



ROCK, PAPER, MINES

INTERNSHIP WITH THE MONTANA BUREAU OF MINES & GEOLOGY

REBECCA LESTER



OVERVIEW

- The Montana Bureau of Mines & Geology
- GeoArchive (Rock)
- Data Preservation (Paper)
- EarthMRI (Mines)
- Things I've learned
- Questions

WHAT IS THE MBMG?

- Established in 1919, the Montana Bureau of Mines and Geology (MBMG) continues to fulfill its mandate to collect and publish information on Montana's geology to promote orderly and responsible development of the energy, groundwater, and mineral resources of the State.
- A non-regulatory state agency, the MBMG provides extensive advisory, technical, and informational services on the State's geologic, mineral, energy, and water resources.
- The MBMG is increasingly involved in studies of the environmental impacts to land and water caused either by past practices in hard-rock mining or by current activities in agriculture and industry.
- The Montana Bureau of Mines and Geology is the principal source of earth science information for the citizens of Montana.

BETTER YET, WHO IS THE MBMG?



THE MAN, THE MYTH, THE PEDANTIC GREMLIN

Luke Buckley

Associate Professor-Data Scientist

MS in Technical Communication, *Highest Honors* 2018

Project Title: *“Applying User Centered Design Principles to Deliver Surface Water Data to Diverse Audiences”*

BS in Mathematics 1995

ASE in Geological Engineering 1993

Certificate holder of *“Least Boring Professor”* 2019

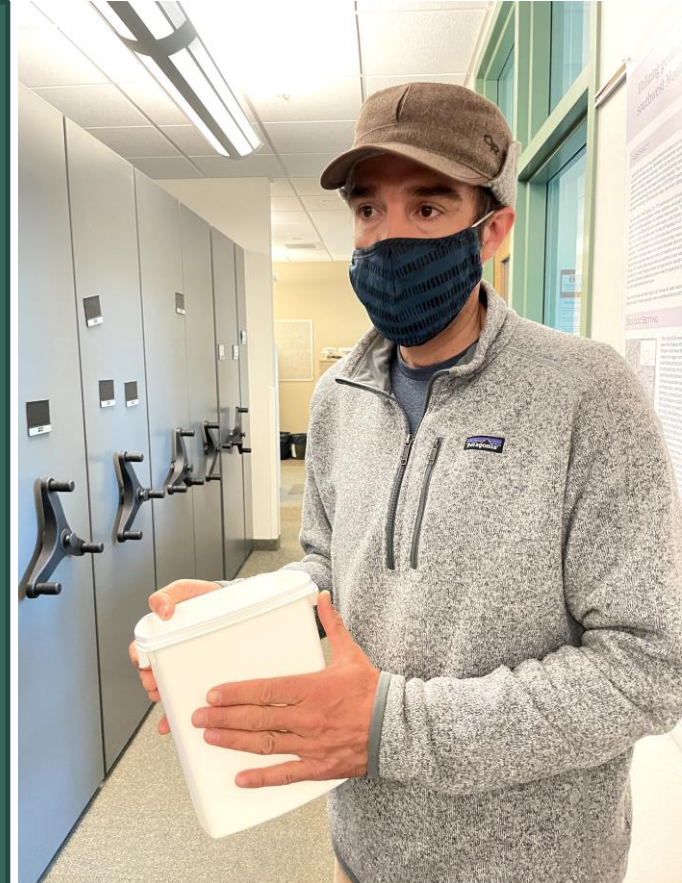


ROCK



MBMG
Geoarchive
Collection

Locations
Sample Types
Analyses Done
Geochemistry
Geochronology



MORE ROCKS – THE ANACONDA COLLECTION



Book No. 6227 Mine Saginaw Hill Pros. S ✓ M
Work No. _____ Level Pima Co, Ariz. T Ts
@ DDH #1 Vein _____ Pm Ps
Date 1/10/62 Sample By R. B. Mulchay Xf Xd Xs DTA
Rock Type 3 specimens Ch As
Notes Σ s Σ g E If Ph SA
Co-ord. N. E. N R



THERE WAS A LOT OF ROCKS...

STATISTICS	
THIN SECTIONS	4,800
DRAWERS	3,000
INDEXED ENTRIES	11,900
SPECIMENS	~100,000
ACTUAL MOVES	5
LAST ENTRY	JUNE 1981/S. CZECHURA
FIRST ENTRY	AUGUST 1940

SO HOW DO YOU DEFINE A ROCK?

