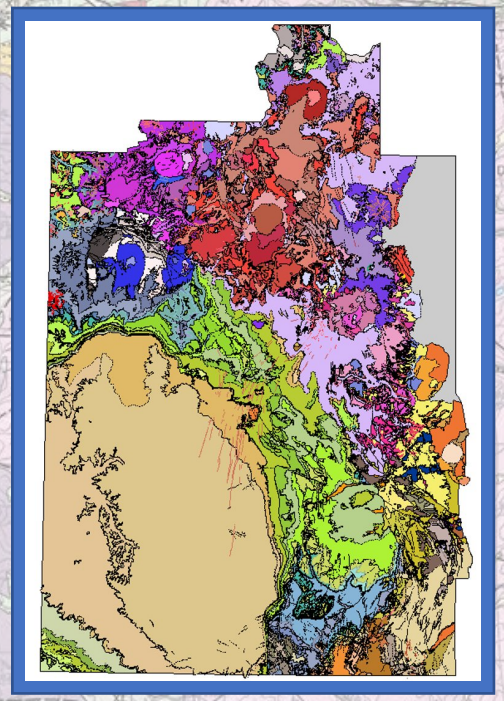
Not a map catalog

Intermountain West Project (IMW)
Geologic Mapping



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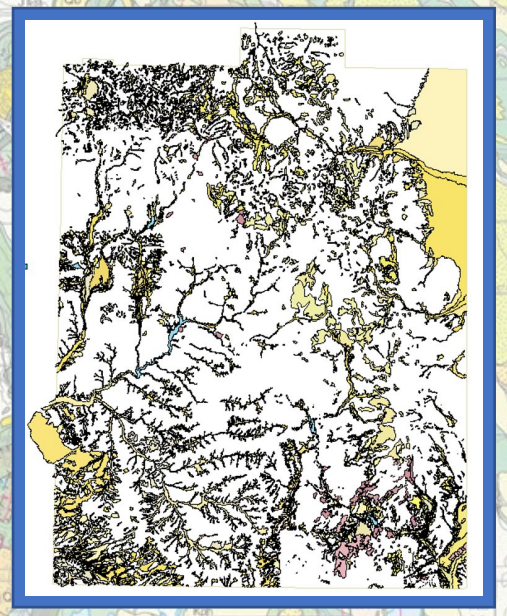

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This is a seamless, multi-authored interpretive product

TECHNICAL PEER REVIEW AT THE USGS

“Peer review is required for virtually all science information products” – Survey Manual 502.3 [3A]

“Peer reviewed information products submitted for Bureau approval must include the original comments from all peer reviewers, reconciliation indicating how review comments were addressed, and the revised manuscript after reconciliation” – Survey Manual 502.3 [3G]

“This Bulletin establishes that important scientific information shall be peer reviewed by qualified specialists before it is disseminated by the federal government” – OMB M-05-03 (December 16, 2004)

USGS

TECHNICAL PEER REVIEW AT THE USGS

Peer review of geologic maps was last addressed in the USGS in 2010

Revised and updated training materials by M. Reynolds and others, 1990

Cooperative effort led by S. Beard (USGS Flagstaff) to discuss the topic across the FedMap program and produce new guidelines (available on NGMDB website)

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Things have changed since 2010 and it's time to take a new look

