How Geology Determined the Denver-Gunnison Mainline of the Denver, South Park & Pacific

(or: How John Evans Missed the Major Mining Districts and Lost to the D&RG !)

Steve Hart
2024

The DSP&P Begins

Mining Districts SW of Denver in 1873

- Ex-Governor John Evans led the group incorporating the DSP&P in October 1872
- Objective was San Juan mining region via South Platte River
- The shortest line between Denver and the San Juans ran through South Park, Trout Creek Pass, and Gunnison
- 4 mountain ranges—Front, Mosquito, Sawatch, San Juan

Who Was John Evans?

A Chicago MD, a founder of NW University, namesake of Evanston, IL

Appt. 2nd Territorial Governor of Colorado by his friend Abraham Lincoln in 1862

- Fired in 1865 after Sand Creek Massacre
- President of Denver-Pacific RR from Denver to UP at Cheyenne, 1867-1872
- A founder of the University of Denver
- President of Denver & New Orleans RR
- Politician/developer, NOT an Engineer!

Who Was Leonard Eicholtz?

Colonel L. H. Eicholtz

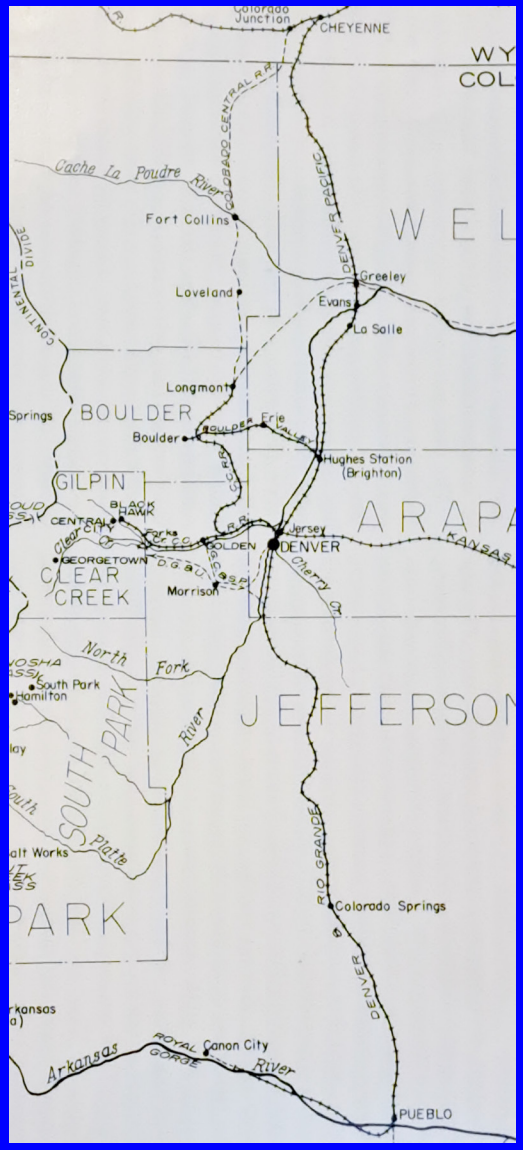
- Born in PA in 1827
- Only civil engineer among DSP&P founders in 1872
- Chief Railway Engineer for Union Army in Mississippi, as a Corps of Engineers colonel, 1862-1865
- Construction engineer for Kansas-Pacific Railway, 1866-68
- UP bridge engineer, 1868-69
- Chief Engineer, DSP&P, 1872-1882
- Surveyed Georgetown Loop, 1881

Who Was Major James A. Evans?

Evans at Promontory, May 10, 1869

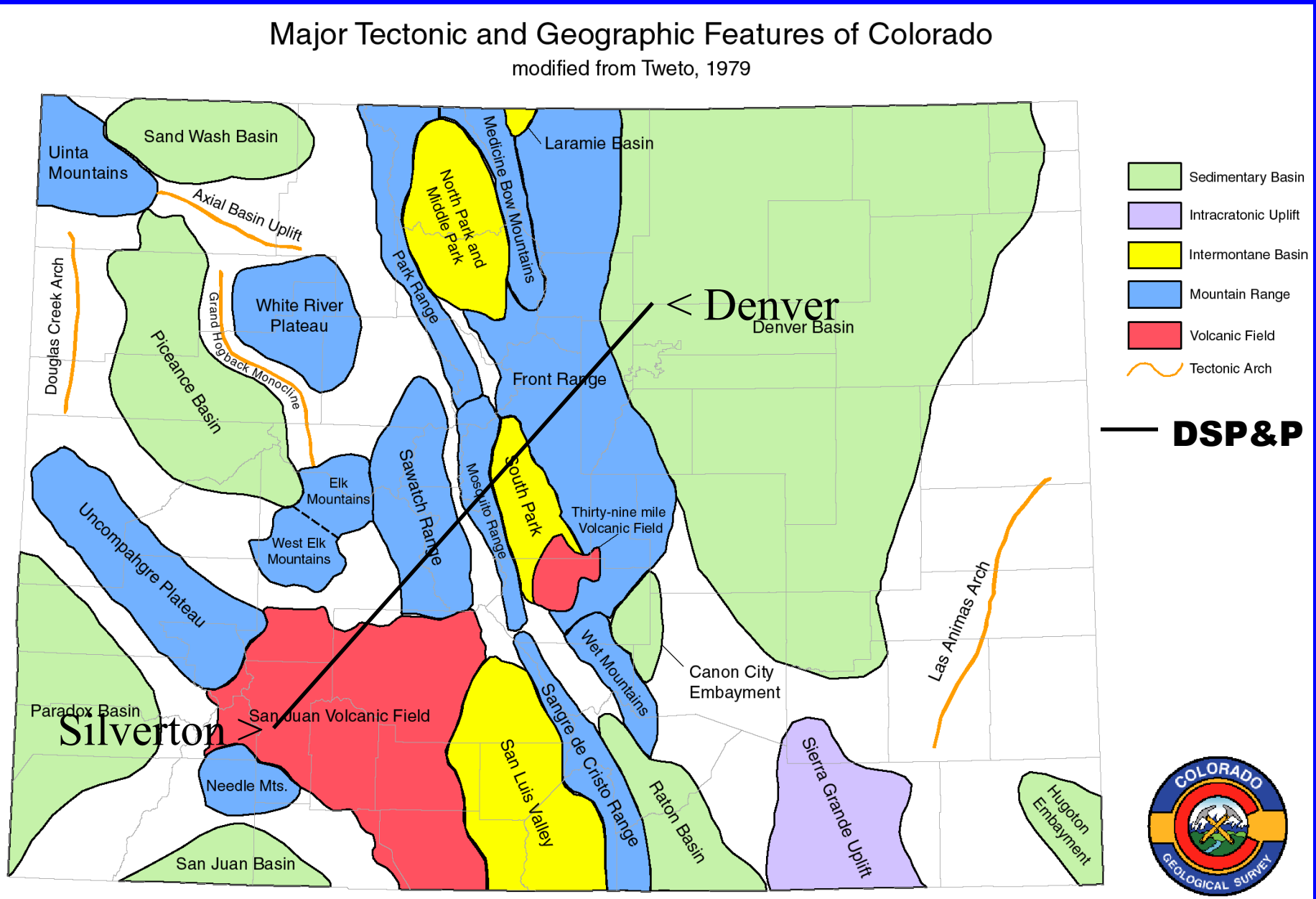
- Born in Dover, England in 1827
- Civil/railroad engineer in UK and US
- 1863-69: UP design & construction superintendent, Laramie-Green River
- 1878: Hired as assistant DSP&P design engineer to Chief Engineer Eicholtz
- 1882: Replaced Eicholtz as Chief Engineer for remainder of construction
- Designed E-W approaches to Alpine Tunnel & Breck-Leadville High Line

Colorado Railroads in 1872

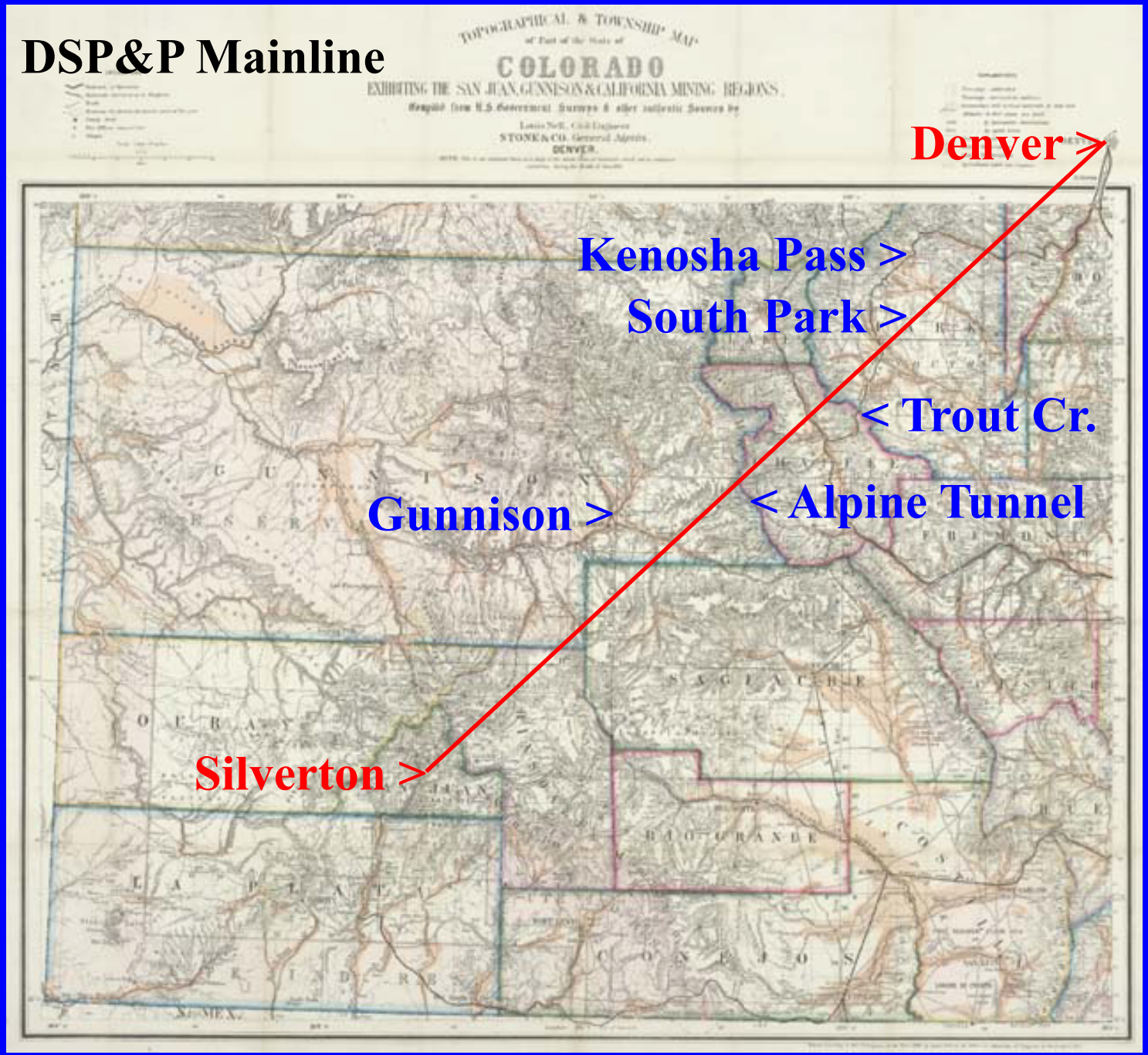


- Denver-Pacific to Cheyenne, June 1870
- Kansas-Pacific in Denver, Aug 1870
- DSP&P incorporated on Oct. 1, 1872
- Denver & Rio Grande water-level route to Colorado Springs, Pueblo, and Florence coal field by Nov. 1872
- Colo. Central in Blackhawk, Dec. 1872
- Panic of 1873 stopped all railroad construction in Colorado