- Color
- Size
- Chemical makeup
- How old?
- Where it came from
- Where is it now



- Who collected it
- Has any one written about it
- Is it part of a collection or a project?
- Is it owned by someone?

HOW THIS INFORMATION WAS BEING TRACKED

Archive_database_061521 - Excel

File Home Insert Page Layout Formulas Data Review View Help Tell me what you want to do

Clipboard Font Alignment Number Styles Cells Editing

A889 BEC-20-01

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Collection information															
2	Sample_name	MBMG_identifier	Project	Collector	Date	State	100k_quad	24k_quad	Latitude	Longitude	Sample_type	Specimen_type	Specimen_subtype	Lithology	Age	Supergroup
3	JDL052713	MBMG-JL-13-GSM-01	STATEMAP - miscellaneous	Lonn	2013	Montana	Salmon	Goldstone Mountain	45.0163	-113.3652	ROK	metamorphic	metasedimentary	quartzite	Proterozoic	Belt
4	BF-1	MBMG-SK-14-RTM-01	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1114	-112.1799	MD	vein			Cretaceous	
5	BF-10	MBMG-SK-14-RTM-10	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1099	-112.1762	MD	vein			Cretaceous	
6	BF-11	MBMG-SK-14-RTM-11	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1099	-112.1762	MD	igneous	intrusive	monzonite	Cretaceous	
7	BF-12	MBMG-SK-14-RTM-12	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1099	-112.1762	MD	vein			Cretaceous	
8	BF-13	MBMG-SK-14-RTM-13	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1020	-112.1953	MD	vein			Cretaceous	
9	BF-14	MBMG-SK-14-RTM-14	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1000	-112.2022	MD	vein			Cretaceous	
10	BF-15	MBMG-SK-14-RTM-15	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0974	-112.2056	MD	vein			Cretaceous	
11	BF-16	MBMG-SK-14-RTM-16	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1024	-112.1935	MD	vein			Cretaceous	
12	BF-17	MBMG-SK-14-RTM-17	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1024	-112.1935	MD	vein			Cretaceous	
13	BF-18	MBMG-SK-14-RTM-18	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0732	-112.1930	MD	igneous	intrusive	monzonite	Cretaceous	
14	BF-19	MBMG-SK-14-RTM-19	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0732	-112.1930	MD	vein			Cretaceous	
15	BF-2	MBMG-SK-14-RTM-02	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1114	-112.1799	MD	vein			Cretaceous	
16	BF-20	MBMG-SK-14-RTM-20	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0732	-112.1930	MD	vein			Cretaceous	
17	BF-21	MBMG-SK-14-RTM-21	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0732	-112.1930	MD	vein			Cretaceous	
18	BF-22	MBMG-SK-14-RTM-22	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0743	-112.1894	MD	vein			Cretaceous	
19	BF-23	MBMG-SK-14-RTM-23	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0743	-112.1894	MD	vein			Cretaceous	
20	BF-24	MBMG-SK-14-RTM-24	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.0732	-112.1930	MD	vein			Cretaceous	
21	BF-25	MBMG-SK-14-RTM-25	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1757	-112.3891	MD	vein			Cretaceous	
22	BF-26	MBMG-SK-14-RTM-26	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1757	-112.3891	MD	vein			Cretaceous	
23	BF-27	MBMG-SK-14-RTM-27	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1757	-112.3891	MD	vein			Cretaceous	
24	BF-28	MBMG-SK-14-RTM-28	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1757	-112.3891	MD	igneous	intrusive	pegmatite	Cretaceous	
25	BF-29	MBMG-SK-14-RTM-29	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1757	-112.3891	MD	vein			Cretaceous	
26	BF-3	MBMG-SK-14-RTM-03	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1114	-112.1799	MD	igneous	intrusive	monzonite	Cretaceous	
27	BF-30	MBMG-SK-14-RTM-30	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1757	-112.3891	MD	vein			Cretaceous	
28	BF-31	MBMG-SK-14-RTM-31	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1315	-112.2356	MD	igneous	intrusive	granite	Cretaceous	
29	BF-32	MBMG-SK-14-RTM-32	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1315	-112.2356	MD	vein			Cretaceous	
30	BF-33	MBMG-SK-14-RTM-33	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1315	-112.2356	MD	igneous	intrusive	granite	Cretaceous	
31	BF-34	MBMG-SK-14-RTM-34	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1315	-112.2356	MD	igneous	intrusive	granite	Cretaceous	
32	BF-35	MBMG-SK-14-RTM-35	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1315	-112.2356	MD	igneous	intrusive	aplite	Cretaceous	
33	BF-36	MBMG-SK-14-RTM-36	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1064	-112.2352	MD	igneous	intrusive	granite	Cretaceous	
34	BF-37	MBMG-SK-14-RTM-37	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1064	-112.2352	MD	vein			Cretaceous	
35	BF-38	MBMG-SK-14-RTM-38	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1064	-112.2352	MD	igneous	intrusive	granite	Cretaceous	
36	BF-39	MBMG-SK-14-RTM-39	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1033	-112.2268	MD	vein			Cretaceous	
37	BF-4	MBMG-SK-14-RTM-04	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1114	-112.1799	MD	igneous	intrusive	monzonite	Cretaceous	
38	BF-40	MBMG-SK-14-RTM-40	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1033	-112.2268	MD	vein			Cretaceous	
39	BF-41	MBMG-SK-14-RTM-41	Economic Geology Research	Korzeb	2014	Montana	Butte North	Ratio Mountain	46.1033	-112.2268	MD	vein			Cretaceous	