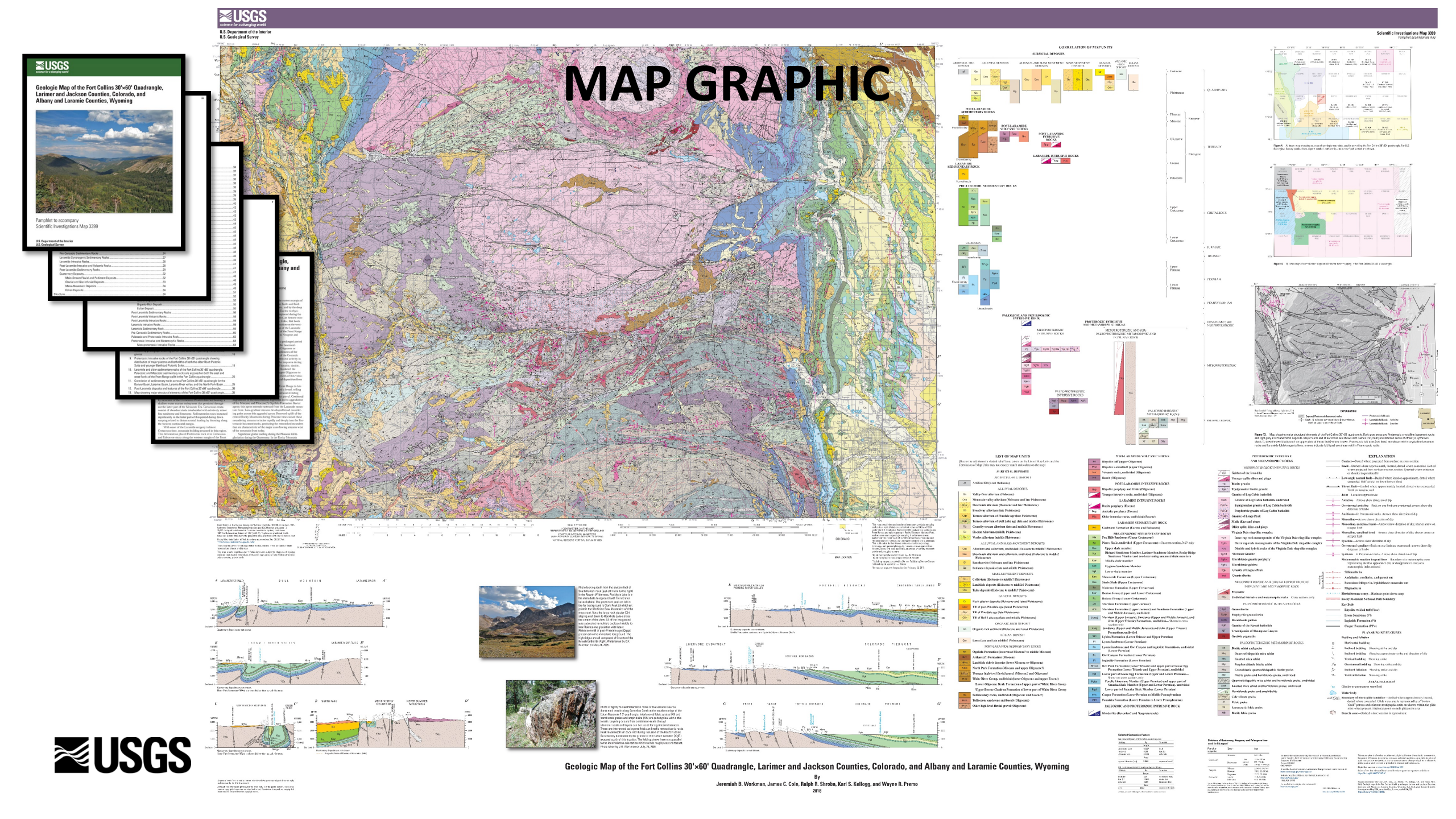
USGS

A SHIFT IN PHILOSOPHY AND THINKING

The product is a database, not a traditional map graphic

The review should occur within the database environment

USGS


MAP GRAPHIC
USGS
science for a changing world
U.S. Department of the Interior
U.S. Geological Survey
Scientific Investigations Map 3399
Pamphlet accompanies map
Geologic Map of the Fort Collins 30'×60' Quadrangle, Larimer and Jackson Counties, Colorado, and Albany and Laramie Counties, Wyoming
Pamphlet to accompany
Scientific Investigations Map 3399
U.S. Department of the Interior
U.S. Geological Survey
CORRELATION OF MAP UNITS
SURFICIAL DEPOSITS
POST-LARAMIDE SEDIMENTARY ROCKS
POST-LARAMIDE VOLCANIC ROCKS
POST-LARAMIDE INTRUSIVE ROCKS
LARAMIDE INTRUSIVE ROCKS
LARAMIDE SEDIMENTARY ROCK
PRE-CENOZOIC SEDIMENTARY ROCKS
PALEOZOIC AND PROTEROZOIC INTRUSIVE ROCK
PROTEROZOIC INTRUSIVE AND METAMORPHIC ROCKS
MESOPROTEROZOIC INTRUSIVE ROCKS
PALEOPROTEROZOIC INTRUSIVE ROCKS
PALEOPROTEROZOIC METAMORPHIC ROCKS
Holocene
Pleistocene
Pliocene
Miocene
Oligocene
Eocene
Paleocene