DSP&P Route Physiography



DSP&P Mainline

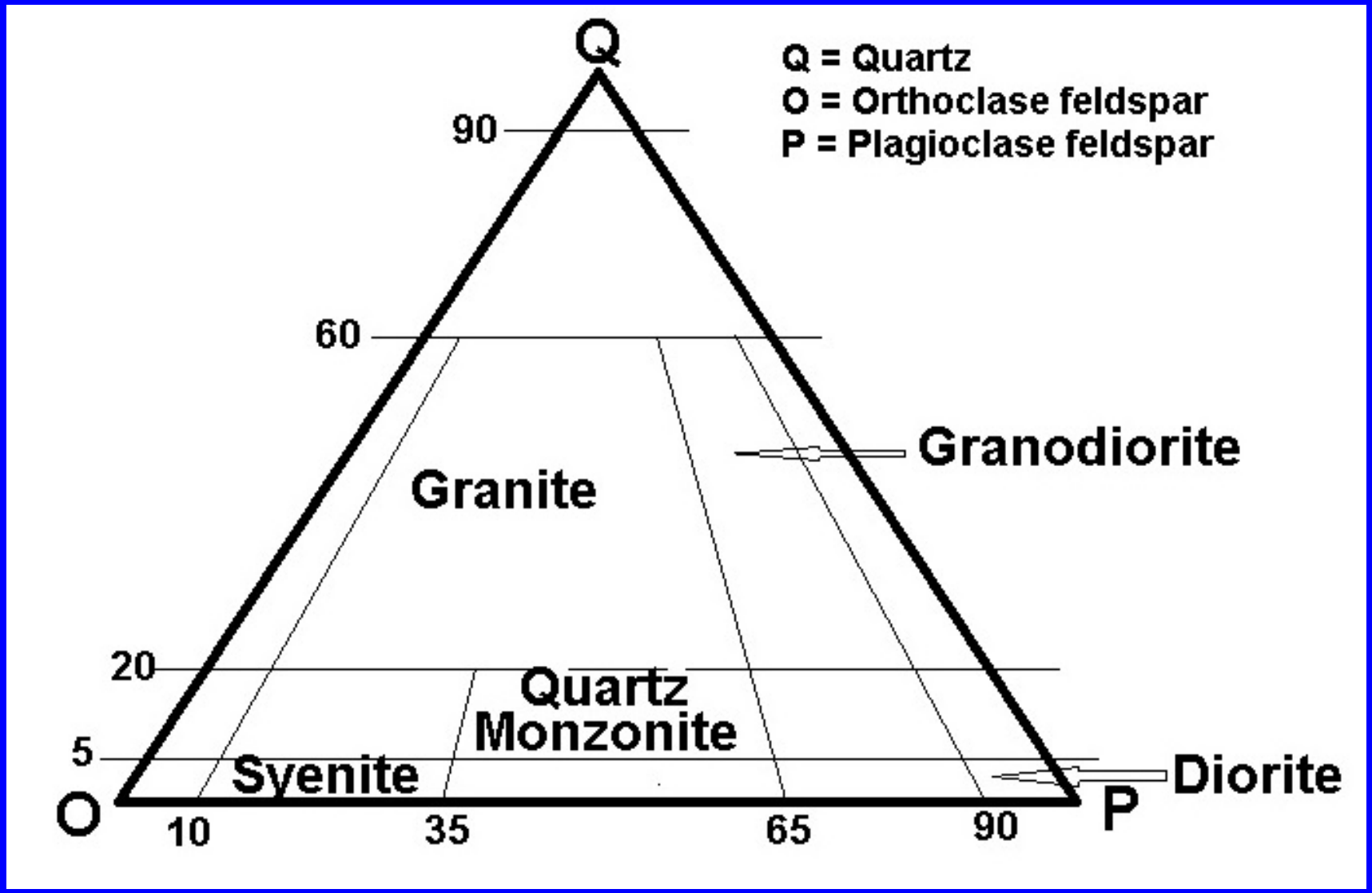


Geologic Time Scale

Eras	Period/ Sub-eras	Million Years ago (approx.)	Formations along U.S. 285 & U.S. 50
Cenozoic	Quaternary	0 - 2	Alluvium Glacial till
	Tertiary	2 - 65	39 Mile Volcanics San Juan Volcanics Mt. Princeton Batholith
Mesozoic	Cretaceous	65 - 145	Denver/Dawson Fm Laramie Fm Fox Hills Sandstone Pierre Shale Dakota Sandstone
	Jurassic	145 - 200	Morrison Fm
	Triassic	200 - 253	Ralston Creek Fm
Paleozoic	Permian	253 - 286	Lyons Sandstone
	Pennsylvanian	286 - 318	Fountain/Maroon Fm
	Mississippian	318 - 360	Leadville Limestone
	Devonian	360 – 418	Chaffee Fm
	Silurian	418 - 443	
	Ordovician	443 - 489	Fremont Fm Harding Limestone Manitou/Tomichi Limestone
	Cambrian	489 - 544	Sawatch Quartzite
preCambrian	Proterozoic	544 – 2,500	Pikes Peak Granite Kenosha Granite Idaho Springs Fm.
	Archeozoic	2,500 – 4,500	

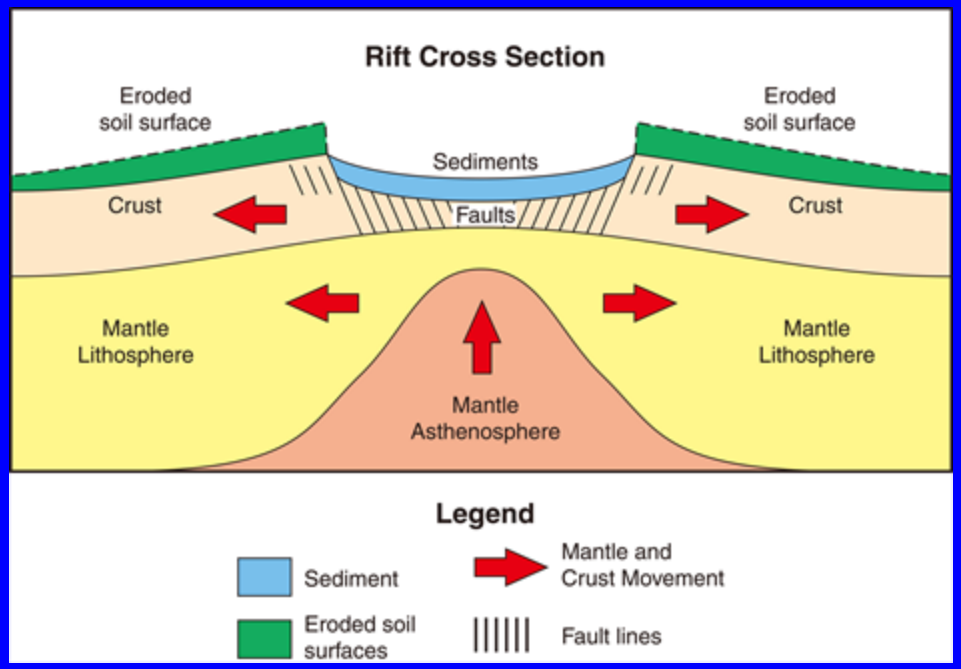
- Igneous rocks = granite, rhyolite & basalt lava, volc. ash
- Sedimentary rocks = sandstone, shale, limestone, coal
- Metamorphic rocks = slate, marble, gneiss, schist