Sample list Explanation Quad Codes Rack Map

WHAT'S SO BAD ABOUT EXCEL?

- No validation
 - i.e., Yellowstone, Carbon, and Powell/Ingera County
- Each geologist had own version of what was important
- No way to share with the public in an easy to understand way

YAY FOR NORMALIZATION

- The process of structuring a database, usually a relational database, in accordance with a series of so-called normal forms in order to reduce data redundancy and improve data integrity.
- It is accomplished by applying some formal rules either by a process of synthesis (creating a new database design) or decomposition (improving an existing database design).

Students

IDSt	LastName	IDProf	Prof	Grade
1	Mueller	3	Schmid	5
2	Meier	2	Borner	4
3	Tobler	1	Bernasconi	6

Startsituation



Students

ID	LastName
1	Mueller
2	Meier
3	Tobler

Professors

IDProf	Professor
1	Bernasconi
2	Borner
3	Schmid

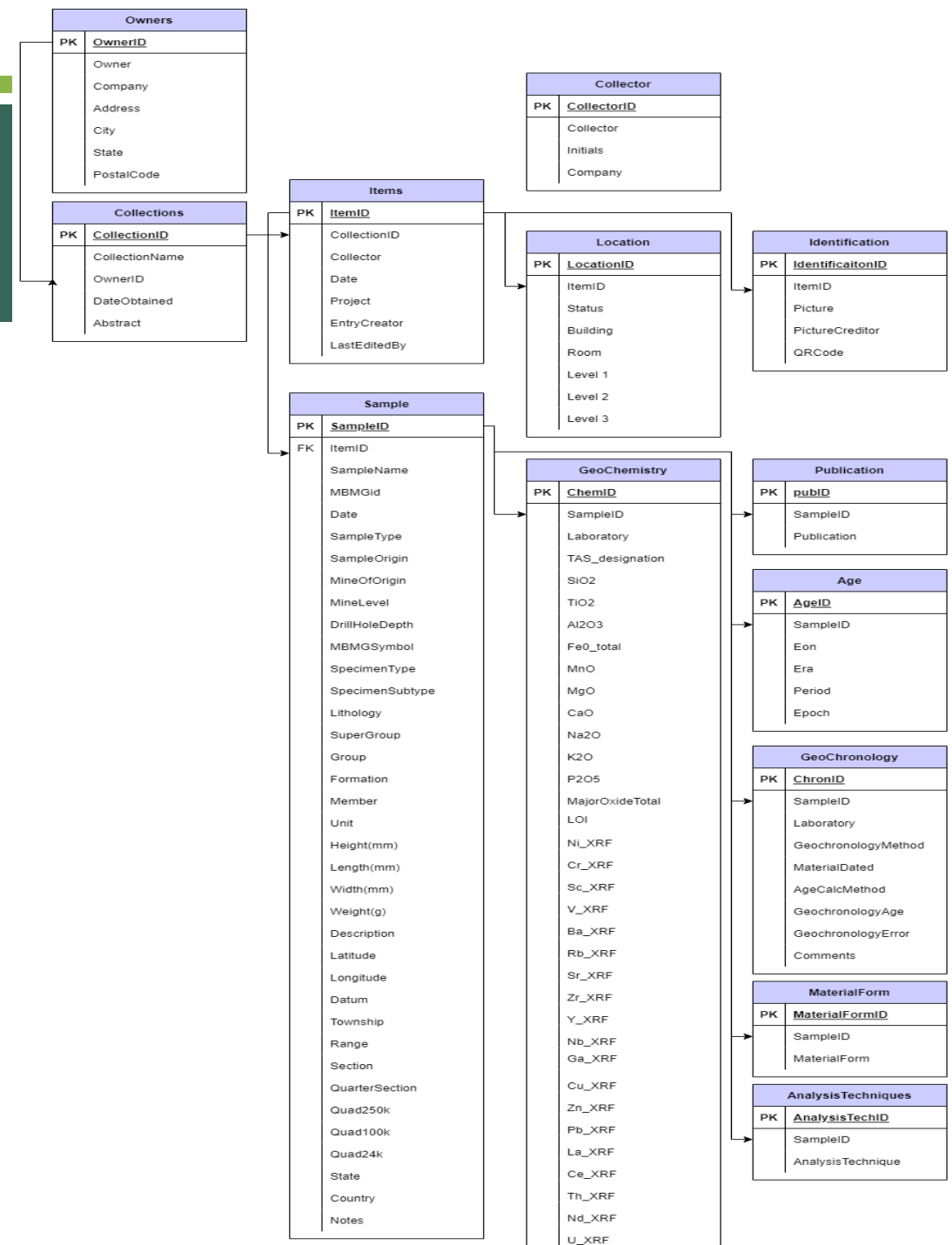
Result after normalisation

Grades

IDStIDProf	Grade	
1	3	5
2	2	4
3	1	6

THE CURRENT GEOARCHIVE DATABASE DESIGN

- 13 tables (not including validation or audit tables)
- ~ 15,000 records with more on the way
- Developed using SQL Server Management Studio (SSMS)