Upper Cretaceous
Lower Cretaceous
Upper Permian
Lower Permian
QUATERNARY
NEOGENE
PALEOGENE
TERTIARY
CRETACEOUS
JURASSIC
TRIASSIC
PERMIAN
PENNSYLVANIAN
DEVONIAN(?) and NEOPROTEROZOIC
MESOPROTEROZOIC
PALEOPROTEROZOIC
ARCHEAN
LIST OF MAP UNITS
SURFICIAL DEPOSITS
ANTHROPOGENIC DEPOSITS
ALLUVIAL DEPOSITS
ALLUVIAL AND MASS-MOVEMENT DEPOSITS
MASS-MOVEMENT DEPOSITS
GLACIAL DEPOSITS
EOLIAN DEPOSITS
ORGANIC-RICH DEPOSIT
POST-LARAMIDE SEDIMENTARY ROCKS
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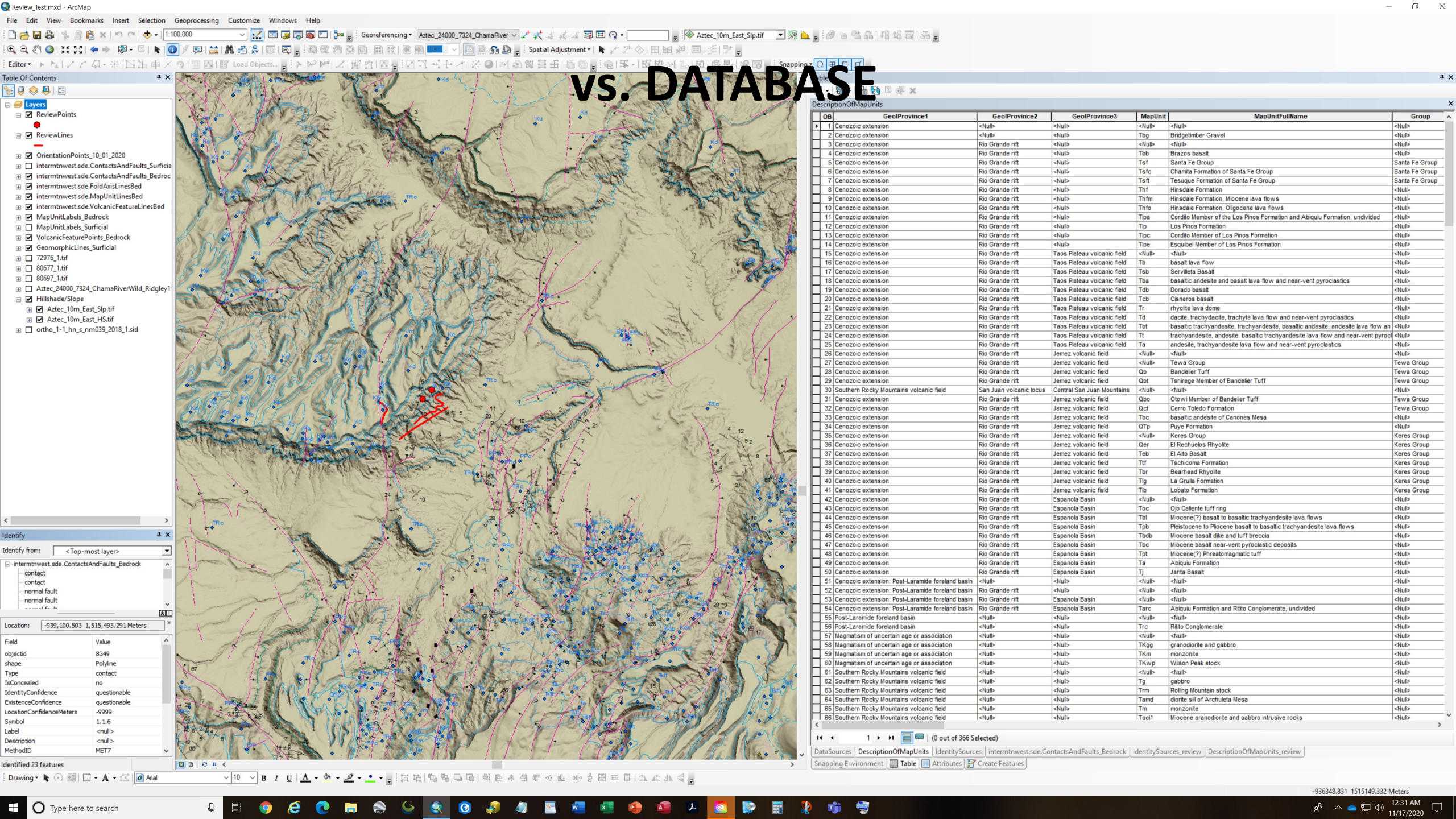
EXPLANATION
Geologic Map of the Fort Collins 30'×60' Quadrangle, Larimer and Jackson Counties, Colorado, and Albany and Laramie Counties, Wyoming
By
Jeremiah B. Workman, James C. Cole, Ralph R. Shroba, Karl S. Kellogg, and Wayne R. Premo
2018
USGS


vs. DATABASE

A SHIFT IN PHILOSOPHY AND THINKING

The product is a database, not a traditional map graphic

The review should occur within the database environment

All routing and approval steps should also use the map database which represents the entire complexity and detail of the publication

