GEL 4050 - Igneous & Metamorphic Petrology

150 pt Field Trip GROUP Assignment: HANDOUT & ORAL FIELD PRESENTATION

NORTH FIELD TRIP - CO - WY

Grading Rubric for Field Trip Handout (100 pts). Upload handout to CANVAS for grading!

/20 COMPOSITION & LAYOUT - one or multiple point deduction per infraction

Maximal 2 pages (back and front). The appearance is neat and orderly. The handout is typed and graphics and data are electronically prepared and inserted. Subscripts and superscripts are appropriately used and equations are explained. The handout is complete with all fields populated, if any. Graphics and data are placed in a coherent form. Proper formatted citations are included.

/30 WRITING & GRAMMAR - one point deduction per infraction

Spelling and grammar are correct. Word repetition and use of first person language is avoided. Statements are factually correct. Appropriate and complete language is used. Scientific notations / abbreviations as well as subscripts and superscripts are appropriately formatted.

/30 COMPILATION - one or multiple point deduction per infraction

Handout should contain geologic summary and details about the rock unit. GPS coordinates of the field stop are present. Age, composition, mineralogy and geochemistry are indicated. Extent of formation (diagenesis) of rock unit are discussed. Explanations and inferences are logically drawn and supported by evidence.

/20 GRAPHICS & ILLUSTRATIONS (Location & Geo Map, QAPF & TAS: 5pts ea.) - one or multiple point deduction per infraction

A location map, geologic map, possible pictures and the QAPF and TAS diagrams are presented. All illustrations must be electronically prepared. Pictures should be clear, of high quality, and with neutral background. Graphs should have a title with appropriate axis and unit labels. Citation of source must be included. Graphics need to meat minimum resolution (300 DPI) requirements. All figures must have captions.

Grading Rubric for Field Trip Lecture (50 pts). Graded during fieldtrip and entered by Instructor on CANVAS

/10 PRESENTATION - one or multiple point deduction per infraction

Voice projects clearly. Speech is free (practiced) and not read. Pointing to the handout is ok. Lecture stays within the allotted time frame.

/15 CONTENT - one point deduction per infraction

Lecture contain geologic summary and details about the rock unit. Age, composition, mineralogy and geochemistry are discussed. Extent of formation (diagenesis) of rock unit is mentioned. Explanations and inferences are logically drawn and supported by evidence.

/15 COMPILATION - one or multiple point deduction per infraction

Presentation is factually correct and actual interacts with the rock unit presented.Word repetition is avoided. Appropriate and complete language is used.

/10 QUESTIONS - one or multiple point deduction per infraction

Response to questions is professional and shows knowledge of subject matter. Conjectures make sense. Answers are factually correct.

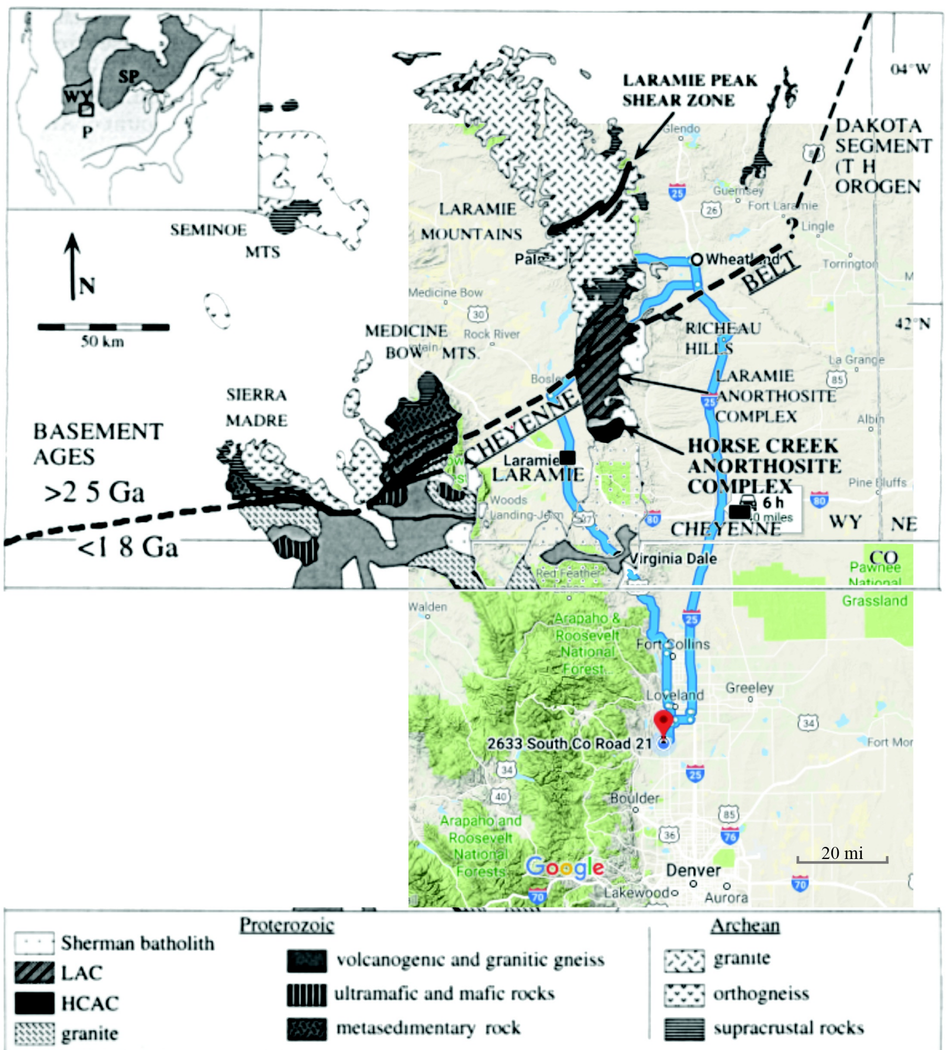
NORTH FIELD TRIP - CO - WY

We will meet Saturday (FOR DATE SEE CANVAS COURSE CALENDAR) at 8:30am at My House: 2633 S County Rd 21, Berthoud, CO 80513, 1.5 mi West of US287 at the Boulder and Larimer County Line. (see Map)
My Cell Phone: 720-257-4486

Things to bring:

- ☐ Firm Shoes (Hiking)
- ☐ Sack Lunch
- ☐ Water Bottle (Drink)
- ☐ Sun screen
- ☐ Hat
- ☐ Jacket
- ☐ Petty Cash *(To reimburse drivers)*
- ☐ Camera
- ☐ Index Cards
- ☐ Field Notebook / Pen
- ☐ Rock-Hammer
- ☐ Hand lense
- ☐ Acid Bottle
- ☐ Mineral Test Kit(s)
- ☐ Ziploc Bags
- ☐ Sharpie Pen
- ☐ Map(s)
- ☐ This handout
- ☐ GPS *(optional)*

TRIP MAP w/ Geology:



150 pt Field Trip GROUP Assignment: HANDOUT & ORAL FIELD PRESENTATION

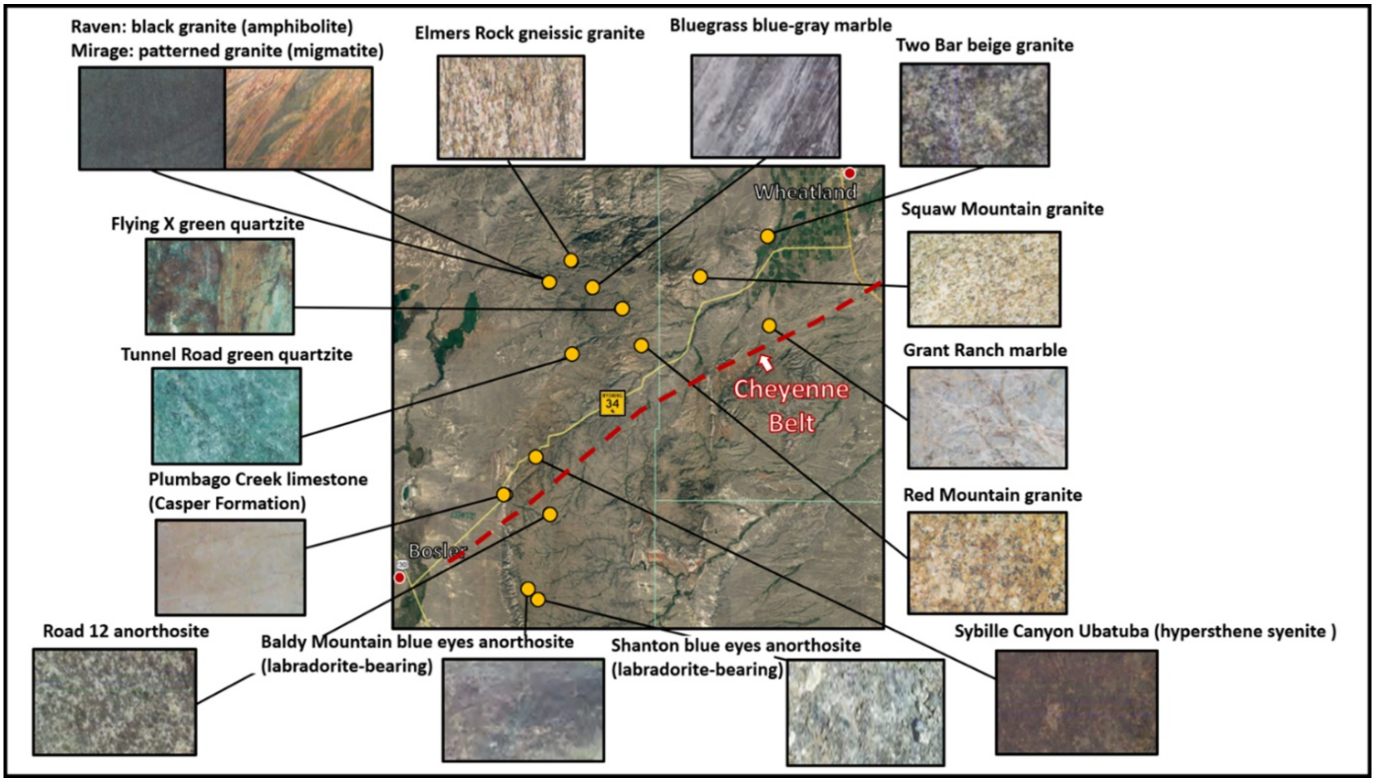
INTRODUCTION: Your field trip assignment consists of two parts:
1. Creating a handout about a certain igneous rock unit we will encounter that shall be given to ALL students and the instructor on field trip day. This assignment is worth 100 pts
2. To give a maximal 15 minute field lecture about your selected rock unit at a field stop you will select. This oral field presentation is worth 50 pts

SUMMARY: During this trip you will focus on the petrology of the igneous system along WY Route 34 which pretty much follows the Cheyenne Belt, a Precambrian suture line of an ancient continental collision. Along this line, a great variety of plutonic igneous rocks have formed.
With your group, you will collect more samples for the course group petrology project, take a picture of your outcrop, and enter detailed descriptions in your field notebook. The collected sample will then be brought back to the lab for further analysis.

Here is a summary list of Possible Rocks we will encounter:

Age (Ma)	Primary Rock Type	Description
2,600 TO 3,100+	GRANITE GNEISS	Layered to massive, locally migmatitic; metasedimentary and metavolcanic rocks locally common
2,600	GRANITOID	Granite, amphibolite, and minor amounts of metasedimentary rocks
2,700+	METAVOLCANIC	Amphibolite of volcanic origin, komatiite(?), metagabbro, and ultramafic sills.
2,800	METASEDIMENTARY	Pelitic schist, iron-formation, quartzite, marble, metaconglomerate, and metagraywacke.
1,435	ANORTHOSITE	Pyroxene and hornblende syenite
? pC	ANORTHOSITE	Anorthosite and norite
pC	PERIDOTITE	Peridotite intrusive
83 Late K	NIOBRARA FORMATION	Light-colored limestone and gray to yellow speckled limy shale
Middle Pen - Late P	CASPER FORMATION	Gray, tan, and red thick-bedded sandstone underlain by interbedded sandstone and pink and gray limestone. May include some Devonian(?) sandstone along east flank of Laramie Mountains.
2,600+	METASEDIMENTARY	Amphibolite, hornblende gneiss, biotite gneiss, quartzite, iron-formation, metaconglomerate, marble, and pelitic schist; locally preserved textures and structures suggest origin to be sedimentary or volcanic
Pen - P	INGLESIDE FORMATION	Limestone & calcareous sandstone
	DIORITE	Coarse-grained diorite generally found within larger bodies of fine-grained diorite. Coarse: plagioclase, hornblende, biotite, and quartz, with alkali feldspar and opaque iron oxides. Accessories: euhedral magnetite and ilmenite in fine, granular apatite, sphene, and epidote in both fine- and coarse
	MONZOGRANITE	Oriented, tabular microcline megacrysts in a finer-grained matrix. Contains quartz, microcline, plagioclase, biotite, and hornblende. Accessories: apatite needles, sphene, magnetite, traces of epidote, zircon, and allanite.

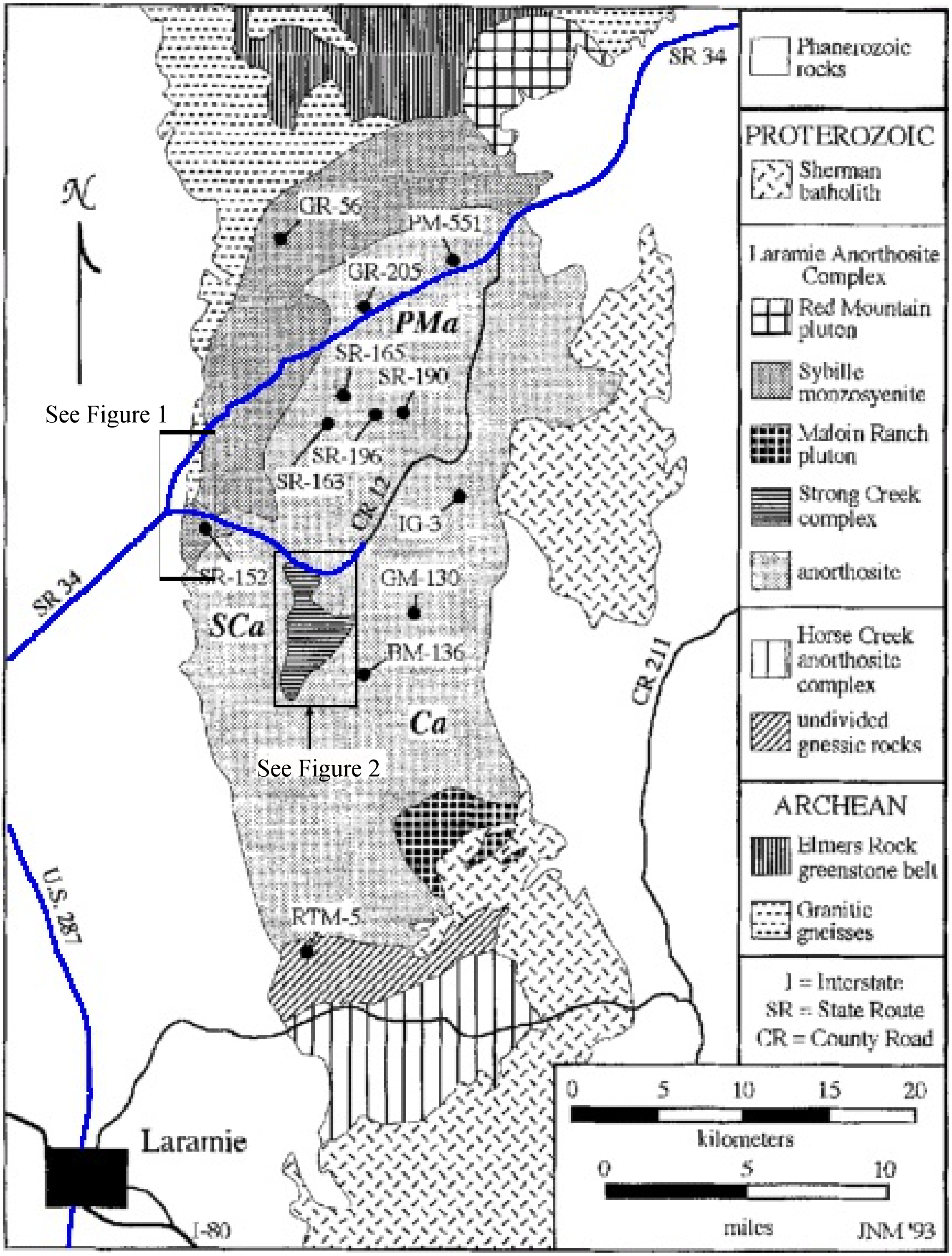
The following graphic indicates select rock types and approximate sample locations:



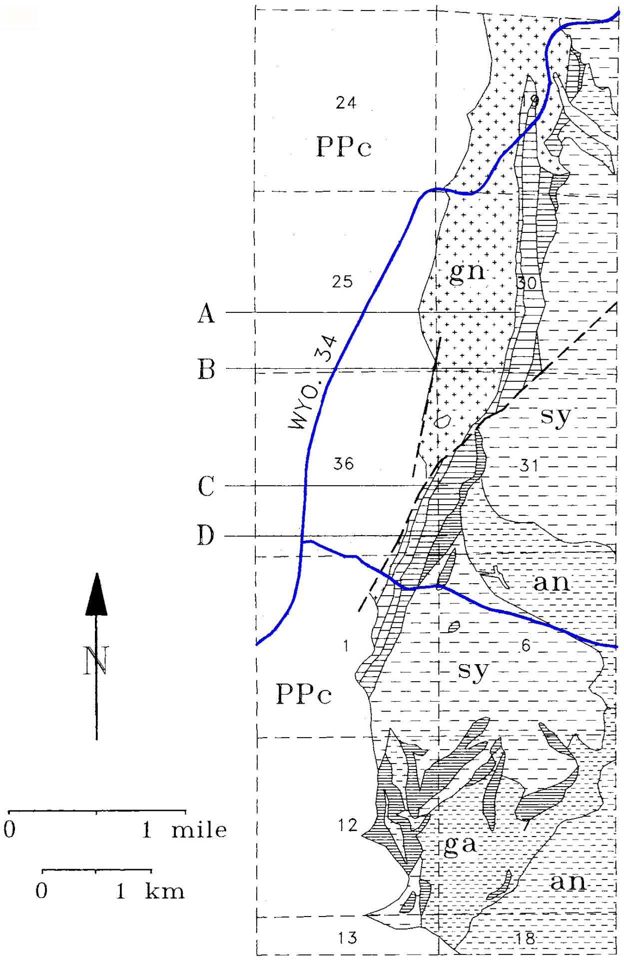
An EXCELLENT resource to select your field stop, prepare your handout and field lecture and determine which sample you would like to collect is the following: **https://www.geowyo.com/sybille-canyon---wy-highway-34.html**

Additional material below summarizes the geology we will encounter during our field trip.