THE WEB INTERFACE

The image displays three screenshots of the MBMG web interface, each showing a different view for the sample MBMG-JM-18-BK-02. The interface includes a navigation bar with 'Home', 'Sign Out', and 'Collections' links, and a breadcrumb trail: 'Sample Information > General Age & Geochronology Report > Geochemistry Report > Storage Location'.

Left Screenshot: General Information

MBMG-JM-18-BK-02 BK-02

General Age +Edit

Eon	PHANEROZOIC
Era	MESOZOIC
Period	CRETACEOUS
Epoch	LATE CRETACEOUS

Geochemistry Report +Edit

Laboratory	UCSB
Geochronology Method	PB206_U238 ICP:MS-LA-MC
Material Analyzed	ZIRCON
Age Calculation Method	WM
Geochronology Age (Ma)	72.1
Geochronology Age Error	0.4
Reported as	2 sigma
Comments	SOME INHERITANCE. NORMAL K DISTRIBUTION. WM FROM 35 AGES

Storage Information +Edit

Status	IN STORAGE
Building	133MTSB
Storage Identifier	B-4-JM149

Geochemistry Report +Edit

Laboratory	WSU
TAS_designation	Trachyandesite
SiO2	59.05
TiO2	0.72
Al2O3	16.85
FeO_Total	4.67
MnO	0.08
MgO	1.36
CaO	5.03
Na2O	5.53
K2O	1.26
P2O5	0.20
MajorOxideTotal	94.78
LOI	4.67
Ni_XRF	6.64
Cr_XRF	29.30
Sc_XRF	10.78
V_XRF	87.12
Ba_XRF	807.30
Rb_XRF	38.74
Sr_XRF	566.96
Zr_XRF	261.88