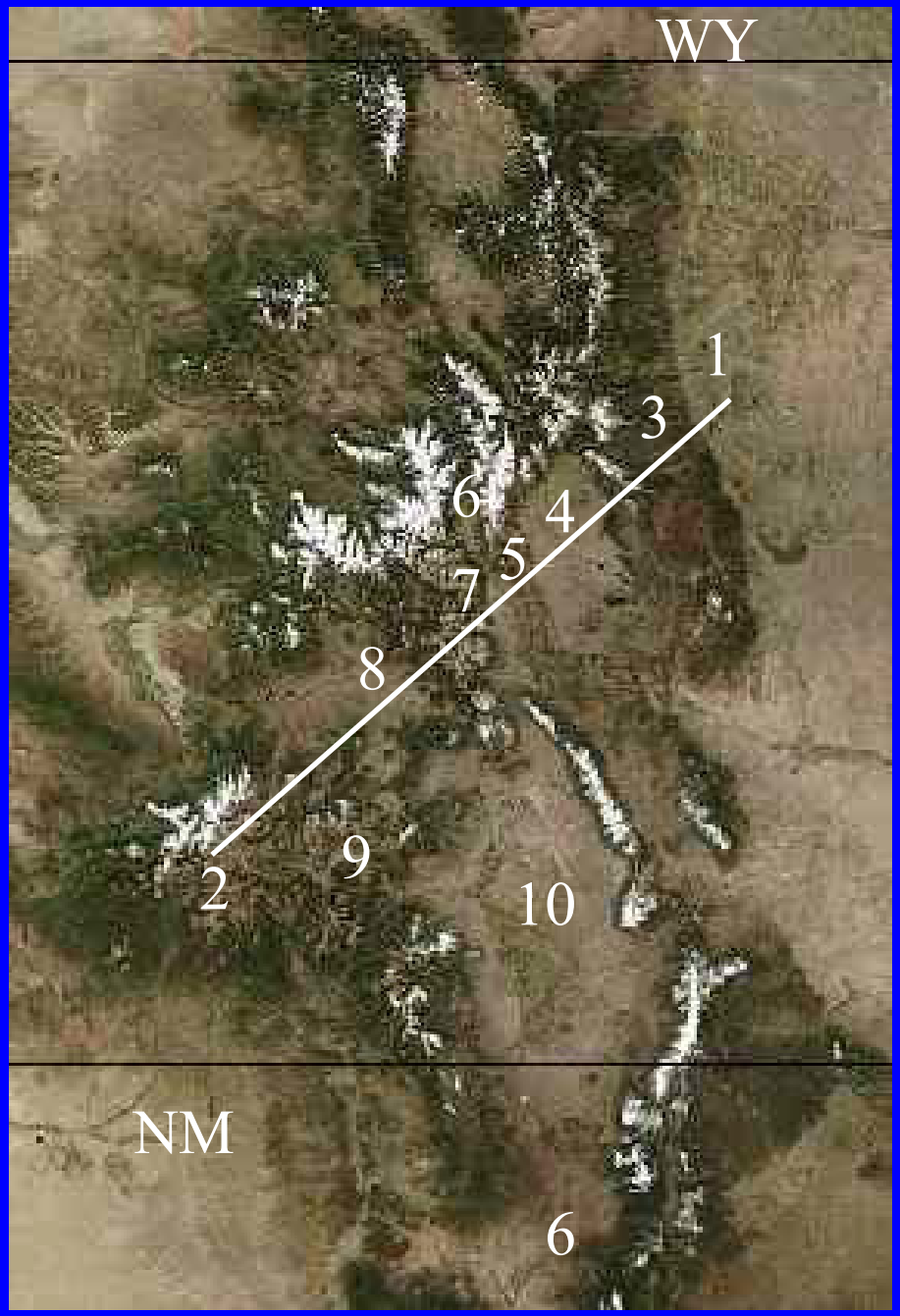
Intrusive Igneous Rock Triangle



Rio Grande Rift

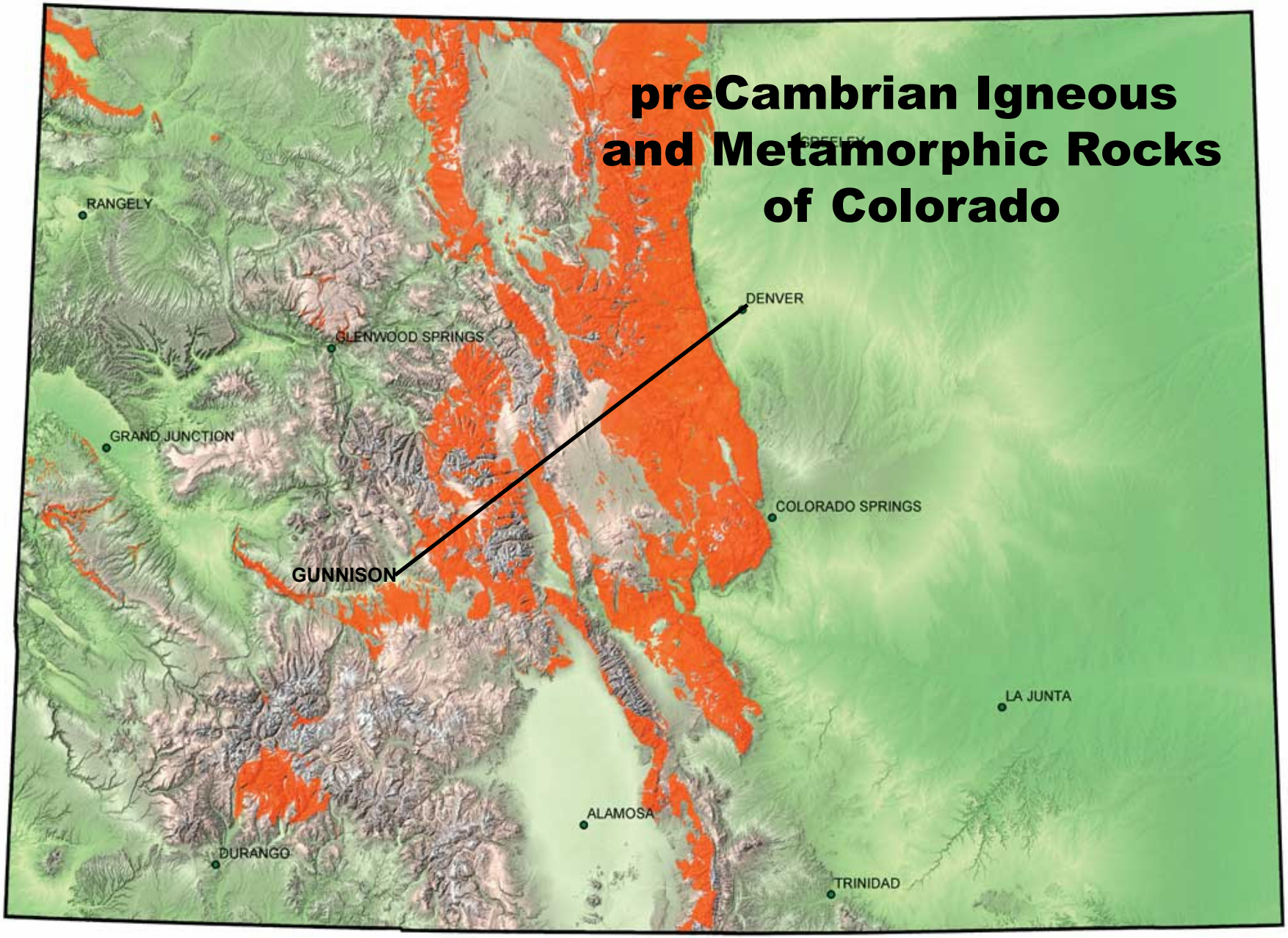
- Rift: long, narrow, fault-bounded, down-dropped block of extensional crust
- ~29M year-old Rio Grande Rift extends 600 miles from Leadville to El Paso, Texas
- Rift valley is cut at Poncha Pass by lava, E-W faults





Satellite Photo of Colorado

1. Denver
2. Silverton
3. Front Range
4. South Park
5. Mosquito Range
6. Rio Grande Rift/ Arkansas River Valley
7. Sawatch Range
8. Tomichi Creek Valley
9. San Juan Mountains
10. San Luis Valley


preCambrian Igneous and Metamorphic Rocks of Colorado
RANGELY
DENVER
GLENWOOD SPRINGS
GRAND JUNCTION
COLORADO SPRINGS
GUNNISON
LA JUNTA
ALAMOSA
DURANGO
TRINIDAD

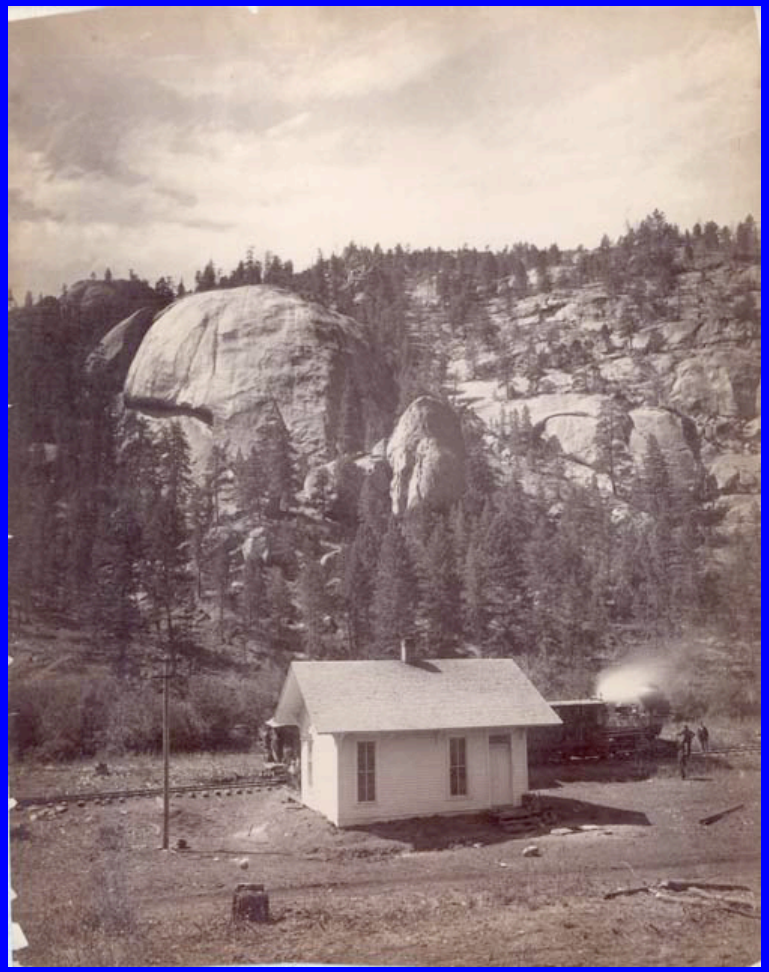
preCambrian Idaho Springs Fm. in Platte Canyon

Dark gray metamorphic gneiss and schist near Waterton intruded by pink pegmatite dikes

preCambrian Pikes Peak Granite

Exfoliation of coarse-grained granite creates rounded spires, domes, and boulders

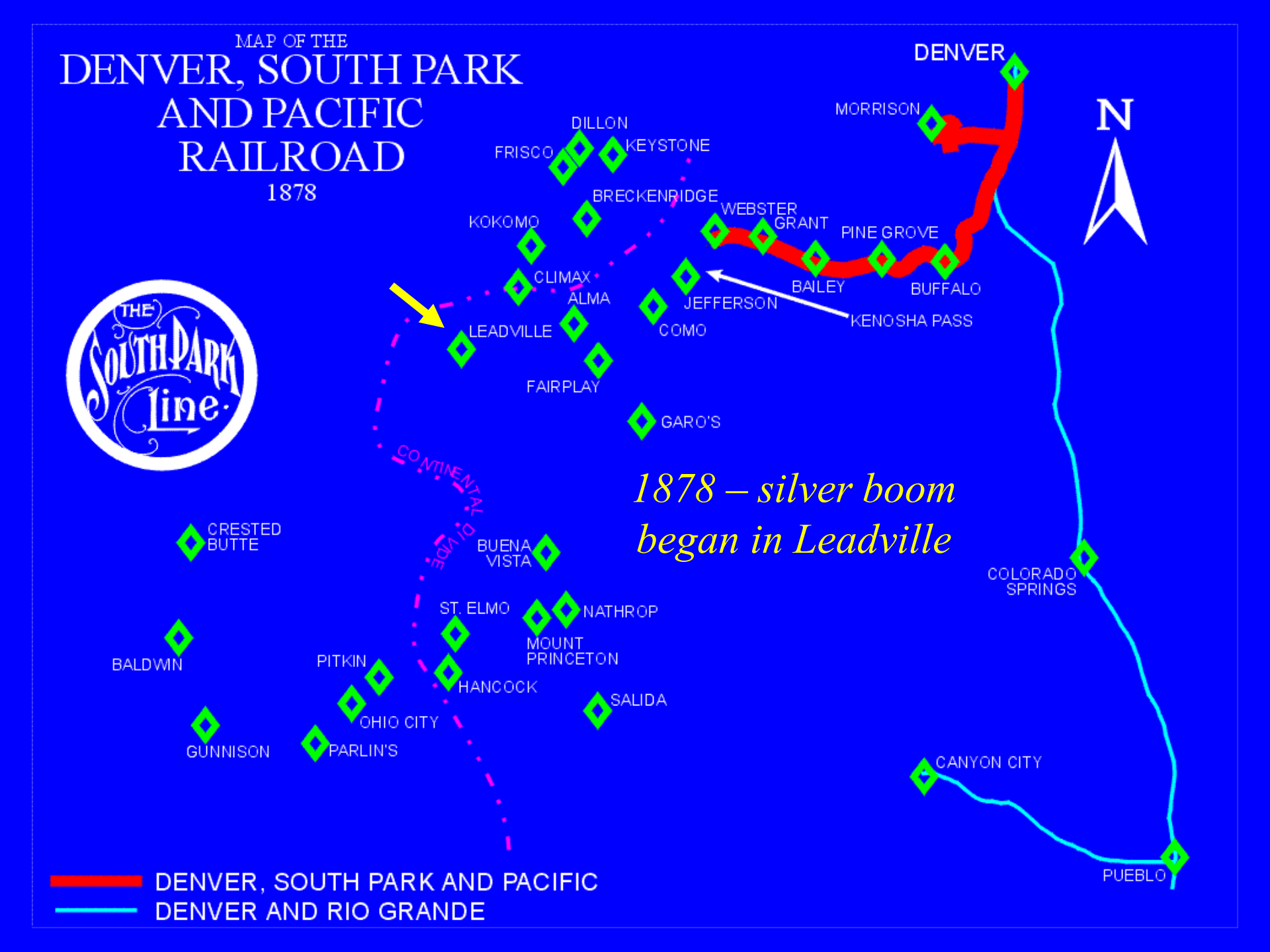
Named Pikes Peak Granite Domes along DSP&P



Dome Rock and Sphinx Rock

Metamorphic rocks along DSP&P grade near Shawnee

- Fine-grained schist is metamorphosed shale and generally must be blasted (top).
- Coarser-grained gneiss has foliation planes similar to bedding and is slightly easier to excavate (bottom).