USGS

A SHIFT IN PHILOSOPHY AND THINKING

Multi-author map data and regional geologic mapping under the GeoFramework initiative will require many authors responding to reviews

Versioning can lead to multiple stages of review

The review is part of a continuous process

There may be many reviewers and many authors over a prolonged period of creation, compilation, and editing

USGS

A SHIFT IN PHILOSOPHY AND THINKING

Reviews, responses, and approval steps are data

Databases allow management of data

Current USGS routing uses the Information Product Data System (IPDS) database for logging steps in the process

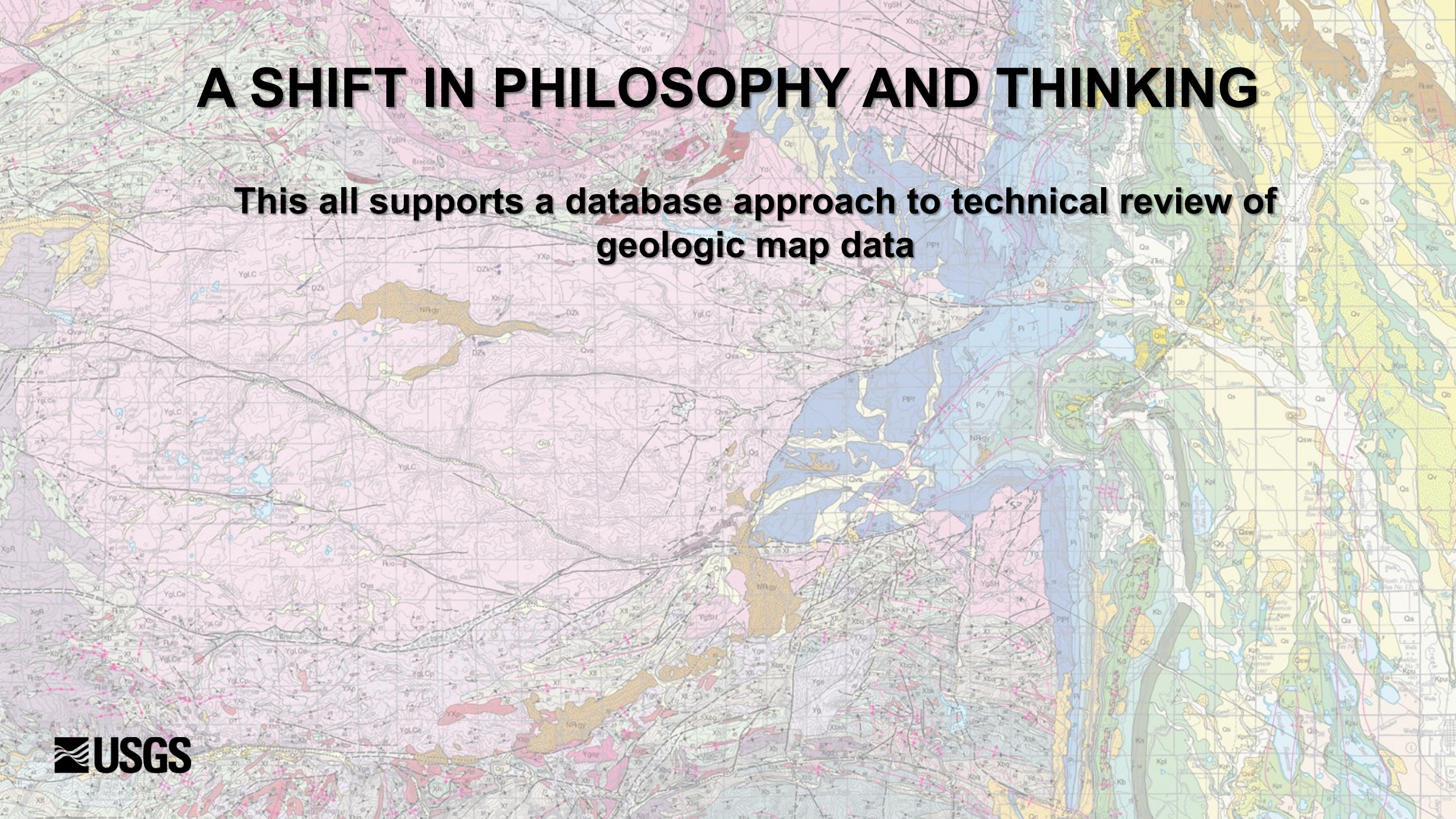
The actual reviews and responses are stored in separate files with no data structure or interconnection within IPDS

(scans of paper with handwriting)