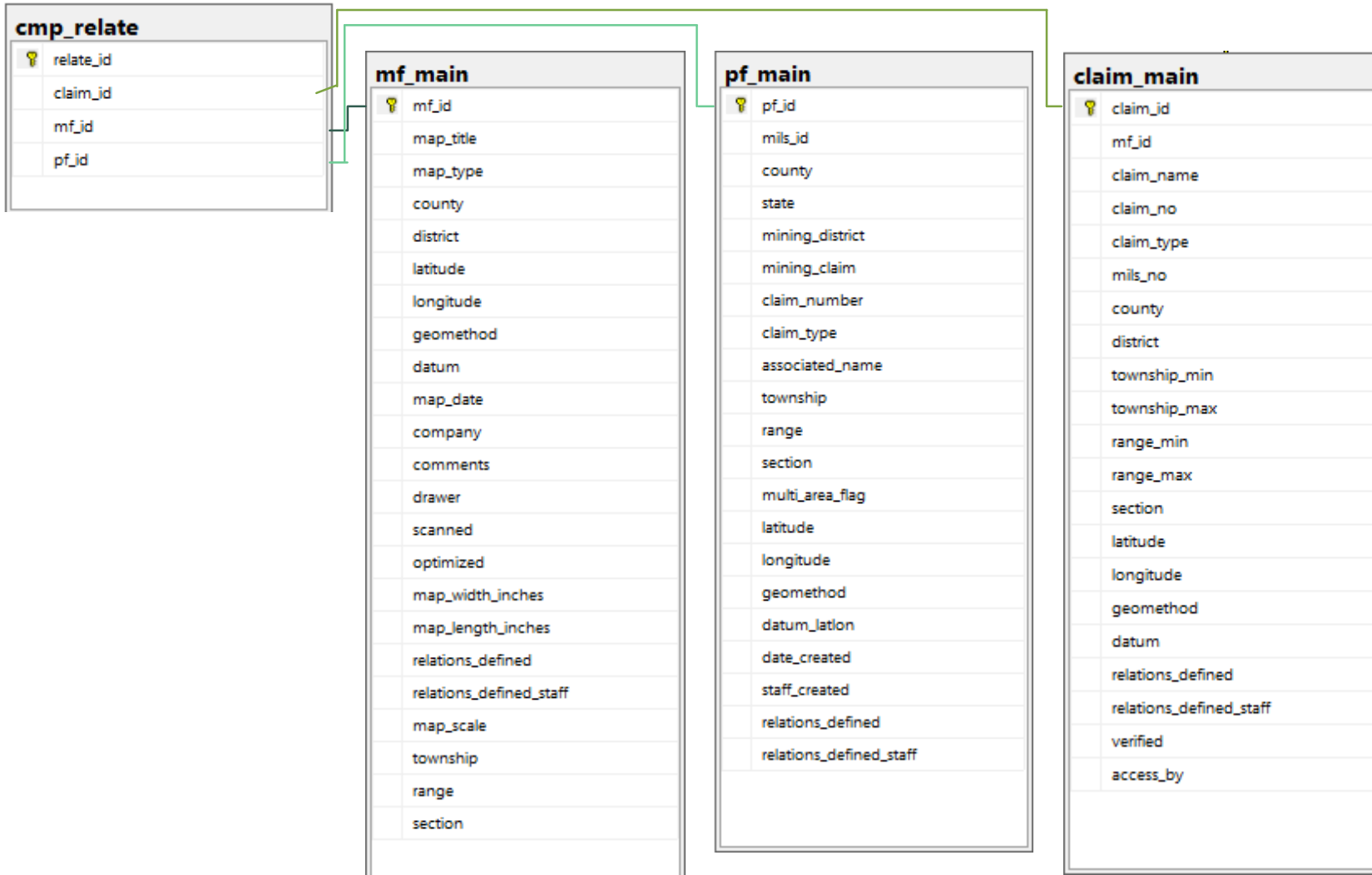
Stratigraphic Information

Supergroup	
Group	BANNACK VOLCANIC GROUP
Formation	
Specimen Type	IGNEOUS
Specimen Subtype	INTRUSIVE
Lithology	TRACHYANDESITE

PAPER



THE CURRENT DATA PRESERVATION DATABASE (KINDA...)



ONE DATABASE TO RULE THEM ALL...