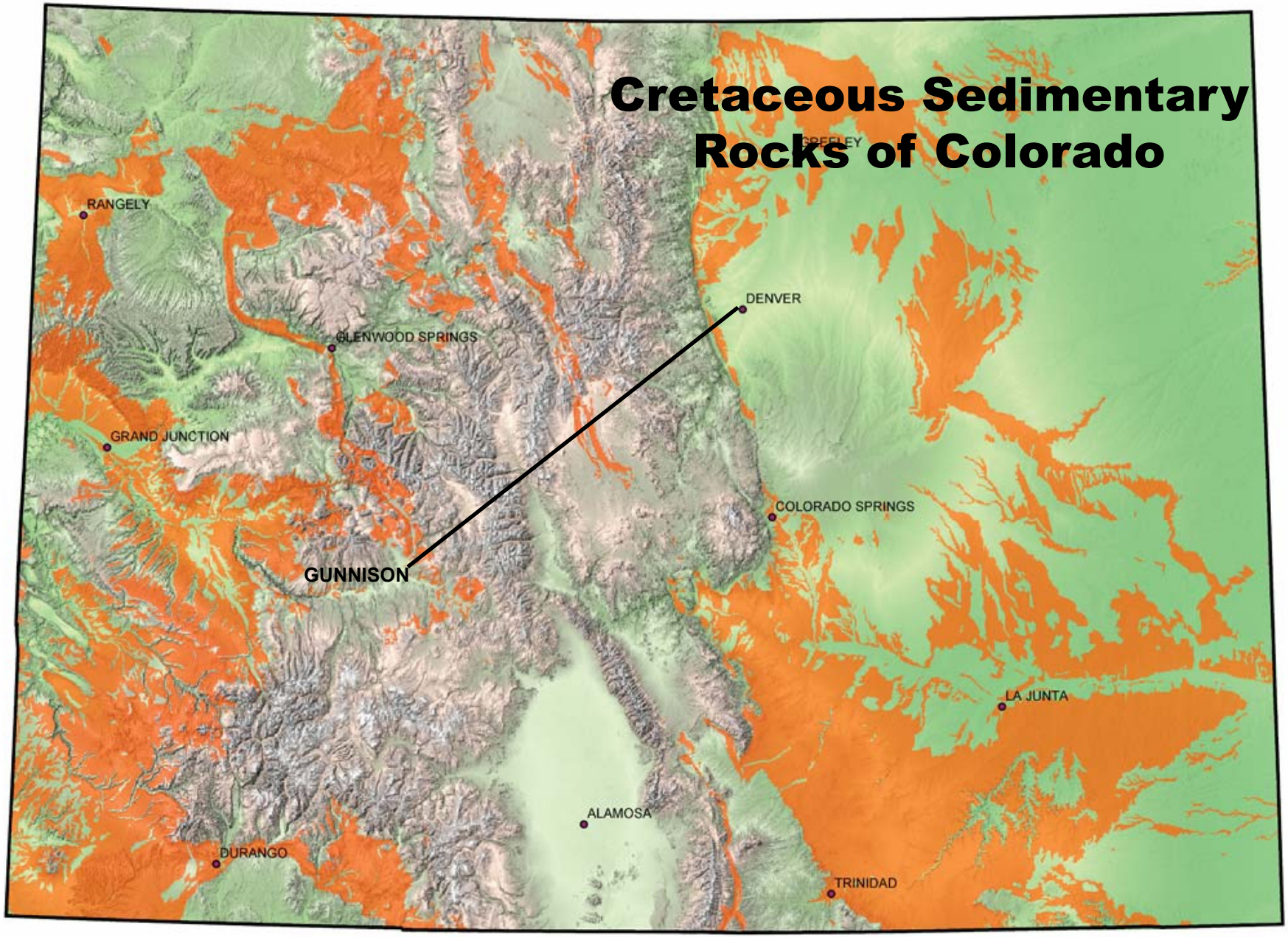

MAP OF THE
DENVER, SOUTH PARK AND PACIFIC RAILROAD
1878
DENVER
MORRISON
DILLON
FRISCO
KEYSTONE
BRECKENRIDGE
WEBSTER
GRANT
PINE GROVE
KOKOMO
CLIMAX
ALMA
BAILEY
BUFFALO
JEFFERSON
KENOSHA PASS
LEADVILLE
COMO
FAIRPLAY
GARO'S
N
THE SOUTH PARK Line
CONTINENTAL DIVIDE
1878 – silver boom began in Leadville
CRESTED BUTTE
BUENA VISTA
COLORADO SPRINGS
ST. ELMO
NATHROP
MOUNT PRINCETON
BALDWIN
PITKIN
HANCOCK
SALIDA
OHIO CITY
GUNNISON
PARLIN'S
CANYON CITY
PUEBLO
DENVER, SOUTH PARK AND PACIFIC
DENVER AND RIO GRANDE

Kenosha Granite unlike Pikes Peak Granite

Kenosha Batholith, older by 300 million years, intruded by Pikes Peak Granite

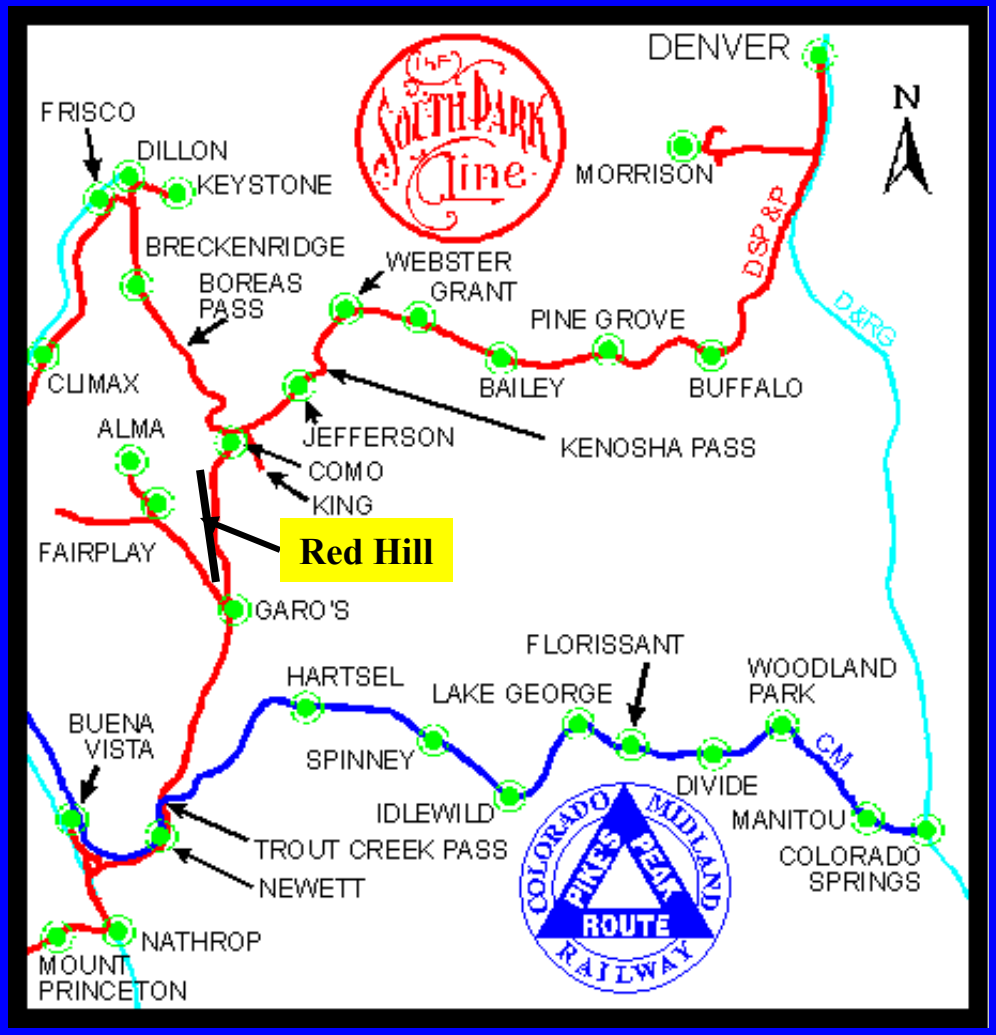
Kenosha Pass at Last !

Views of South Park from Kenosha Pass in 1880 and today


Cretaceous Sedimentary Rocks of Colorado
GREELEY
RANGELY
DENVER
GLENWOOD SPRINGS
GRAND JUNCTION
COLORADO SPRINGS
GUNNISON
LA JUNTA
ALAMOSA
DURANGO
TRINIDAD