Greater Field Trip Route, associated geology and possible field stops along US287 & WYO 34.



Fieldtrip route in ***blue!***



MORTON PASS : STRATIGRAPHY

Figure 1 - Morton Pass

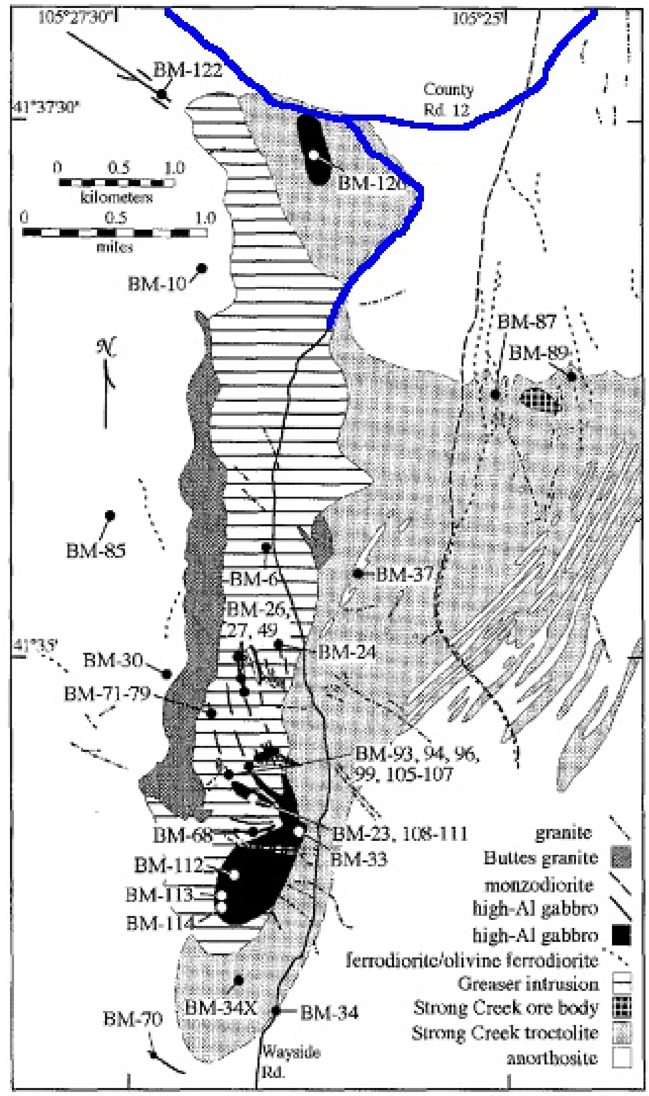
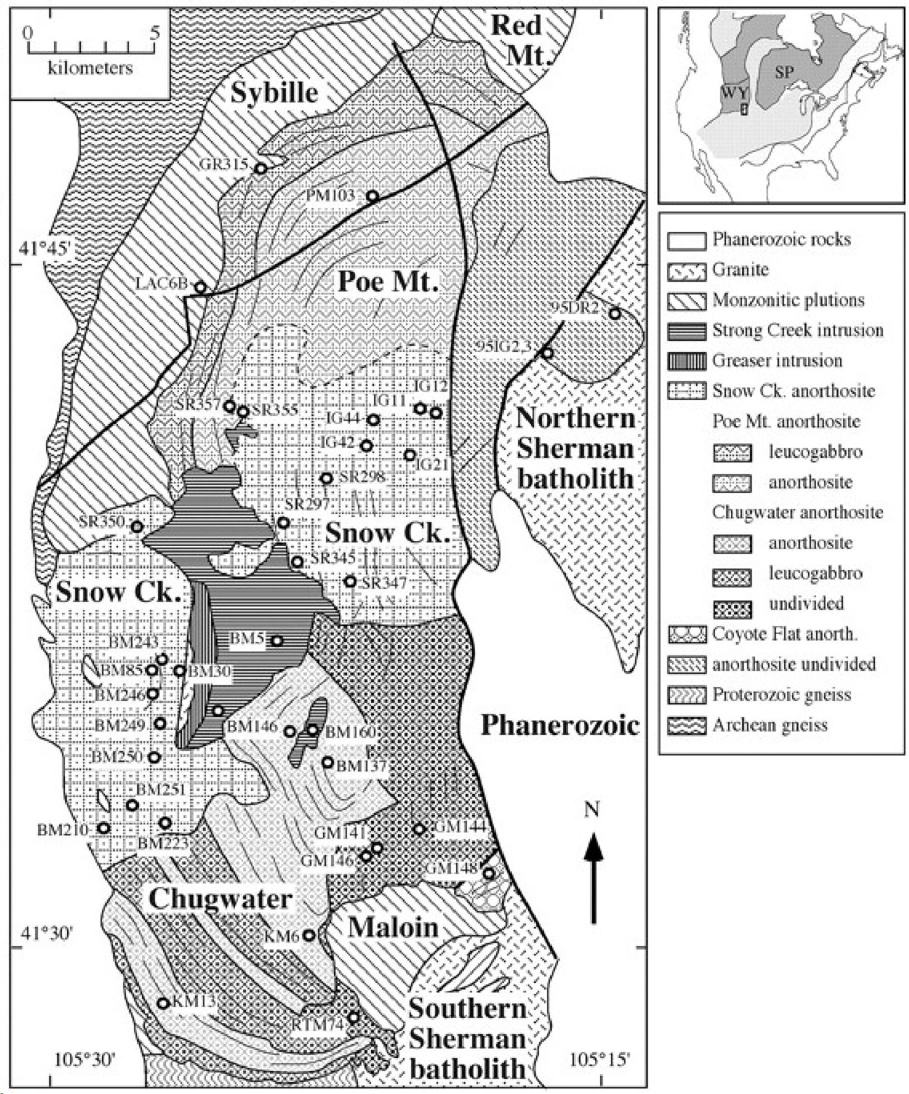
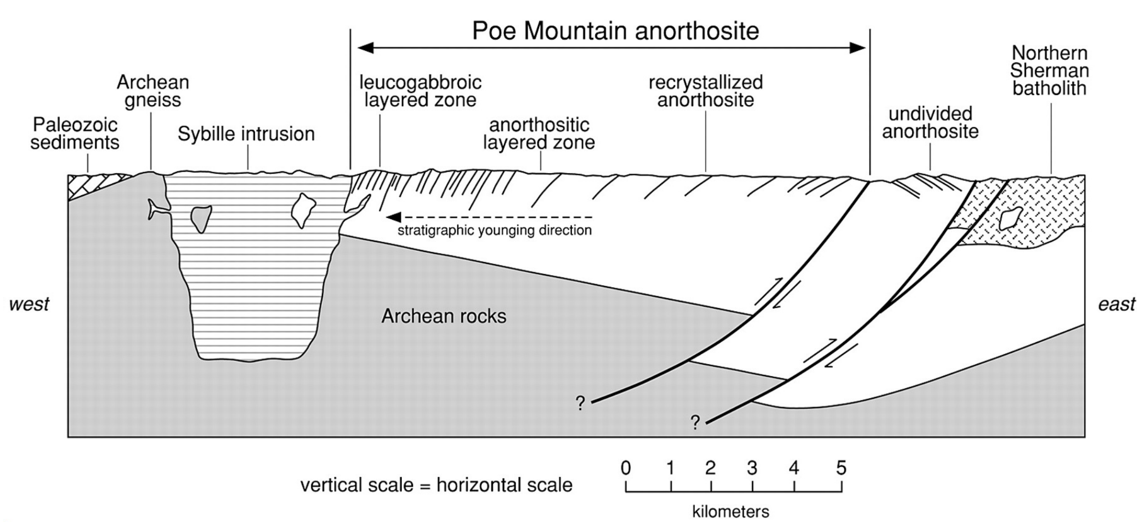
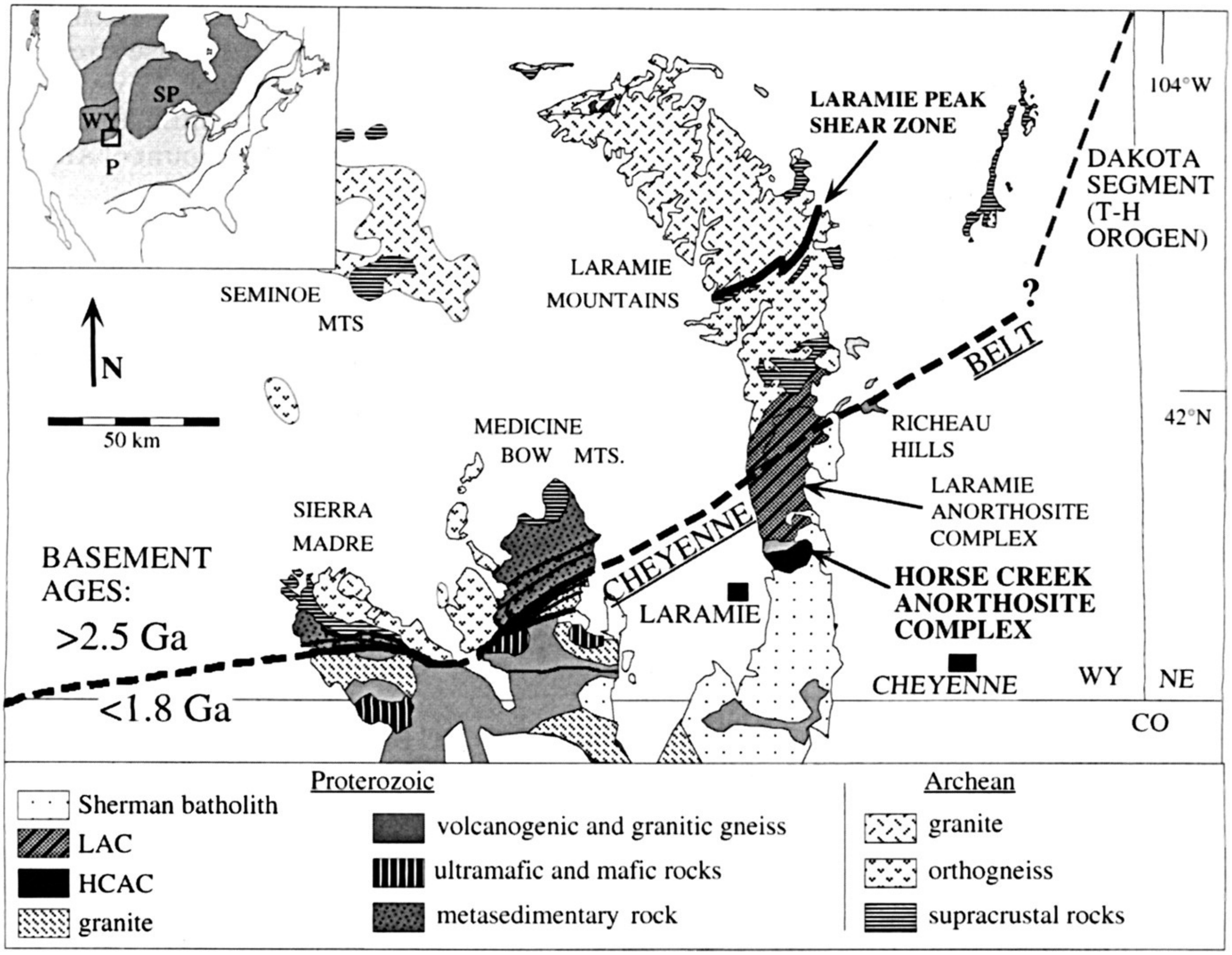