MINES

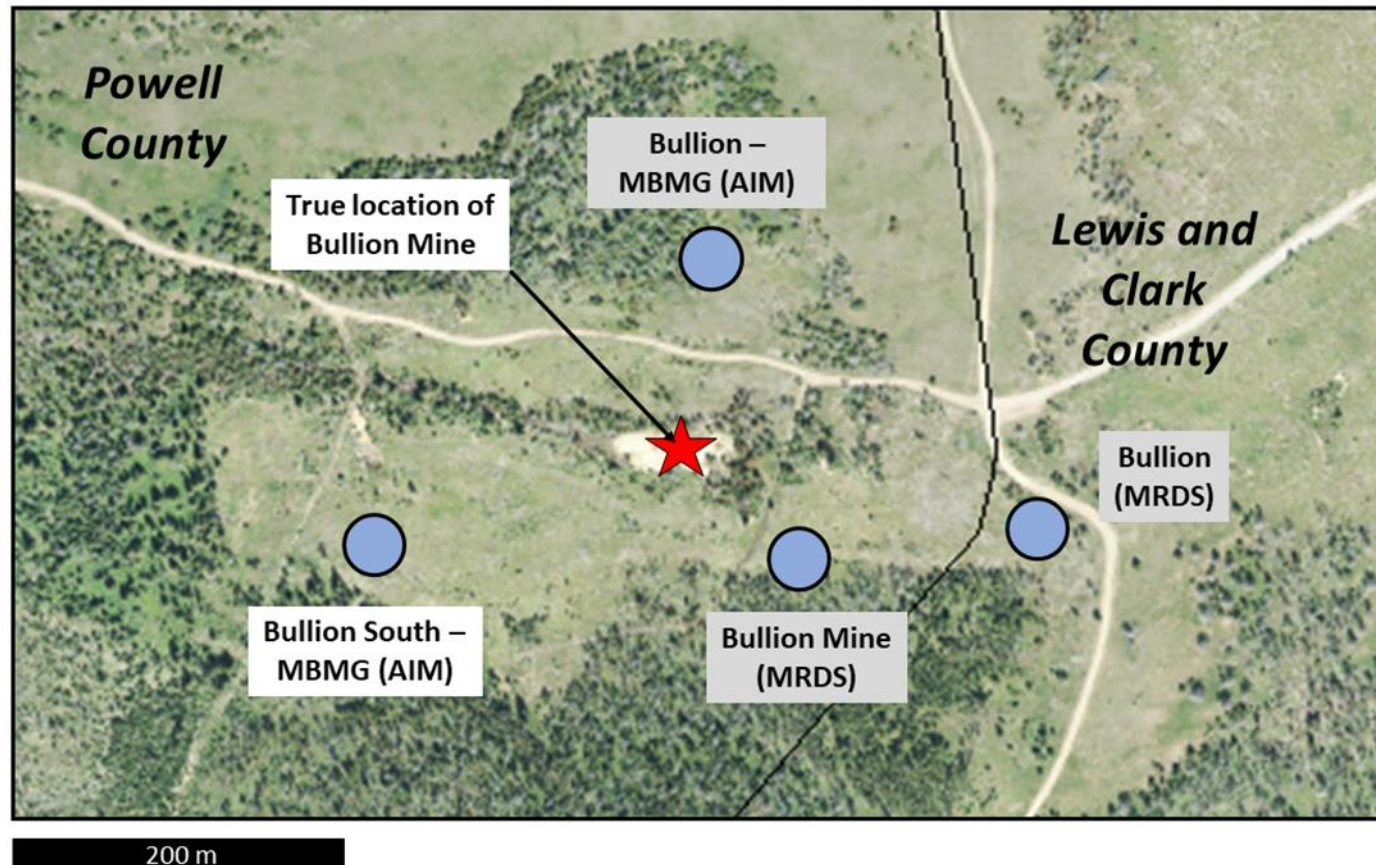


Earth MRI

Mines
Critical Minerals
Mineral Systems

A large table with multiple columns and rows, likely a data table. The table is divided into several sections with different colored backgrounds (yellow, pink, green, blue, purple, orange). The text in the table is small and difficult to read, but it appears to be a detailed report or data set. The table is pinned to a wall with a silver clip at the top right.