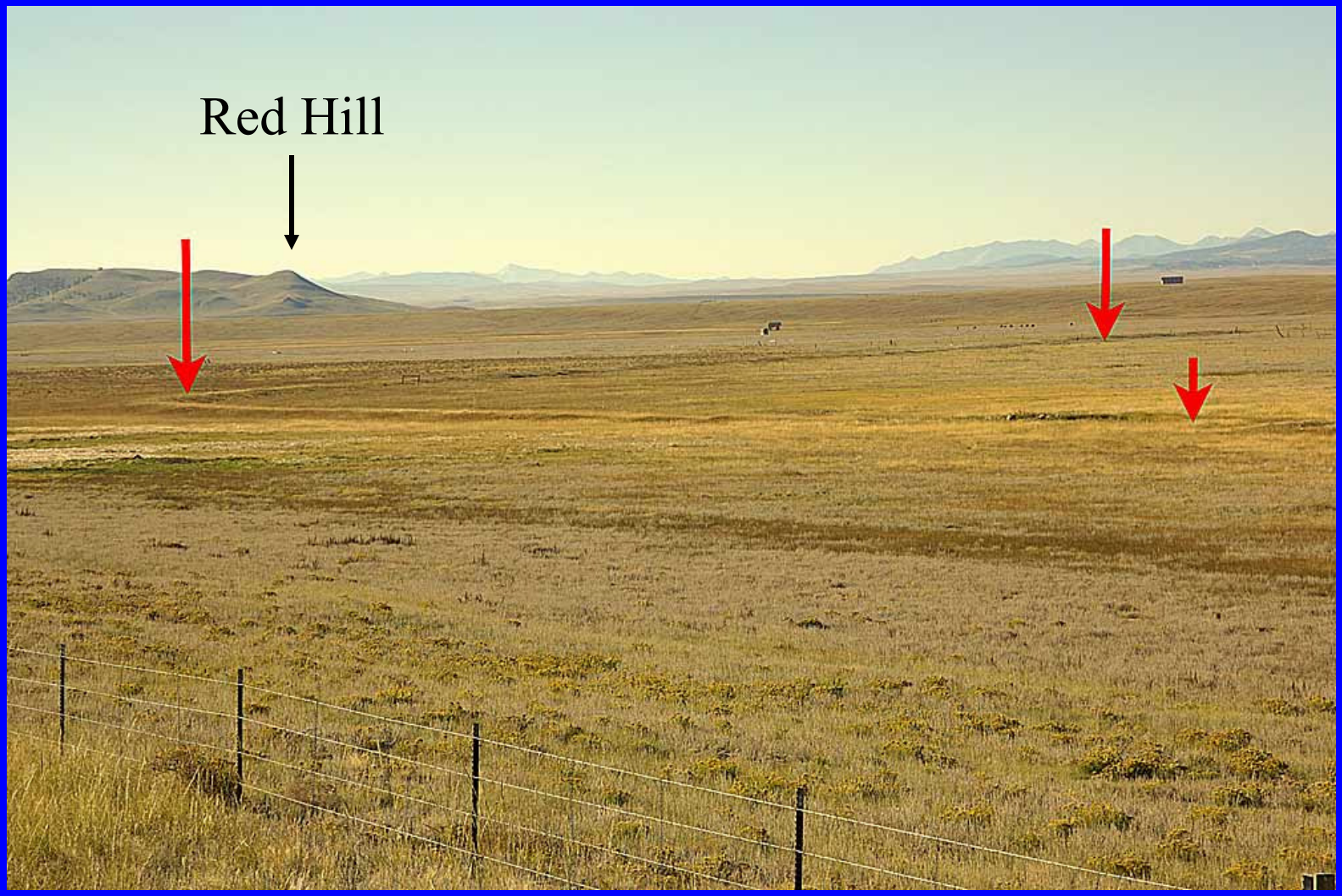
The Dakota Hogback on I-70

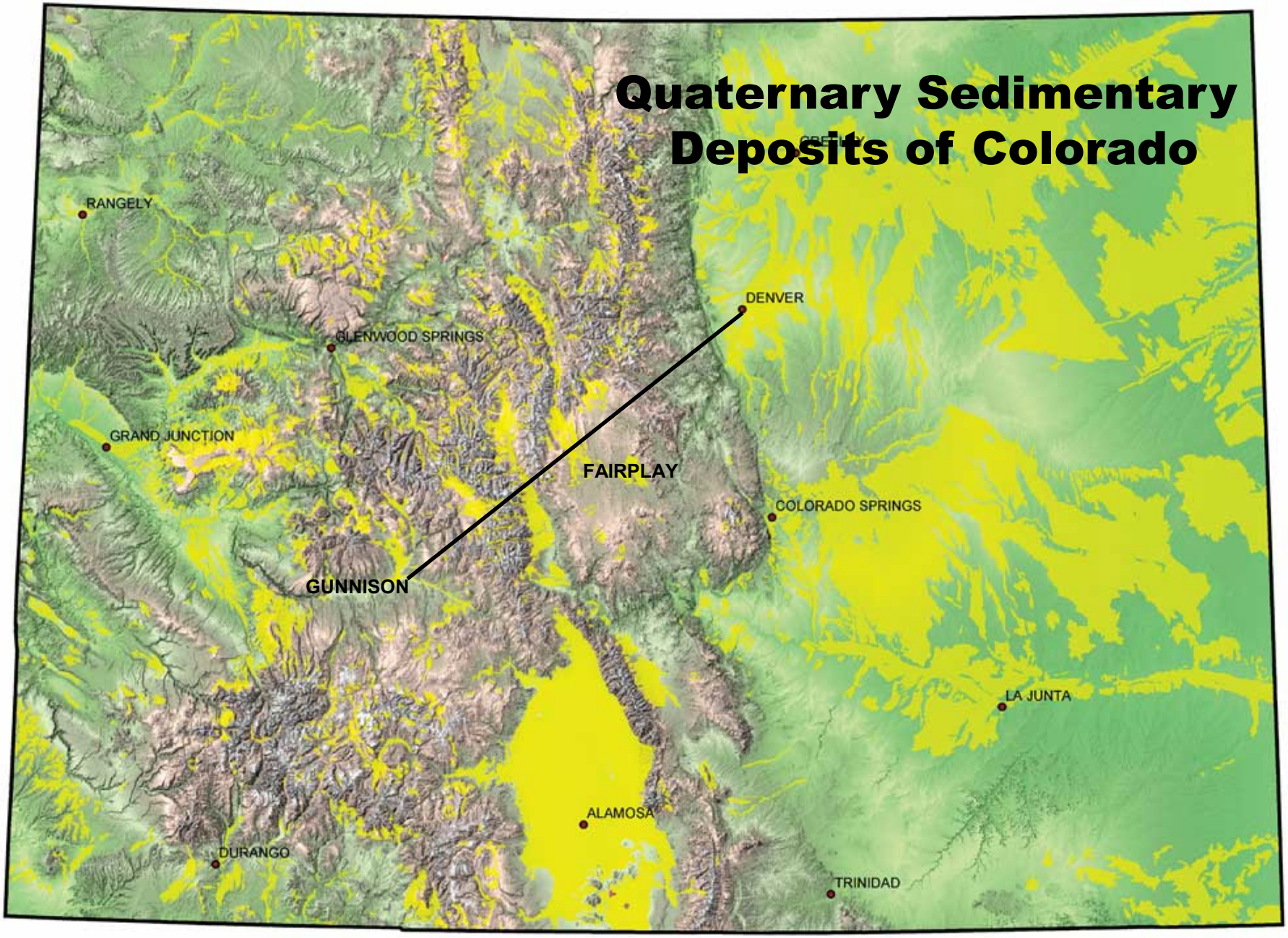
Fairplay on Branch Line Due to Dakota Ss forming Red Hill



DSP&P Skirts East Base of Red Hill

The “Detour” South of Red Hill




Quaternary Sedimentary
Deposits of Colorado
RANGELY
DENVER
GLENWOOD SPRINGS
GRAND JUNCTION
FAIRPLAY
COLORADO SPRINGS
GUNNISON
LA JUNTA
ALAMOSA
DURANGO
TRINIDAD

Fairplay Sluices in 1860s

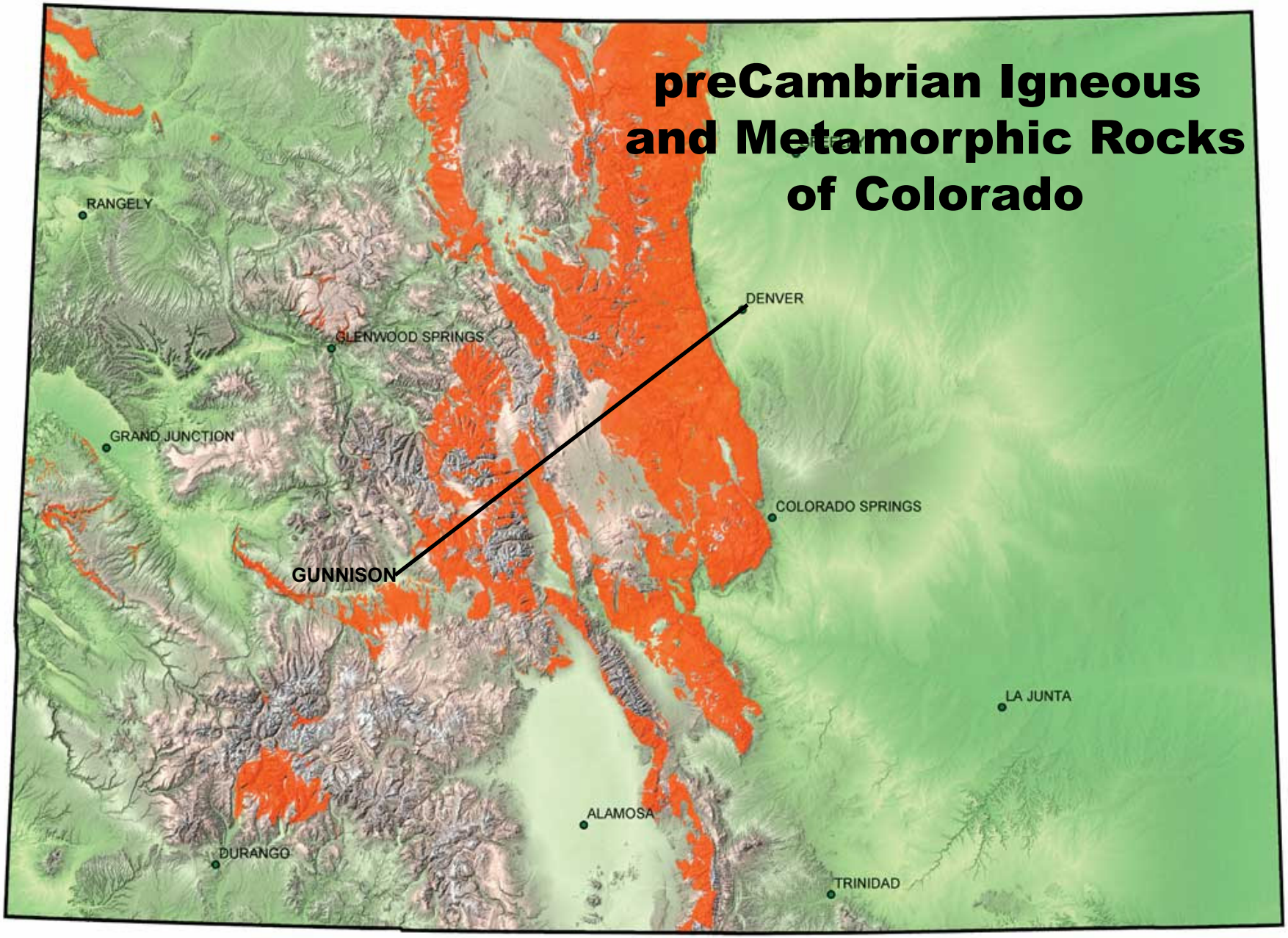
- Placer gold discovered at Fairplay in 1859
- Gold in glacial outwash gravels and moraines along South Platte River
- Some gravels were 40-50 thick
- Gravel terraces as high as 120 feet above present river level were mined hydraulically
- Moraines as high as 300 feet above river were mined hydraulically and with steam shovels

Fairplay Hydraulic Mining, 1870s

Fairplay Floating Dredge in 1930s

Fairplay – The Aftermath

Spoils from hydraulic mining and dredging along S. Platte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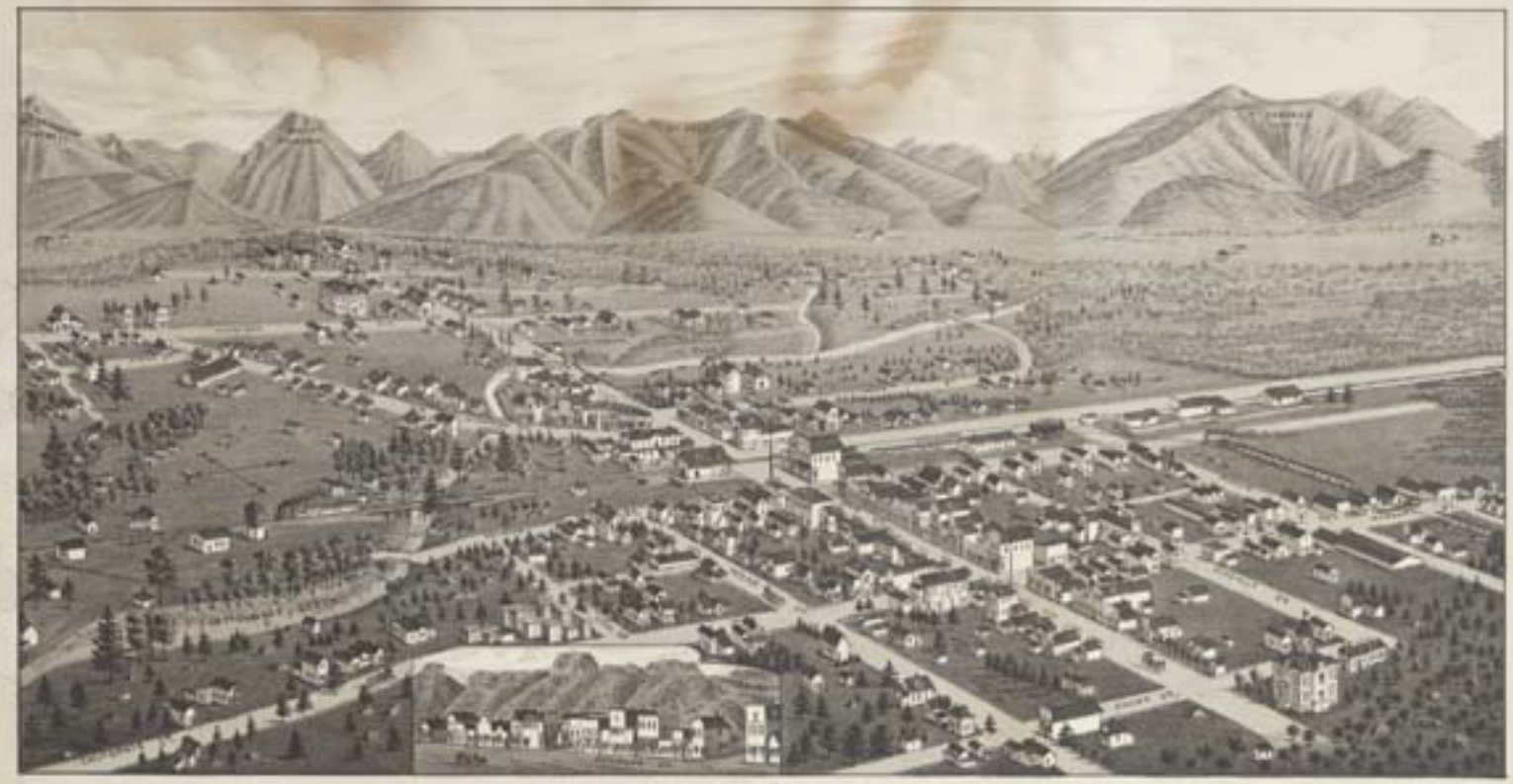
Through the Mosquito Range - Trout Creek Pass

Lower Paleozoic rocks sitting on top of
Mosquito Range preCambrian granodiorite

Gold Mining – Trout Creek Style

Into the Rio Grande Rift: Buena Vista and Collegiate Peaks



Published by J. J. Stone, Madison, Wis.