Figure 2

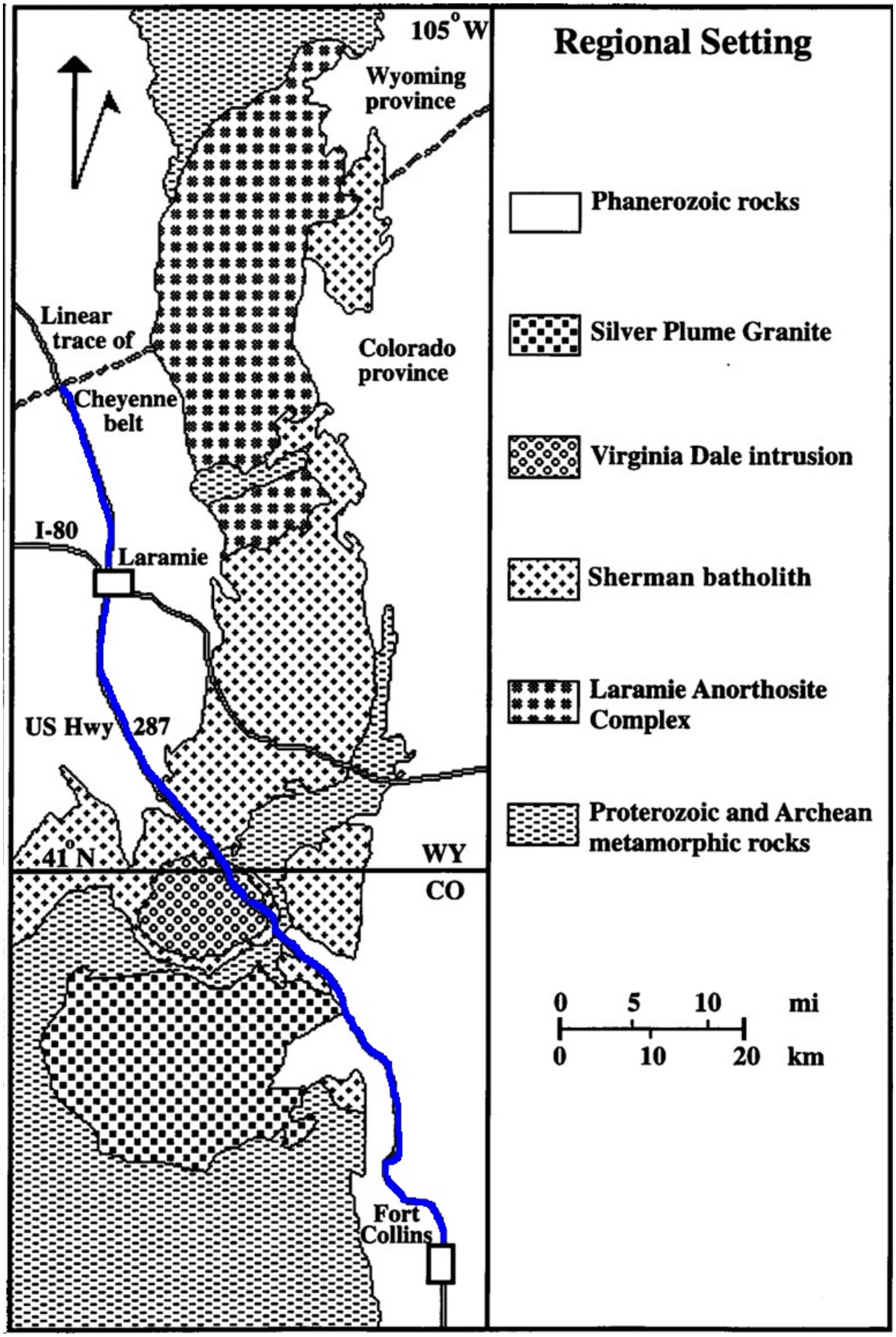
*Field Trip Route in **Blue!***


0 5
kilometers
Red Mt.
Sybille
Poe Mt.
Northern Sherman batholith
Snow Ck.
Snow Ck.
Phanerozoic
Chugwater
Maloin
Southern Sherman batholith
41°45'
41°30'
105°30'
105°15'
N
GR315
PM103
LAC6B
95DR2
95IG23
SR357
SR355
IG11
IG12
IG44
IG42
IG21
SR298
SR297
SR350
SR345
SR347
BM5
BM243
BM85
BM30
BM246
BM249
BM146
BM160
BM137
BM250
BM251
BM210
BM223
GM141
GM144
GM146
GM148
KM6
KM13
RTM74
WY
SP
Phanerozoic rocks
Granite
Monzonitic plutions
Strong Creek intrusion
Greaser intrusion
Snow Ck. anorthosite
Poe Mt. anorthosite
leucogabbro
anorthosite
Chugwater anorthosite
anorthosite
leucogabbro
undivided
Coyote Flat anorth.
anorthosite undivided
Proterozoic gneiss
Archean gneiss


Poe Mountain anorthosite
Archean gneiss
Paleozoic sediments
Sybille intrusion
leucogabbroic layered zone
anorthositic layered zone
recrystallized anorthosite
undivided anorthosite
Northern Sherman batholith
stratigraphic younging direction
west
east
Archean rocks
?
?
vertical scale = horizontal scale
0 1 2 3 4 5
kilometers

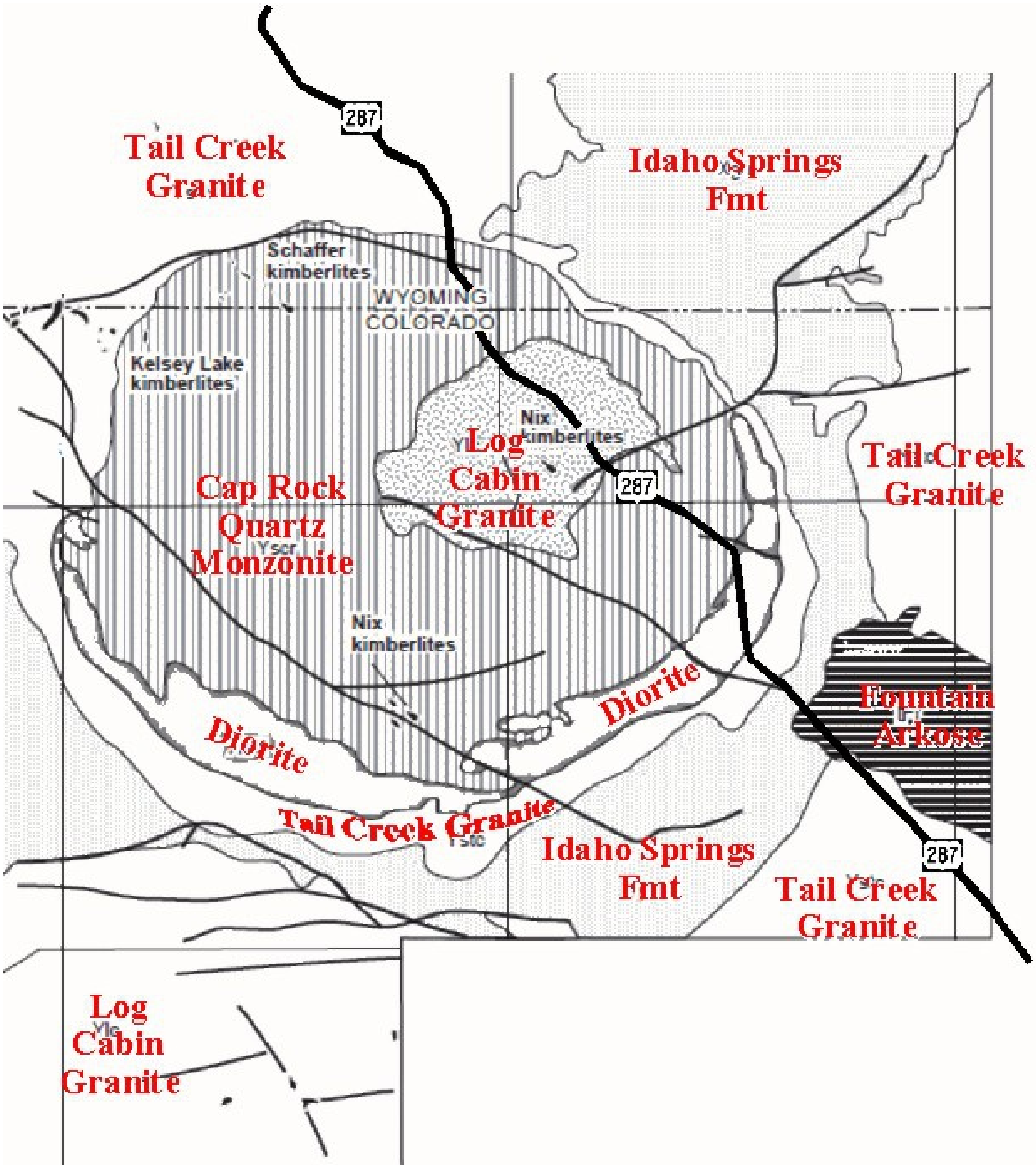


Cheyenne Belt: Old Proterozoic Suture Line of an Ancient Plate collision



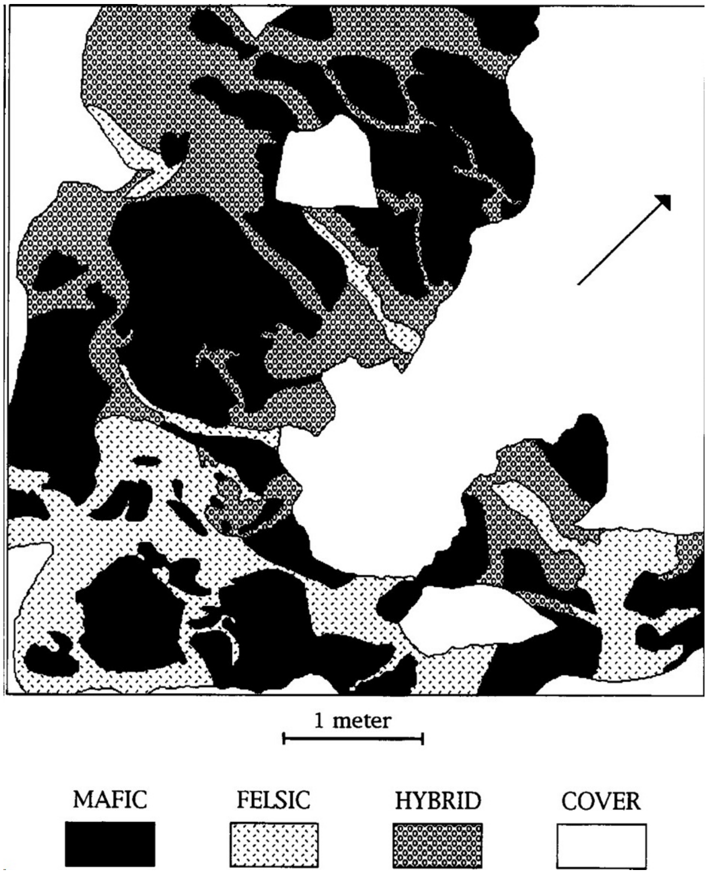
Regional setting, showing relationships of the Virginia Dale intrusion to other major Proterozoic and Archean features in southeastern Wyoming and northern Colorado. The intrusion is at the southern margin of the 1.43-Ga Sherman batholith and north of the 1.39-Ga Silver Plume Granite. The Cheyenne belt marks the suspected suture boundary between the 1.8-Ga Proterozoic Colorado province to the south and the Archean Wyoming province to the north. (Modified from Karlstrom and Houston, 1984.) Full arrow indicates north.