USGS

A SHIFT IN PHILOSOPHY AND THINKING

This all supports a database approach to technical review of geologic map data



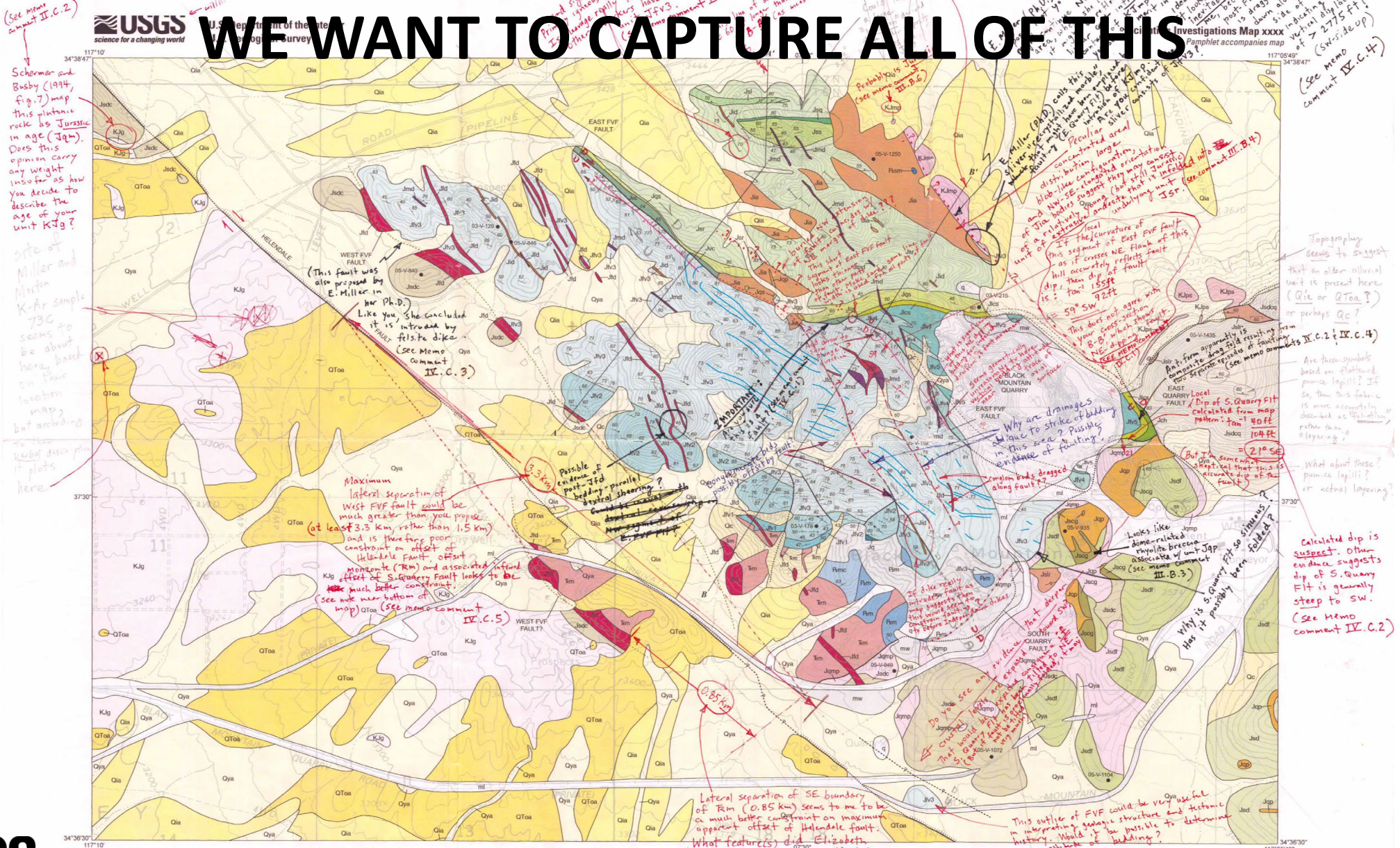
A SHIFT IN PHILOSOPHY AND THINKING

This all supports a database approach to technical review of geologic map data

How do we capture the traditional technical peer review within a database?

USGS

WE WANT TO CAPTURE ALL OF THIS



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Annotation of a digital graphic

sticky notes on a PDF

most common approach to create "digital" review comments

USGS

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NOT A TRUE DATA DRIVEN APPROACH

USGS

A SHIFT IN PHILOSOPHY AND THINKING

This all supports a database approach to technical review of geologic map data

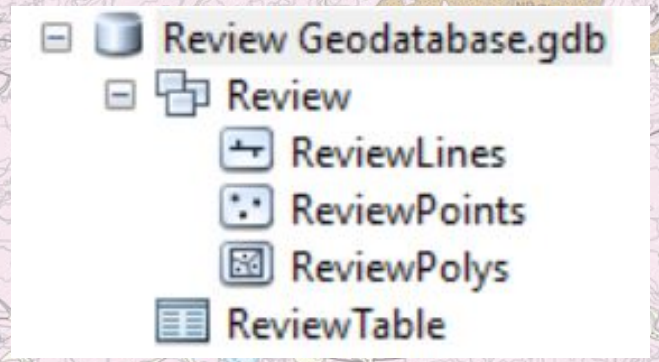
How do we capture the traditional technical peer review within a database?