Bird's Eye View of

BUENA VISTA, COLO.

COUNTY SEAT OF CHAFFEE COUNTY.

7300 FT. ABOVE SEA LEVEL

1882.

POPULATION 2500

Gast & Post, Lithographers, Milwaukee, Wis.

1. Court House.
2. School House.
3. Hiller, Hallock & Co.'s Opera House.
4. D. & R. G. R. R. Depot.
5. F. W. Ower's Sampling Works.
6. Turn Halle and Buena Vista Guards Armory Co. H.
7. County Jail.
8. Mining Exchange and Assay Office, J. C. H. Grabill, Prop'r.
9. American House, Mrs. E. A. Albright, Prop'r.
10. Commercial House, Capt. L. J. Edwards, Prop'r.
11. Walker House, Mrs. Lizzie Walker, Prop'r.
12. Lake House.

A.—Congregational Church.
B.—Methodist Episcopal Church.
C.—Roman Catholic Church.
D.—Post Office, H. A. E. Pickard, P. M.
E.—Masonic and I. O. O. F. Hall.
F.—Hiller, Hallock & Co.'s Bank.
G.—Fire Department House.
H.—Free Reading Room.
I.—Buena Vista Democrat, Holmes & White, Editors and Prop'rs.
J.—Buena Vista Herald, Kennedy & Logan, Editors and Prop'rs.
H.—Chaffee Co. Times, P. A. Leonard, Editor and Prop'r.

Tourists Alone Wouldn't Pay for DSP&P

But It Would Supplement Mining Revenues

Nathrop – D&RG Meets DSP&P

Mason-Bogie with DSP&P mixed train at Nathrop Depot interchange with D&RG

- DSP&P arrived in Buena Vista on March 3, 1880 and continued to build to Nathrop
- D&RG arrived in Nathrop 3 months later

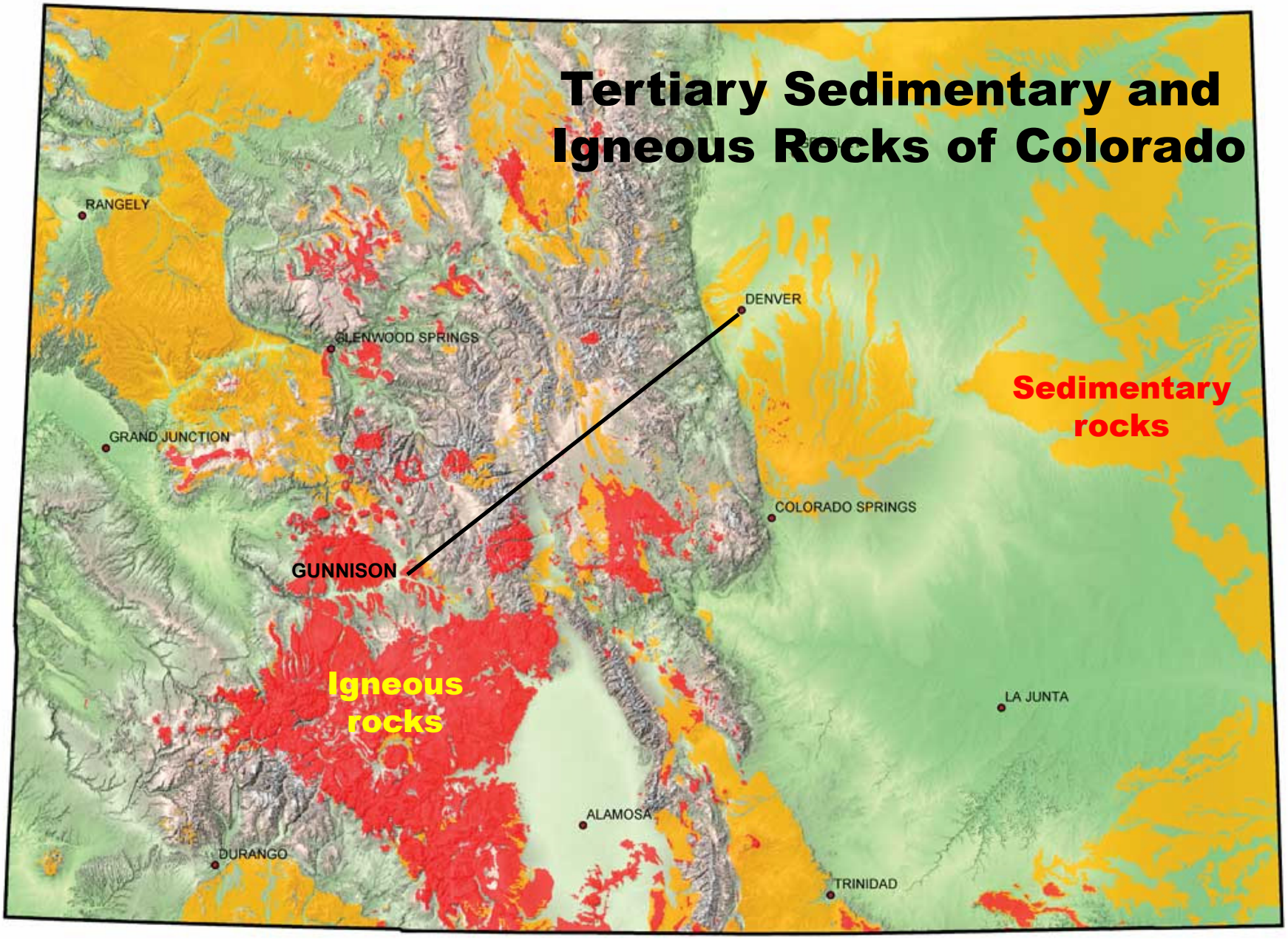
Comparison of DSP&P to D&RG Route to Leadville in 1880

DSP&P:

- Blasted through gneiss and granite along South Platte and North Fork
- Crossed Front Range via Kenosha Pass @10,001'
- Through South Park @ 9,000' on sediments
- Crossed Mosquito Range via Trout Creek Pass @ 9,500' in granodiorite
- Buena Vista to Leadville on D&RG tracks: JOA

D&RG:

- Laid on Plum Creek alluvial terraces to Palmer Divide
- Crossed Palmer Divide @ 7,300' on sedimentary rocks
- Followed sediments/terraces along Monument/Fountain Creek to Pueblo @ 4,700'
- Water-level route up Arkansas River thru Royal Gorge to 7,100' Salida
- Salida to 10,200' Leadville on alluvium at ~0.9% grade

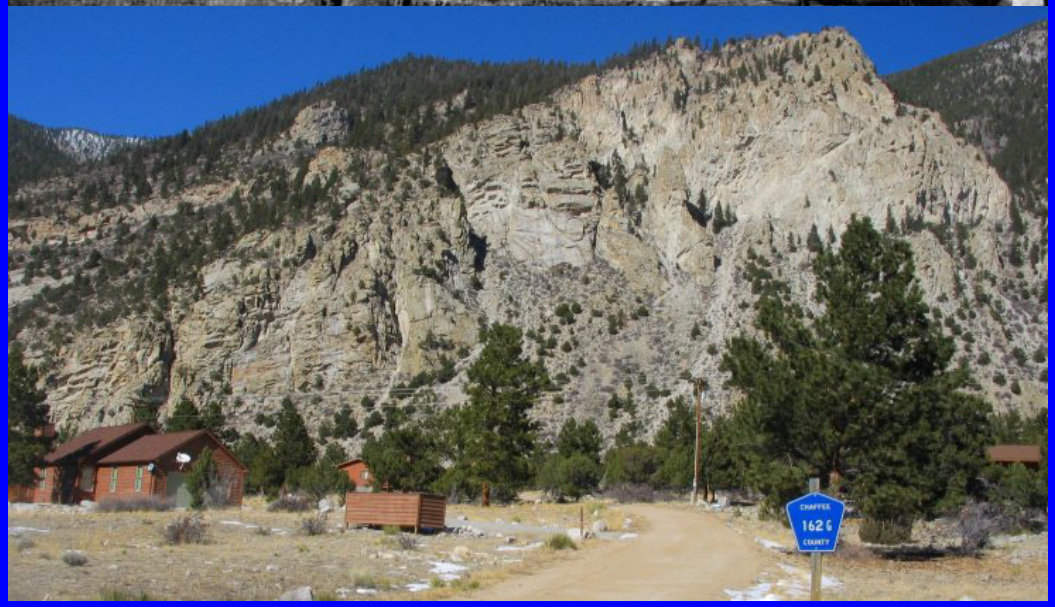

Tertiary Sedimentary and Igneous Rocks of Colorado
RANGELY
DENVER
GLENWOOD SPRINGS
GRAND JUNCTION
COLORADO SPRINGS
GUNNISON
LA JUNTA
ALAMOSA
DURANGO
TRINIDAD
Sedimentary rocks
Igneous rocks

Mt. Princeton Batholith

- Quartz monzonite magma chamber only 36M years old and emplaced at a shallow depth
- Quartz monzonite has ~ equal parts plagioclase and orthoclase feldspar, only 5-20% quartz
- Granite is orthoclase feldspar and 20-60% quartz
- Plagioclase alters to clay faster than orthoclase

- June 2, 1879: Chief Engineer Eicholtz wrote of Altman/Alpine Pass route, “Do not regard this practical or safe at any reasonable cost.”
- Major Evans was tasked with tunnel construction

Chalk Creek – Not Chalk at All



It's weathered, highly altered igneous granodiorite

St. Elmo – DSP&P Mainline Reaches a Lode Mining District !

Small silver-lead mining district from 1870s – 1940s

A Little Extravagant for a Line Building the Alpine Tunnel !

DSP&P bridge at Hancock, east of Alpine Tunnel

"White Elephant" Completed

Alpine Tunnel cost 2 yrs, $300,000*, and 1 documented death to complete

* $8.75M in 2023

- E-W approach grades of 3.26 - 4%
- Tunnel length = 1,810' with 160', 24° curve inside east portal
- Quartz monzonite was so weak, entire tunnel supported by redwood posts, beams, and lagging at great cost

Through Mt. Princeton Batholith – at 11,524 or 11,612 FT ?