ONE GOAL OF THE EARTHMRI DATABASE



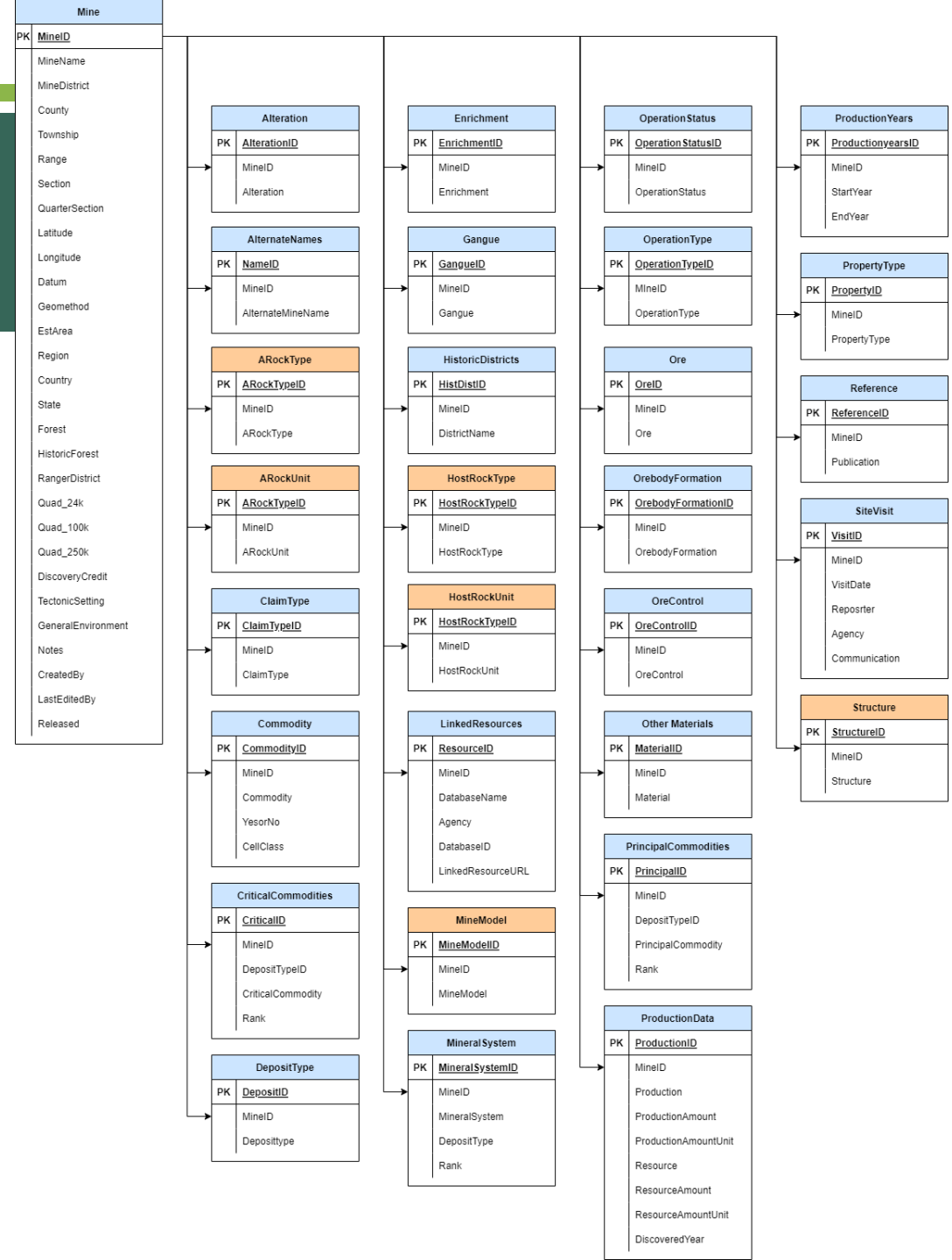
HOW DO YOU DEFINE A MINE?

- Location
- Production
- Owner
- Mineral Systems
- Deposit(s)



CURRENT EARTH MRI DATABASE DIAGRAM

- 30 tables (not including validation or audit tables)
- 5 records with more on the way
- Developed using SQL Server Management Studio (SSMS)
- Tables that are already outdated



WEB INTERFACE

SHEEP CREEK DEPOSIT

[+Site Visit](#)

[+Edit Record](#)

Alternate Site Names

BLACK BUTTE COPPER, JOHNNY LEE

Location

Coordinates 46.784032, -110.915143 (WGS84)

Estimated Area

Location Information

Mining District SMITH RIVER

Historical Districts

County MEAGHER

State MONTANA

Country UNITED STATES

Region NORTH AMERICA

USGS Map Quadrangles

Township 12N

Range 06E

Section 11

Quarter-Section

Public Land Survey System

24K Quadrangle STRAWBERRY BUTTE

100K Quadrangle WHITE SULPHUR SPRINGS

250K Quadrangle WHITE SULPHUR SPRINGS

National Forest Service

National Forest HELENA - LEWIS AND CLARK


Ranger District KINGS HILL


Historic Forest

Geologic Environment

General Description MINERALIZATION DOMINATED BY CHALCOPYRITE WITH LESS TENNANTITE WITHIN STRATIFORM, MASSIVE TO SEMI-MASSIVE PYRITE LENSES IN THE NEWLAND FM. - A MARINE BLACK SHALE W/ DOLOMITE AND DEBRIS FLOWS. BA OCCURS IN STRAWBERRY MAIN DEPOSIT. SHALES ARE SILICIFIED WHERE CU GRADES ARE HIGHEST AND CU-RICH ZONES LOCALLY PRESENT DISSEMINATED CO-NI SULFIDES AND SULFARSENIDES. ADDITIONAL MINERAL ZONES ARE ACTIVELY BEING EXPLORED AND EVALUATED. 4 KM WEST OF BLACK BUTTE - SUPERGENE DEPOSITS HAVE BEEN MINED FOR FE AT A SMALL SCALE. DOCUMENTED PRODUCTION OF AG AND BA.