*Field Trip Route in **Blue!***



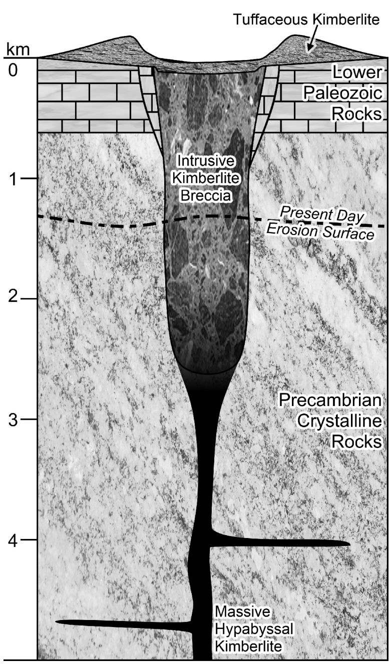
Virgina Dale Ringdike: Geologic map showing components of the Virginia Dale intrusion. Crescent-shaped mixed zone, consisting of dioritic and hybrid rocks, surrounds a core of Cap Rock monzogranite and a central stock of Silver Plume Granite. The mixed zone, surrounded by main phase Sherman Granite and older metamorphic rocks, consists of discontinuous bodies of metamorphic rocks, Cap Rock monzogranite, diorite, and intermediate rocks interpreted as hybrids of the monzogranite and diorite. Remarkable exposures of commingled rocks are present throughout the mixed zone, especially at two sites: 1, a roadside quarry adjacent to U.S. Highway 287, south of the historic site of Virginia Dale; and 2, a drainage to the west of Turkey Roost (a local landmark) at Cherokee Park. (Modified from Braddock et al., 1989.) Arrow indicates north.

Field Trip Route along US287!



Outcrop sketch map of 25 m^2 part of the quarry floor at the Virginia Dale locality (site 1 of Fig. 2). Three discrete rock types are present: fine-grained diorite; outer Cap Rock (OCR) monzogranite; and intermediate rocks formed by hybridization of mafic and felsic magmas. Diorite typically is present as pillow-shaped segregations within both felsic and intermediate hosts. Hybrid rocks are commingled with both felsic and mafic rocks, suggesting that all three were present together as magmas. Many pillows display crenulate margins, some of which partly to mostly envelop surrounding felsic material. Similar features are recognized elsewhere, where mingling or mixing of contrasting magmas has occurred (e.g., Wiebe, 1988; Frost and Mahood, 1987; Eklund, 1993). Arrow indicates north.

Northern Colorado / Wyoming Kimberlites - State Line District



“Kimberlites are the predominant ore rock for diamonds. These ultramafic igneous lithologies originate in the mantle and are carrot-shaped in cross-section. Their surface exposure can be limited to only a few meters in diameter, tapering downward to smaller diameters toward their point of origin. Because kimberlites are composed of ultramafic mantle minerals, they weather very rapidly when exposed to surface conditions. Thus they become very elusive lithologies and are difficult to discover even for well-trained geologists.

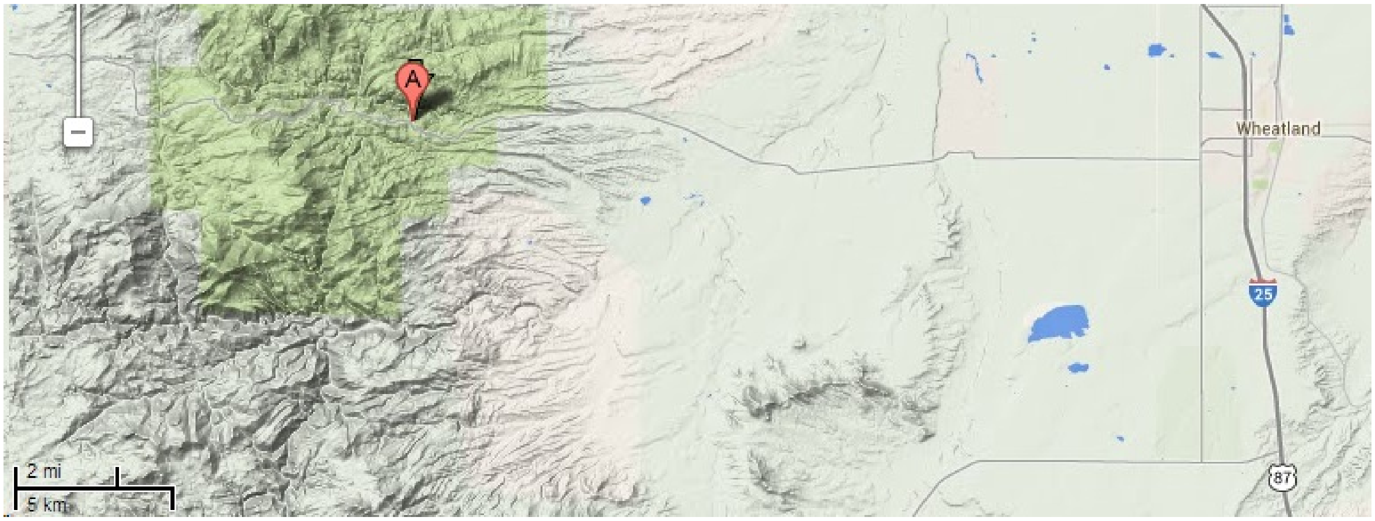
Weathering can corrode the upper 10 m of a kimberlite into a soft soil cover. Only a slight depression and an unusual soil mineralogy may point to a hidden kimberlite below. The kimberlite at our field stop was discovered in 2012 by Dr. Uwe Kackstaetter and his Metropolitan State University of Denver mineralogy students by looking at some unusual soil in the area. Testing indicated an unusually high amounts of clinochlore in the soil material, divergent from the felsic igneous lithologies of the area.

While the discovery of a new kimberlite among the over 100 known ones at the Colorado-Wyoming border may not be significant, this new pipe is within a public road cut and therefore easily accessible. It is within the public roadway easement and can be reached by anyone.”

From: *EchoHawk, B. and Kackstaetter, U. R., 2016,* ***Roadside faults, folds, fossils, crystals, and diamond pipes—Sampling the geologic diversity of northern Colorado.*** In: Unfolding the Geology of the West, Eds.: Keller, S.M. and Morgan, M.L. GSA Field Guides 2016, Geological Society of America, Volume 44, Chapter 11, pp 247-266, DOI:10.1130/2016.0044(11).

APPENDIX I: **OPTIONAL EXPLORATION:** GEMSTONE DEPOSITS IN METAMORPHIC FACIES

Palmer Canyon (N/2 NW Section 18, T24N, R70W) (42°3'25"N; 105°17'10"W): The deposit lies on a ridge along the southern flank of Palmer Canyon 17 miles west of Wheatland. Iolite occurs in a succession of Archean quartzofeldspathic gneiss, granite gneiss, metapelite, and biotite-chlorite-vermiculite schist north of the Elmer's Rock greenstone belt. The deposit is accessible from the Palmer Canyon road which is paved to the forest boundary from Wheatland. The deposit lies a short distance further west (in less than a mile) along the Palmer Canyon road and is just north of the road along a short jeep trail running east of the main road.