The Openings: July 1882

- Alpine Tunnel opened with the 1st DSP&P train through the Sawatch Range and under the Continental Divide at 11,600'!

- The Silverton Branch opened with 1st D&RG train reaching center of San Juans via 9,400' LaVeta Pass, 7,500' San Luis Valley, 10,000' Cumbres Pass, and 6,500' Durango!

The Most Famous Geology on the DSP&P – The Palisades

Formed by erosion of the vertically jointed, quartz monzonite of the Tertiary-age Mt. Princeton Batholith

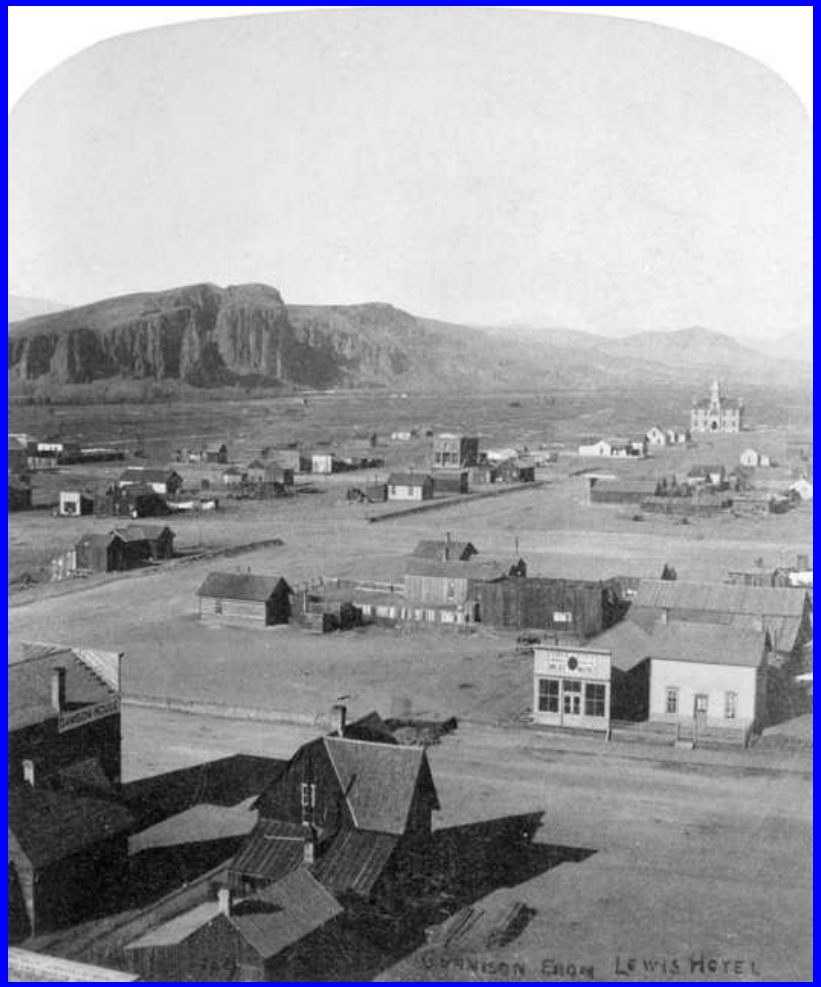
Pitkin – Mining on West Edge of Mt. Princeton Batholith

Parlin – DSP&P met D&RG again in the valley of Tomichi Creek

Tomichi Creek Valley

Valley formed in easily eroded Cretaceous shales bounded by more resistant sandstones

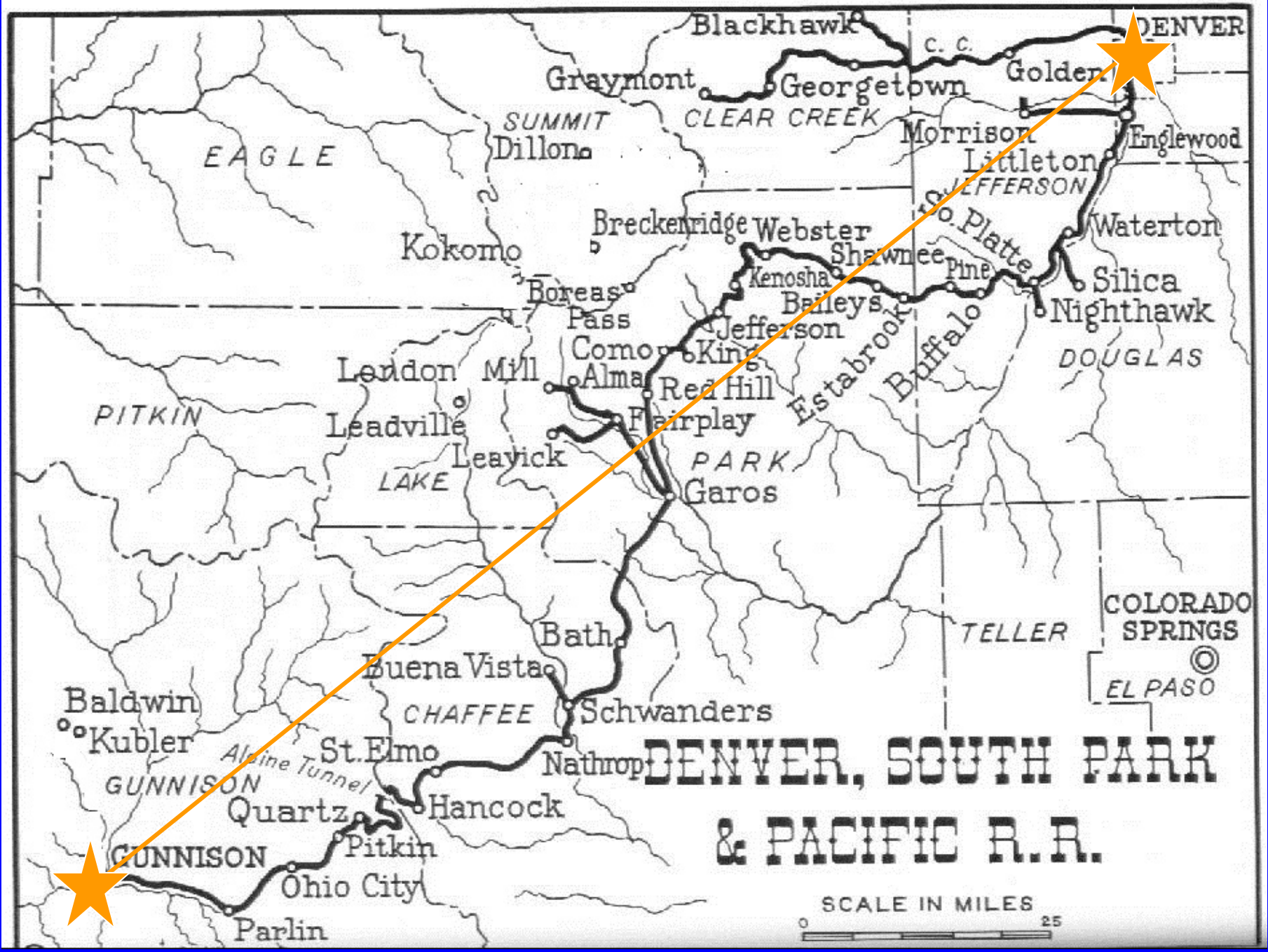
Mainline Ends in Gunnison, 8/1882!

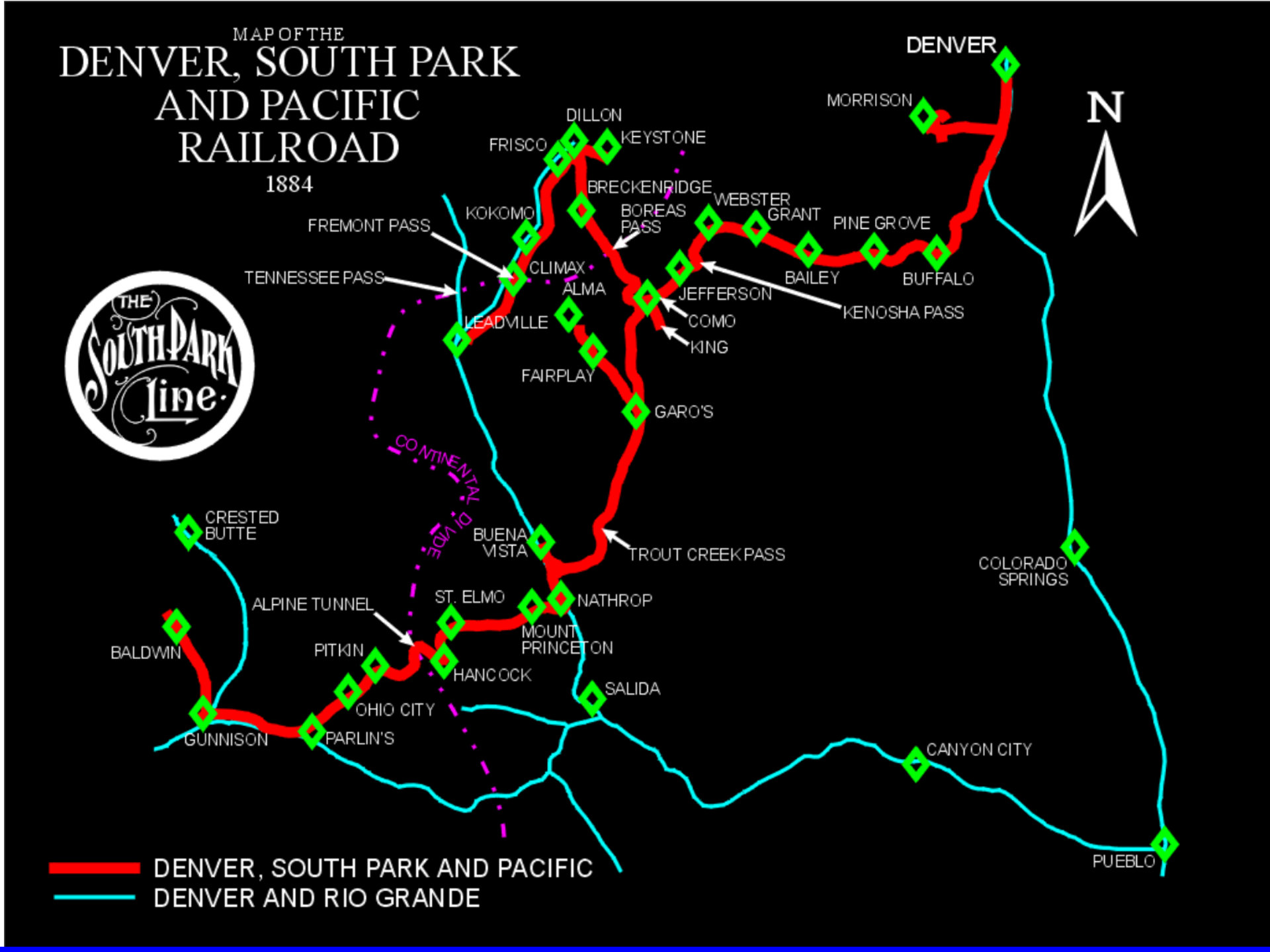


Note the West Elk lava flows in the background

DSP&P station

Baldwin branch


DENVER
Blackhawk
C. C.
Golden
Graymont
Georgetown
SUMMIT
CLEAR CREEK
Morrison
Englewood
Littleton
EAGLE
Dillon
JEFFERSON
So. Platte
Waterton
Breckenridge
Webster
Kokomo
Shawnee
Pine
Kenosha
Silica
Boreas
Pass
Baileys
Nighthawk
Jefferson
Como
King
DOUGLAS
London Mill
Alma
Red Hill
Estabrook
Buffalo
PITKIN
Leadville
Fairplay
Leavick
PARK
LAKE
Garos
Bath
TELLER
COLORADO
SPRINGS
Buena Vista
EL PASO
Baldwin
CHAFFEE
Schwanders
Kubler
St. Elmo
Alpine Tunnel
Nathrop
GUNNISON
Quartz
Hancock
Pitkin
GUNNISON
Ohio City
Parlin
DENVER, SOUTH PARK
& PACIFIC R.R.
SCALE IN MILES
0
25