A TRUE DATA DRIVEN APPROACH CREATES FUNCTIONALITY FOR THE REVIEWER, THE RESPONDING AUTHORS, AND THE APPROVING OFFICIALS

USGS

RECORDING REVIEW COMMENTS

Allow the reviewer all feature types of GIS to provide comments:



- **Polygons (ReviewPolys)**
- **Lines (ReviewLines)**
- **Points (ReviewPoints)**
- **Tables (ReviewTable)**

USGS

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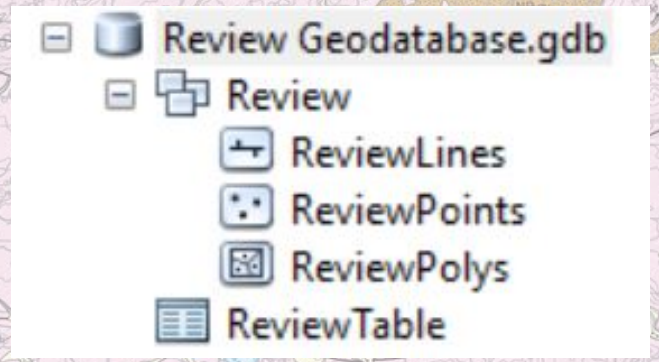

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Separate database from the GeMS database being reviewed

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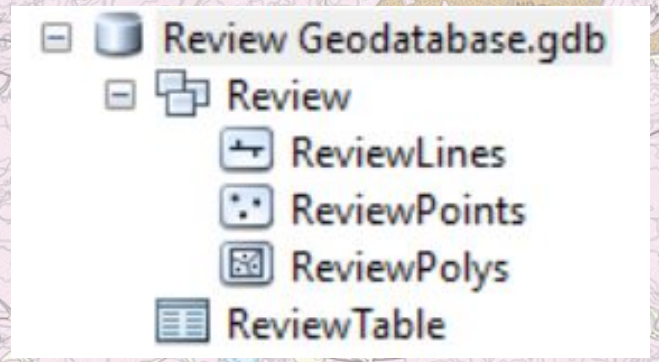

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Polys can be used to circle a bunch of lines

A point can be snapped to a line to comment

Can copy and edit a line to suggest new geometry

USGS

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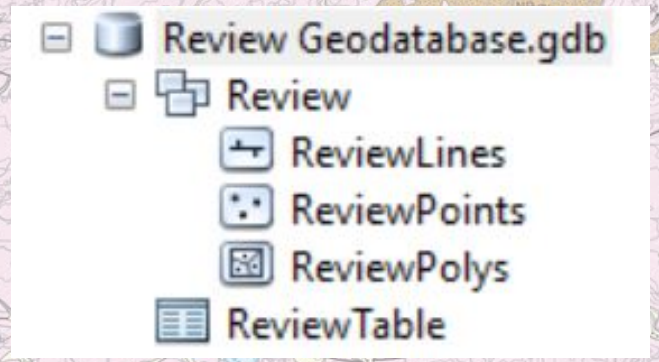

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Tabular comments are best suited to address a tabular field

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RECORDING REVIEW COMMENTS

Attribution to address comment and routing of comment:

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RECORDING REVIEW COMMENTS

Attribution to address comment and routing of comment:

- **Name of reviewer making comment**

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RECORDING REVIEW COMMENTS

Attribution to address comment and routing of comment:

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Attribution to address comment and routing of comment:

- **Name of reviewer making comment**
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- **Progress of the comment (routing step)**

USGS

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USGS

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- **Name of author responding to comment**
- **Progress of the comment (routing step)**
- **Data targeted by the comment**
- **Comment open text**

USGS

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- **Data targeted by the comment**
- **Comment open text**
- **Author response open text**

USGS

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- **Comment open text**
- **Author response open text**
- **Approving official response open text**

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- **Comment open text**
- **Author response open text**
- **Approving official response open text**
- **Approval check-box to close out the comment**