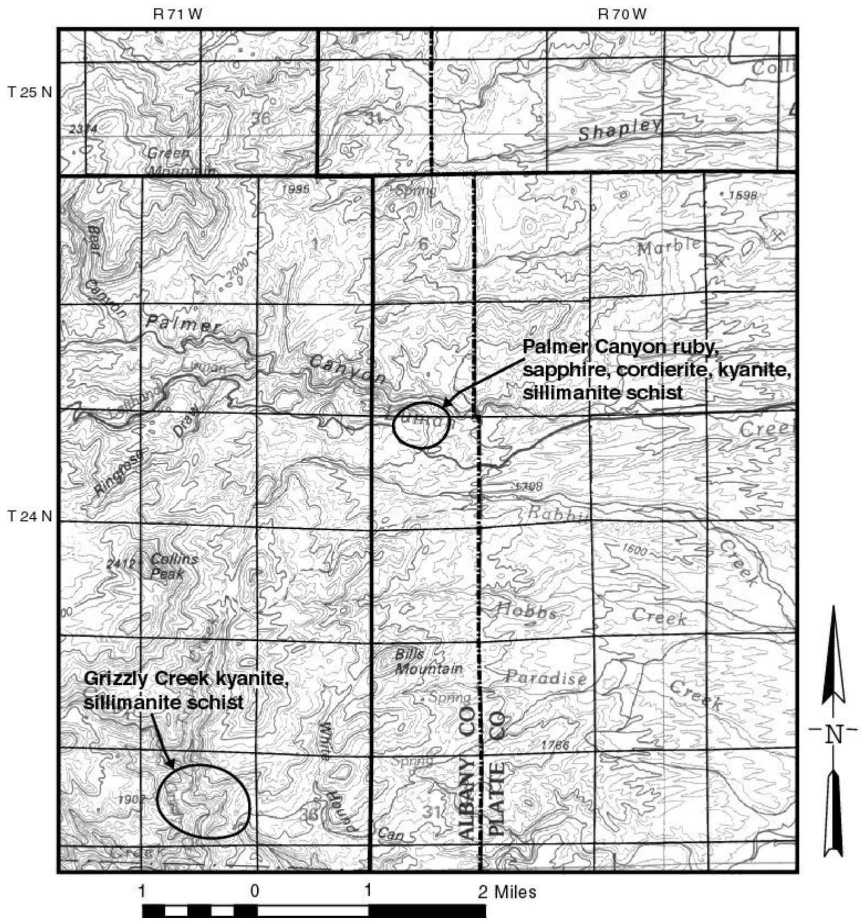


The following types of gems, near-gems and potential gem material were described at Palmer Canyon by Hausel: (1) high-quality flawless violet-blue, dark-blue to light-blue transparent iolite, (2) dark-gray to dark-blue transparent iolite with tiny mineral inclusions, (3) black translucent iolite, (4) low quality, dark-gray to blue-gray translucent to cloudy mylonitic cordierite (mylonite is intensely sheared and crushed), (5) red transparent ruby, (6) red translucent ruby, (7) reddish-brown translucent sapphire, (8) white to pink sapphire, (9) sky-blue translucent kyanite, and (10) common translucent cordierite with rhombohedral fractures.

Unfortunately, the area is actively claimed [LODE CLAIM WMC312733; Claim Name: WAGY 4 AGAIN] and no mineral / rock collecting is allowed. However, NO claim exists to the North beginning northward from N 42.058, W 105.2743.

Possible continuation of the indicated Ruby Schist at N 42.061 W 105.2769 outside of the claimed area. If time permits we shall explore the terrain North of the claim in the indicated vicinity.

Petrology Question: Why do kyanite and cordierite occur together at this location, even though they are mutually exclusive in PT diagrams?


R 71 W
R 70 W
T 25 N
T 24 N
Shapley
Green Mountain
Marble
Palmer
Canyon
Palmer Canyon ruby, sapphire, cordierite, kyanite, sillimanite schist
Creek
Rabbit
Collins Peak
Hobbs
Creek
Bills Mountain
Paradise
Creek
Grizzly Creek kyanite, sillimanite schist
ALBANY CO
PLATTE CO
1 0 1 2 Miles
N

APPENDIX II: Possible minerals you may encounter (but not limited):

Mineral Name	**Chem. Formula**	**Crystal Structure**	**Mineral Group**
Anatase (= Octahedrite)	TiO_2	Tetragonal	Oxide
Andalusite	Al_2SiO_5	Orthorhombic	Nesosilicate
Anhydrite	$CaSO_4$	Orthorhombic	Sulfate
Apatite	$Ca_5(F_3Cl)(PO_4)_3$	Hexagonal	Phosphate
Arsenopyrite	FeAsS	Orthorhombic	Sulphide
Augite (Pyroxene)	$Ca(Mg, Fe, Al)(Al,Si)_2O_6$	Monoclinic	Inosilicate
Azurite	$Cu_3(CO_3)_2(OH)_2$	Monoclinic	Carbonate
Barite	$BaSO_4$	Orthorhombic	Sulfate
Bauxite	$Al_2O_3 * 2H_2O$	None	Oxide (Mixture)
Beryl	$Be_3Al_2Si_6O_{18}$	Hexagonal	Cyclosilicate
Biotite (Mica)	$K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$	Monoclinic (small angle)	Phyllosilicate
Bornite	Cu_5FeS_4	Isometric	Sulphide
Brookite	TiO_2	Orthorhombic	Oxide
Calcite	$CaCO_3$	Hexagonal-Rhombohedral	Carbonate
Chalcopyrite	$CuFeS_2$	Tetragonal	Sulphide
Chlorite	$(MgFe)_5Al_2Si_3O_{10}(OH)_8$	Monoclinic	Phyllosilicate
Chromite	$Fe_2Cr_2O_4$	Isometric	Oxide
Cinnabar	HgS	Hexagonal-Rhombohedral	Sulphide
Copper	Cu	Isometric	Native Mineral
Cordierite *Iolite*	$(Mg, Fe)_2Al_4Si_5O_{18}$	Orthorhombic	Cyclosilicate
Corundum *Ruby* *Sapphire*	Al_2O_3	Hexagonal	Oxide
Dolomite	$CaMg(CO_3)_2$	Hexagonal-Rhombohedral	Carbonate
Epidote	$Ca_2(Al,Fe)_3(SiO_4)_3OH$	Monoclinic	Sorosilicate

Mineral Name	**Chem. Formula**	**Crystal Structure**	**Mineral Group**
Fluorite	CaF_2	Isometric	Halide
Galena	PbS	Isometric	Sulphide
Garnet Group	$X_3Y_2(SiO_4)_3$ *X: divalent metals (Ca, Fe, Mg, &/or Mn)* *Y: trivalent metals (Al, Cr, Fe, &/or Mn)*	Isometric	Nesosilicate
Graphite	C	Hexagonal-Rhombohedral	Native Mineral
Gypsum	$CaSO_4*2H_2O$	Monoclinic	Sulfate
Halite	$NaCl$	Isometric	Halide
Hematite	Fe_2O_3	Hexagonal-Rhombohedral	Oxide
Hornblende (Amphibole)	$Ca_2Na(Mg,Fe)_4(Al, Fe,Ti)_3Si_6O_{22}(O,OH)_2$	Monoclinic	Inosilicate
Ilmenite	$FeTiO_3$	Hexagonal	Oxide
Kaolinite (Clay)	$Al_2Si_2O_5(OH)_4$	Monoclinic	Phyllosilicate
Kyanite	Al_2SiO_5	Triclinic	Nesosilicate
Limonite	$FeO(OH)*nH_2O$	None	Oxide
Magnetite	Fe_3O_4	Isometric	Oxide
Malachite	$Cu_2CO_3(OH)_2$	Monoclinic	Carbonate
Microcline (Feldspar)	$KAlSi_3O_8$	Triclinic	Tectosilicate
Molybdenite	MoS_2	Hexagonal	Sulphide
Muscovite (Mica)	$KAl_3Si_3O_{10}(OH)_2$	Monoclinic	Phyllosilicate
Octahedrite (= Anatase)	TiO_2	Tetragonal	Oxide
Olivine *Fosterite* *Fayalite*	**$(Mg,Fe)SiO_4$** *$MgSiO_4$* *$FeSiO_4$*	Orthorhombic	Nesosilicate
Orthoclase (Feldspar)	$KAlSi_3O_8$	Monoclinic	Tectosilicate
Orpiment	As_2S_3	Monoclinic	Sulphide
Plagioclase (Feldspar) *Albite* *Labradorite* *Anorthite*	 *$NaAlSi_3O_8$* *solid solution series* *$CaAl_2Si_2O_8$*	Triclinic	Tectosilicate

Mineral Name	**Chem. Formula**	**Crystal Structure**	**Mineral Group**
Pyrite	FeS_2	Isometric	Sulphide
Pyrolusite	MnO_2	Tetragonal	Oxide
Quartz	SiO_2	Hexagonal	Tectosilicate
Realgar	AsS	Monoclinic	Sulphide
Rutile	TiO_2	Tetragonal	Oxide
Sillimanite	Al_2SiO_5	Orthorhombic	Nesosilicate
Sphalerite	ZnS *(may contain Fe, Mn, Cd)*	Isometric	Sulphide
Sphene	$CaTiSiO_5$	Monoclinic	Nesosilicate
Staurolite	$FeAl_4Si_2O_{10}(OH)_2$	Pseudo-Orthorhombic	Nesosilicate
Stibnite	Sb_2S_3	Orthorhombic	Sulphide
Sulphur	S	Orthorhombic	Native Mineral
Sylvite	KCl	Isometric	Halide
Talc	$Mg_3Si_4O_{10}(OH)_2$	Monoclinic	Phyllosilicate
Topaz	$Al_2SiO_4(F,OH)$	Orthorhombic	Nesosilicate
Tourmaline	$Na(Mg,Fe,Li,Al,Mn)_3Al_6(BO_3)_3(Si_6O_{18})(OH,F)_4$	Hexagonal	Cyclosilicate
Zircon	$ZrSiO_4$	Tetragonal	Nesosilicate

GRADING and NOTATIONS

ALL ANSWERS MUST BE TYPED USING A WORD PROCESSOR! This includes chemical formulas, equations, tables and special characters. Become intimately familiar with these functions in your preferred word processor. Where graphics are indicated insert the proper graphic or picture. Be familiar with placing and sizing visuals into a written document. Attach your completed document(s) to this sheet!