MAP OF THE
DENVER, SOUTH PARK AND PACIFIC RAILROAD
1884
THE SOUTH PARK Line
DENVER
MORRISON
N
DILLON
FRISCO
KEYSTONE
BRECKENRIDGE
BOREAS PASS
WEBSTER
GRANT
PINE GROVE
KOKOMO
FREMONT PASS
TENNESSEE PASS
CLIMAX
ALMA
LEADVILLE
JEFFERSON
COMO
KING
BAILEY
BUFFALO
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MOUNT PRINCETON
BALDWIN
PITKIN
HANCOCK
SALIDA
OHIO CITY
GUNNISON
PARLIN'S
CANYON CITY
PUEBLO
DENVER, SOUTH PARK AND PACIFIC
DENVER AND RIO GRANDE

Comparison of DSP&P & D&RG routes to Leadville in 1890

DSP&P:

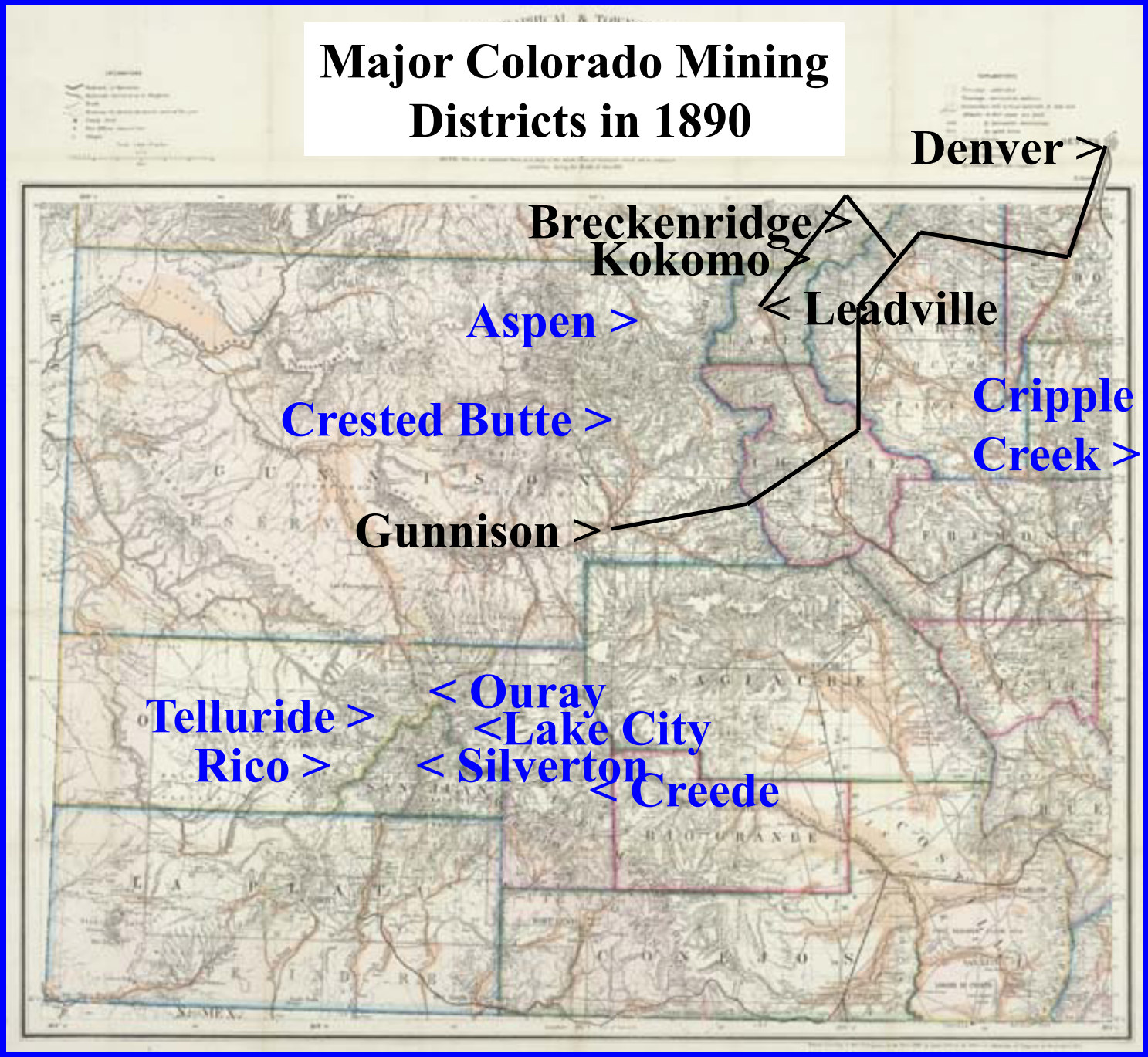
- Platte Canyon constrained DSP&P to narrow-gauge
- New NG High Line built via Breckenridge/Frisco by 1884
- High Line saved 21 miles over Trout Creek Pass route
- 2 CD crossings over Boreas Pass @ 11,500 ft and Fremont Pass @ 11,300 ft
- Frequent snow closures + Alpine Tunnel closed since 1888 due to roof cave

D&RG:

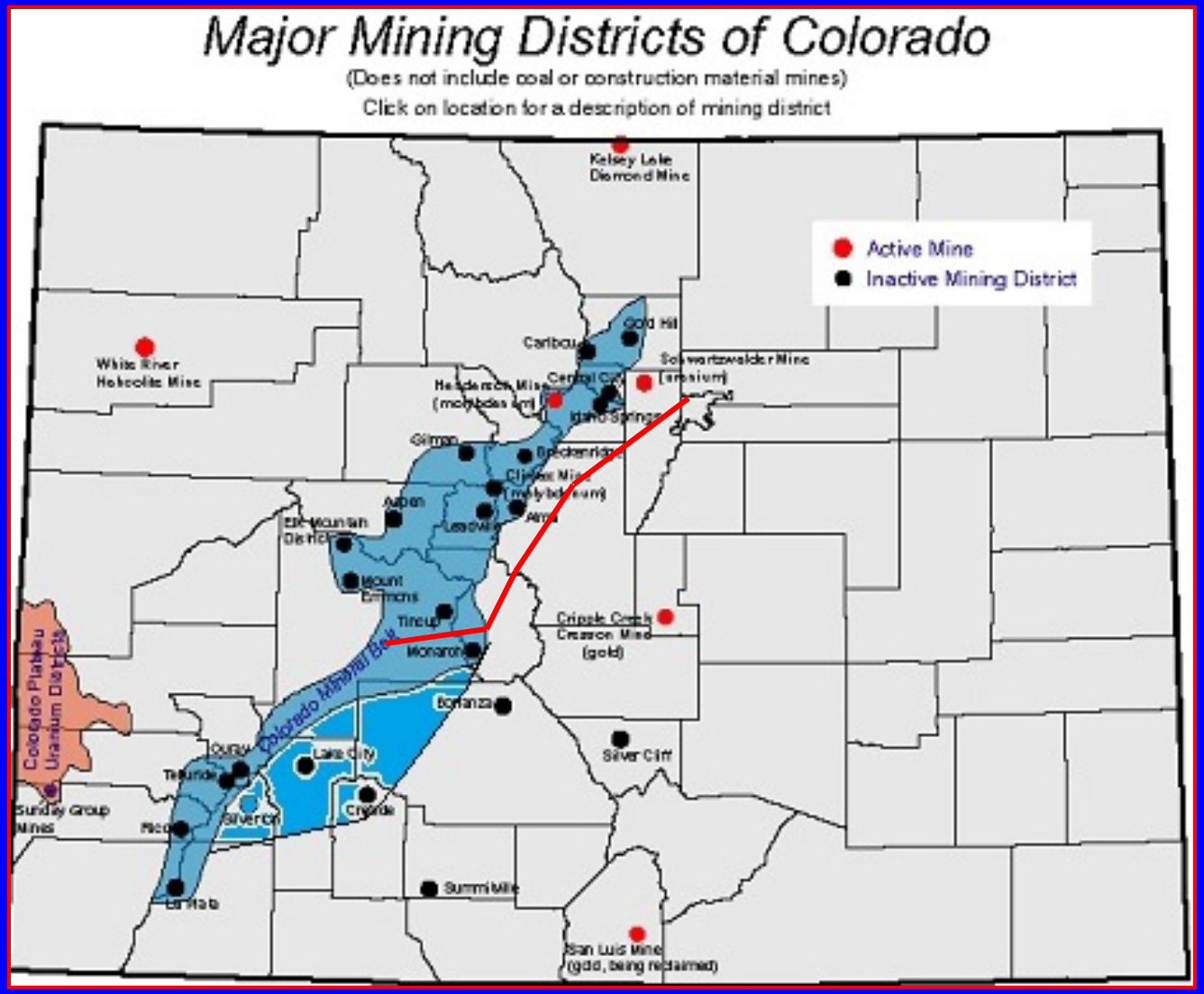
- Route unconstrained by gauge, grades, or curvature
- New SG mainline built from Denver to Leadville by 1890
- Royal Gorge route 112 miles longer Denver to Leadville than DSP&P "High Line"
- Water-level route crossed no mountain passes and Salida to Leadville grade at <1%
- Few winter snow closures

Winter on the DSP&P

Major Colorado Mining Districts in 1890



How Did DSP&P Miss All Those Mining Districts?



75% of DSP&P mainline from Denver to Gunnison (red line) is not in the Colorado Mineral Belt (blue shading)

Comparison of DSP&P to D&RG Metal Mining Districts

(Production in $ millions, 1859-1945)

DSP&P:

- Fairplay/Alma ($44)
- Chalk Creek ($22)
- Pitkin/Qtz Creek ($10)
- * Leadville ($462)
- * Breckenridge ($55)
- * Kokomo ($13)
- * Climax ($315, 1918)

* On new "High Line"

D&RG:

- Silverton ($117)
- Ouray ($86)
- Crested Butte (coal = $22)
- Leadville ($462)
- Aspen (1886-92 = $112)
- Lake City ($25)
- Creede ($50 after 1890)
- Cripple Creek ($455) (via F&CC from 1894-1912)

How did DSP&P Lose? Geology !

Inflexible, single-minded pursuit of shortest route to San Juans, instead of most economical route, led to:

- Crossing 3 mtn. ranges = steep grades, sharp curves
- Blasting crystalline rocks = higher per mile costs (Cost = $4,853,000 or ~$24,000/mile)
- Alpine Tunnel rock type = delays & cost overruns
- By-passing major metal mining districts = lower freight and passenger income
- No major coal mines = costly, uphill haul of fuel
- Elevations of 8,000 – 11,600 ft = heavy snows

Gone, But Not Forgotten!

Last passengers down Platte Canyon, 4/10/1937

Last freight down Platte Canyon, 4/11/1937

Photo/map credits:

Denver Public Library

Colorado Geological Survey

Todd Hackett

http://railsproject.com

http://www.geocities.com/jghist/

Poor, *DSP&P*. RMRC, 1976.