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RECORDING REVIEW COMMENTS

Spatial feature comments vs Tabular feature comments

Field Name	Data Type
OBJECTID	Object ID
shape	Geometry
reviewer	Text
responder	Text
progress	Text
featuredataset	Text
featureclass	Text
commenttype	Text
comment	Text
comment2	Text
authorresponse	Text
approvingofficialcomment	Text
approval	Text

Field Name	Data Type
OBJECTID	Object ID
reviewer	Text
responder	Text
progress	Text
tablename	Text
commentid	Text
commenttype	Text
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comment2	Text
authorresponse	Text
approvingofficialcomment	Text
approval	Text

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IDENTIFY THE TARGET FEATURE OF THE COMMENT

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comment	Text
comment2	Text
authorresponse	Text
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FeatureDataset **for multi-map databases**

FeatureClass **to identify the target feature type (concatenation)**

Use spatial review features (poly, line, point) to identify specific target

USGS

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Spatial feature comments vs Tabular feature comments

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responder	Text
progress	Text
tablename	Text
commentid	Text
commenttype	Text
comment	Text
comment2	Text
authorresponse	Text
approvingofficialcomment	Text
approval	Text

TableName **to identify the target table**

CommentID (or FieldID?) **to identify the row of the table**

FieldName **to identify comments for entire fields?**

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RECORDING REVIEW COMMENTS

Analyzing the review process?

Field Name	Data Type
OBJECTID	Object ID
shape	Geometry
reviewer	Text
responder	Text
progress	Text
featuredataset	Text
featureclass	Text
commenttype	Text
comment	Text
comment2	Text
authorresponse	Text
approvingofficialcomment	Text
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Field Name	Data Type
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progress	Text
tablename	Text
commentid	Text
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comment	Text
comment2	Text
authorresponse	Text
approvingofficialcomment	Text
approval	Text

***CommentType* is a field intended to record general categories of comments**

Allow post assessment of the process:

What types of comments are we getting?

Are different areas/rock types/etc. producing different problems?

Are different coauthors' workflows producing inconsistencies?

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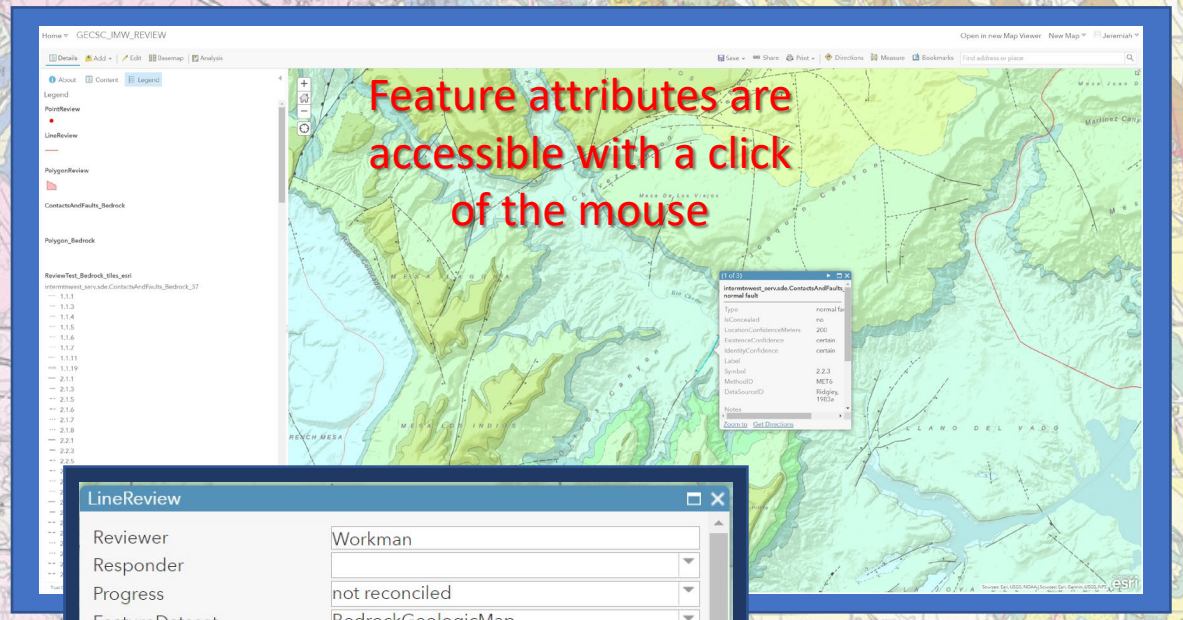
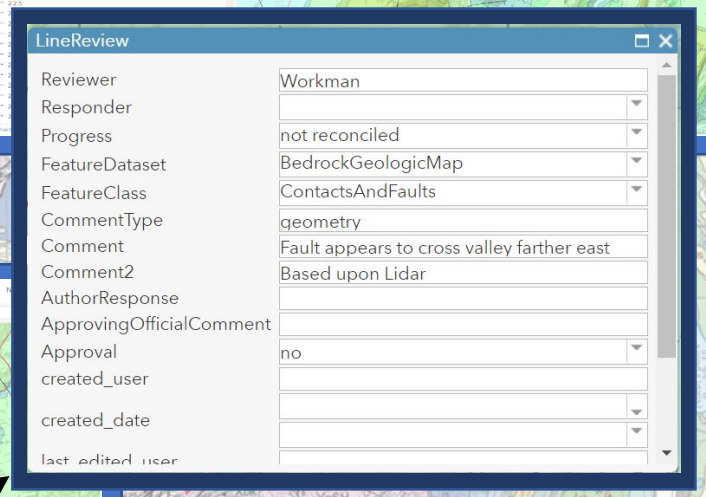
METHODS MADE POSSIBLE IN A DATABASE ENVIRONMENT