LAB PROCEDURE: This is a INDIVIDUAL project, this is **NOT** a group project. You will be responsible for your own compilations, including OWN pictures, data tables, graphics, etc.!

For ALL assignments use a citation's database:

ZOTERO citations database	ZOTERO is a citations database that incorporates itself into Word and your Browser.	Free open source software available at https://www.zotero.org/

Note: You may use a different citations database, if desired. But you MUST use a citations database!

NOTE: After downloading and installing ZOTERO, take an hour or two to become familiar with the operation of the software. One of your first tasks will be to set the citation style to the United States Geologics Survey (USGS) format in ZOTERO. The USGS citation system will be required for this course and your final product.

Loading the USGS citation format into ZOTERO: Once Zotero Standalone is installed, click on "Preferences" under the Edit tab. Once there click on "Cite" and go to the "Styles" tab. Click on the "Get additional styles..." below the Styles Manger Box. When the Zotero Styles Repository Window opens, click on the "geology" button within the "Fields" section. A list of geology journals should now appear. Scroll down to the U.S.Geological Survey and click on it. The U.S.G.S style will now be part of your Zotero system and you can set your citations to be formatted accordingly in Zotero.

General Writing Instruction Summary:

- Use professional language, which means AVOID first person expressions such as "I", "we", "our". Use normal prose, active voice and third party language. Do NOT use informal wording, contractions, jargon, slang terms, or superlatives. Exclude similes/metaphors (and humor!)
- Use present tense to report well accepted facts, e.g. 'Pyrite is a sulfide mineral'. Use past tense to describe specific results, e.g. 'When acid was applied, the specimen effervesced'
- Be quantitative wherever relevant (stats, numbers etc.).

Subscript & Superscript	Use appropriate subscript and superscript, especially when it comes to chemical formulas and mathematical units.. Acceptable examples: 2.9 g/cm^3, H_2O, PO_4^{3-}, a_g=9.8m/s^2 Unacceptable examples: 2.9 g/cm3, H2O, PO4 3-, ag=9.8m/s^2

- Use precise concrete language, no ambiguity e.g, 'correlated' ≠ 'related'. Use simple language – no unnecessary "frills" (distractions). Pay attention to sentence structure and grammar

COMPILING TABLES, FIGURES and EQUATIONS

GRAPHICS are the heart of any report. Nothing is more true than in science that a picture is worth a thousand words. Always compile graphics first and then write your text focusing on your graphic. In order to create good graphics and photographs, follow the instructions below.

Cameras and Photos:
Cell phones with a 7.2MP camera are usually ok. When taking pictures, lighting and background is key. This means dark objects should be photographed with light or white backgrounds (sheet of paper) and visa versa for light objects. Having adequate lighting will also help to get sharp, crisp, in focus pictures. Blurry and out of focus pictures are not acceptable.

Graphics:
You should be able to modify, enhance, annotate or overlay graphics. Minimum resolution is 300dpi. Make sure graphics are crisp, clear and any label is easily readable. All graphics should have a caption stating the author and/or citation. Preferably use lossless graphic formats, such as .tif or .bmp. Unfortunately .jpg is NOT lossless and will degrade a little every time you open and save it again in order to manipulate picture contents.

Graphics Editor Software: You will need a graphics editor and learn how to use it. Windows comes with its default Windows Paint editor. It is found in the Windows Accessories Folder. For a more advanced option with many more professional features you may try GIMP: https://www.gimp.org/ This is a FREE, open source image editor working across all computing platforms (Windows, Apple, Linux, etc.). The software comes with ample documentation and examples on how to manipulate any picture or graphic.

Screen Capture Software: A screen capture or snipping software is advantageous in order to only grab the part of a graphic from the screen that is important or necessary. Windows 10 comes with a default snipping tools, such as “Snip & Sketch” found in its own folder or “Snipping Tool” found in the Windows Accessaries Folder. Note: When snapping a picture, make sure it is large enough on the screen to capture enough pixels to have adequate resolution for the final product.

NOTE: Compiling acceptable and good looking graphics and photographs is very involved and can not be rushed. These are often the heart of any report and should be compiled BEFORE writing. Last minute thrown together graphics will without doubt lower your grade on the client report significantly.

COMPOSITION, LAYOUT, WRITING & GRAMMAR SUMMARY

Language

The following list is an example of common faults in language usage and attribution.

Errors / Mistakes / Faults	Examples with margin *Fault Counts & Codes*	
Spelling:		
	| |	The mineral florite has a mohs hardness of four.
incl. capitalization errors & spacing	|	Nicolas Steno_was trained in the classical texts on science.
Grammar:		
incl. punctuation, superfluous	|	Isometric crystals are also isotropic Here light propagates at the same speed.
words, transpositions	| |	Rocks are composed of many ~~many~~ minerals mixed.
Style:		
incl. paragraph,	|*Para.*	... in the geologic sciences.¶Near the end of the 19th a new theory ...
repetitive expressions / words	|||*rep*	... is a light colored mineral. These light colored minerals are often light...
erroneous expression / words,	|	Stalactites hang from the sealing? of a limestone cave.
sub- or superscription,	|*sup*	The density of quartz is 2.65 g/cm3.
unprofessional style,	| |	I was investigating the outcrop with my group.
word insertion	|	Sodium sulfate forms a chalky, ~~incoherent~~ ^ precipitate. *amorphous?*
Sentence:		
incl. grammar,	|	The density of gold is greater then? the density of silver.
run-on,	|	Pyrite has a symmetrical crystal structure, it is cubic.
strings of nouns	| |	Skarn mineral zonation? is apparent in the sample.

Content

Errors in content are spelled out. Severe infractions may count for multiple errors.

Errors / Mistakes / Faults	Examples with margin *Fault Counter & Codes*	
Unclear / erroneous statements	|*unclear, units?*	Mohs hardness of the mineral in question is 16.5.
False / nonsense	||*Nonsense*	~~Glaciation cause severe metamorphism of the region~~

TABLES, FIGURES & EQUATIONS SUMMARY

Tables

Each table must be sufficiently complete that it could stand on its own, separate from text.

Only HORIZONTAL lines are allowed in tables. Do NOT use any VERTICAL lines.

DO consecutively number and caption tables and refer to them accordingly within your text. Captions go ABOVE the table.
DO provide a short description of your table within the caption.
DO place your tables appropriately, closest to their mention in the text.
DO make sure tables are legible and reproduce well. Print can be smaller than text, with an 8pt size minimum.
DO appropriately label columns. Do NOT forget units for numeric values.

AVOID splitting tables across pages.

Figures

Each figure must be sufficiently complete that it could stand on its own, separate from text.

DO number and caption figures consecutively and refer to them accordingly within your text. Captions go BELOW the figure.
DO provide a short description of your figure within the caption.
DO place your figures appropriately, closest to their mention in the text.
DO use appropriate citations for figures that are NOT your own. If you use a figure that has been modified by you, the phrase "modified after...." is most appropriate. Photos should show the name of the photographer.
DO make sure figures are legible and reproduce well. Print can be smaller than text, with an 8pt size minimum. Use a minimum resolution of 300dpi. This is a common publication standard.

AVOID cluttering of figures with too much detail. Simplify if necessary.
AVOID moire patterns in photos, a nuisance in copied or scanned pictures. Most scanners come with a moire pattern removal tool.

GRAPHS
Understand graphs: Bar graphs and/or line graphs are used when plotting nominal vs. ratio or interval data. Scatter plot graphs are used when plotting numeric vs. numeric data.
DO make sure that the graph axis are appropriately labeled and scaled. Axis should have titles as well as scalar units.
DO use electronic means to generated graphs. Hand drawn graphs are no longer acceptable.

Equations & Computations

- ☐ Equations should contain explanation of symbols used.
- ☐ A reader should be able to follow where your values or numbers come from. Indicate accordingly.
- ☐ WRITE DOWN UNITS!!!!
- ☐ Show equations used before indicating any computation

Acceptable Example: $F = m \times a = 0.034kg \times 9.8\, {}^{m}\!/\!{}_{s^2} = 0.33\, {}^{kgm}\!/\!{}_{s^2}$

where *m* is mass of the object in kg as determined with a triple beam balance and *a* is the gravitational acceleration. *F* indicates force expressed in kgm/s^2 or *N* (Newtons).

Unacceptable example: The answer is 0.33. This is obtained by multiplying gravity by 0.034.