Age and Tectonic Setting MESOPROTEROZOIC 1.4 GA; EXTENSIONAL CONTINENTAL MARGIN.

Primary Mineral System - BASIN BRINE PATH 

Secondary Mineral System - CHEMICAL WEATHERING 

WHY IT MATTERS

Nice job everyone-- on the database and the **presentation!**

It's clear from the questions that folks will appreciate being able to query the database—good to know it may have a broad base of users interested in the geochemistry at various mines.

We've really been impressed with some recent presentations showcasing your NGGDPP Priority 1 and Priority 2 work at the Montana Bureau of Mines and Geology. [REDACTED] and [REDACTED] have both done a fantastic job in recent presentations highlighting these shared team successes. Kudos to the team! You all have a great story in your web of interrelated activities (cleanup, inventory, PID system, sample relocation into new repository, database, analytical data, web page development, and web application) in your preservation project including coordinating with Val Stanley on your implementation of IGSN. Beautiful.

The format for the presentation is a 2-3 minute lightning presentation and I was hoping you could share some of the highlights from your activities. Might you be willing to present on March 1, 2022?

I finally had time this morning before everything hit the fan to listen to your talk given at the NGGDPP data workshop seminar series. [REDACTED]'s recordings are really wonderful for those of us who couldn't make the live talks. I really am impressed with your team's work and how you are enacting the vision of Earth MRI and the NGGDPP goals of bringing to the public the vast amounts of information you host. **Congratulations** on your creative approach to archiving samples, data, and paper files. That is a major effort. It is our job at the USGS to strive to maintain funding streams to help support your long-term efforts.

Looking forward to your data becoming live.

Subject: your database is cool!

External email: Use caution with links and attachments.

Just sayin'. 😊

THINGS I'VE LEARNED

PILOT +See Visit
+LDK Record

Location Information

Location

Coordinates 48.34730 - 112.10454 (MUS04)

Administrative Divisions *Location Information*

Mining District AMAZON

County JEFFERSON

State MONTANA

Country UNITED STATES

Region NORTH AMERICA

USGS Map Quadrangles

24K Quad WICKES

100K Quad BUTTE NORTH

250K Quad BUTTE

Public Land Survey System

Township 05N

Range 05W *⊕ estimate area covered by question?*

Section 4

Quarter Section

National Forest Service

National Forest

Ranger District *24 OK*

Historic Forest HEADWATERS

Alternative Mine Names

FLORENCE, SILVER STAR *This could go above.*

Historical Mining Districts

WICKES *This could also go above. (scribble)*

Operation Information

Property Type CODE

Operation Type UNDERGROUND

Operation Status PAST PRODUCER

Mineral Information

Ore	Gangue	Other
GALENA	UMONITE	
GOLD	PYRITE	
MALACHITE	QUARTZ	
SPHALERITE		

more towards top.

Mining Information

Claim Type PAST PRODUCER

Deposit Type

Ore Control SHEAR ZONE, BLEACHED ZONE 8-10 FT.

Alteration OXIDIZED, SULFIDED

Enrichment

Ornbody Formation

Mine Model *mineral system*

Surrounding Geology

Structure BOULDERBATHOLTH *→ relate origin/size/conditions*

Tectonic

Host Rock Unit

Host Rock Type QUARTZ MONZONITE

Alteration Rock Unit

BUTTEQUARTZMONZONITE(BOULDERBATHOLTH)

A Rock Type QUARTZMONZONITE

Production Information

Produced

Resource Amount

Production years

Year Discovered

Number of Production Years

Discovery Credit

⊕ of question about what data to take info... (scribble)

PP

“Requirements gathering is the process of determining what your projects need to achieve and what needs to be created to make that happen. You’re probably familiar with the fact that everybody has their own common project assumptions about what a project should include.”

A guide to requirements gathering. Wrike. (n.d.). Retrieved November 9, 2021, from <https://www.wrike.com/blog/requirements-gathering-guide/#What-is-requirements-gathering-in-project-management>.



QUESTIONS