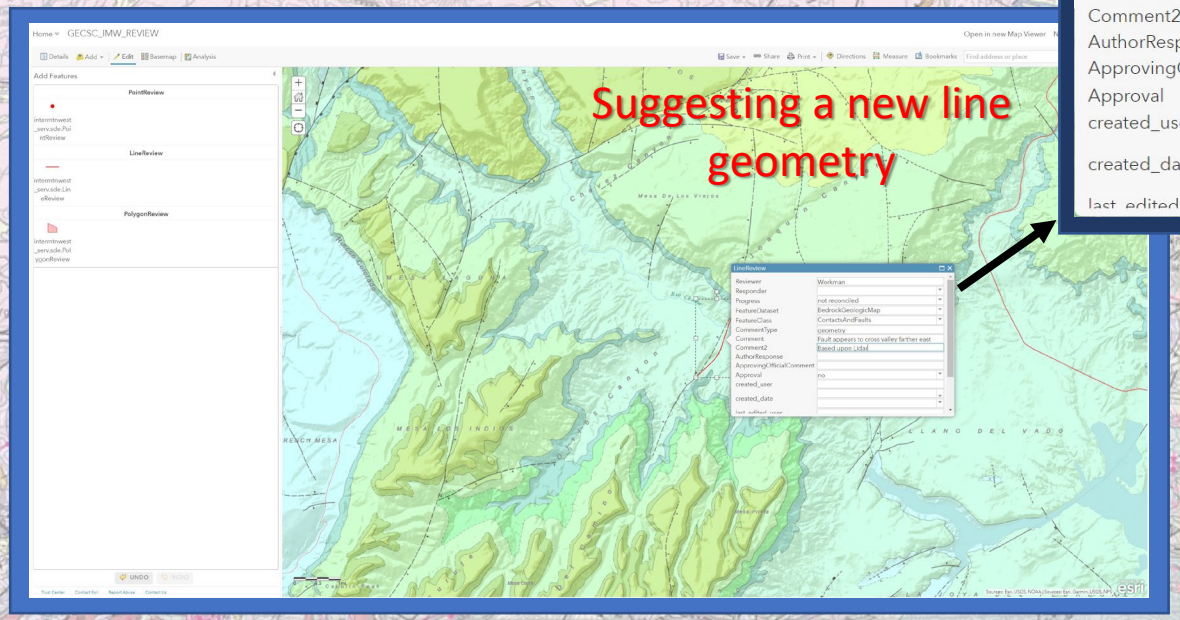
- Use of AGOL MapViewer for technical peer review
- TileService provides smooth viewing of symbolized map – map author controls visualization
- Queryable FeatureService provides controlled access to GeMS map database for querying – data remain secure

Allows map authors full control over their pre-publication data

- Editable FeatureService provides full access to review database – technical reviewer can draw and attribute comments







- Web interface only requires the technical reviewer has an Org AGOL account
- Simple review feature/comment creation tools
- Domains create easy drop-down attribution
- Low technology threshold for reviewer

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MANAGING THE REVIEW COMMENTS

Map authors can track progress while addressing review comments

Project managers overseeing multi-authored maps can use spatial and attribute queries of review comments to assign response duties and track progress

Multiple reviews can be managed simultaneously with ease due to comment level metadata

Routing and approval for updates to sections of a previously approved database can be treated in a more continuous workflow

Review comments can easily be archived in a uniform format and accessed later for full transparency of process

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A BASIC FRAMEWORK FOR A STANDARD

A database approach requires a standard

A standard will facilitate construction of tools and consistency in the technical peer review process

The GeoFramework Initiative requires consistency of process across all agencies involved and may incorporate work from 100's of geologists as authors and as reviewers (crowd sourcing)

Management of this process will require a robust data solution

USGS