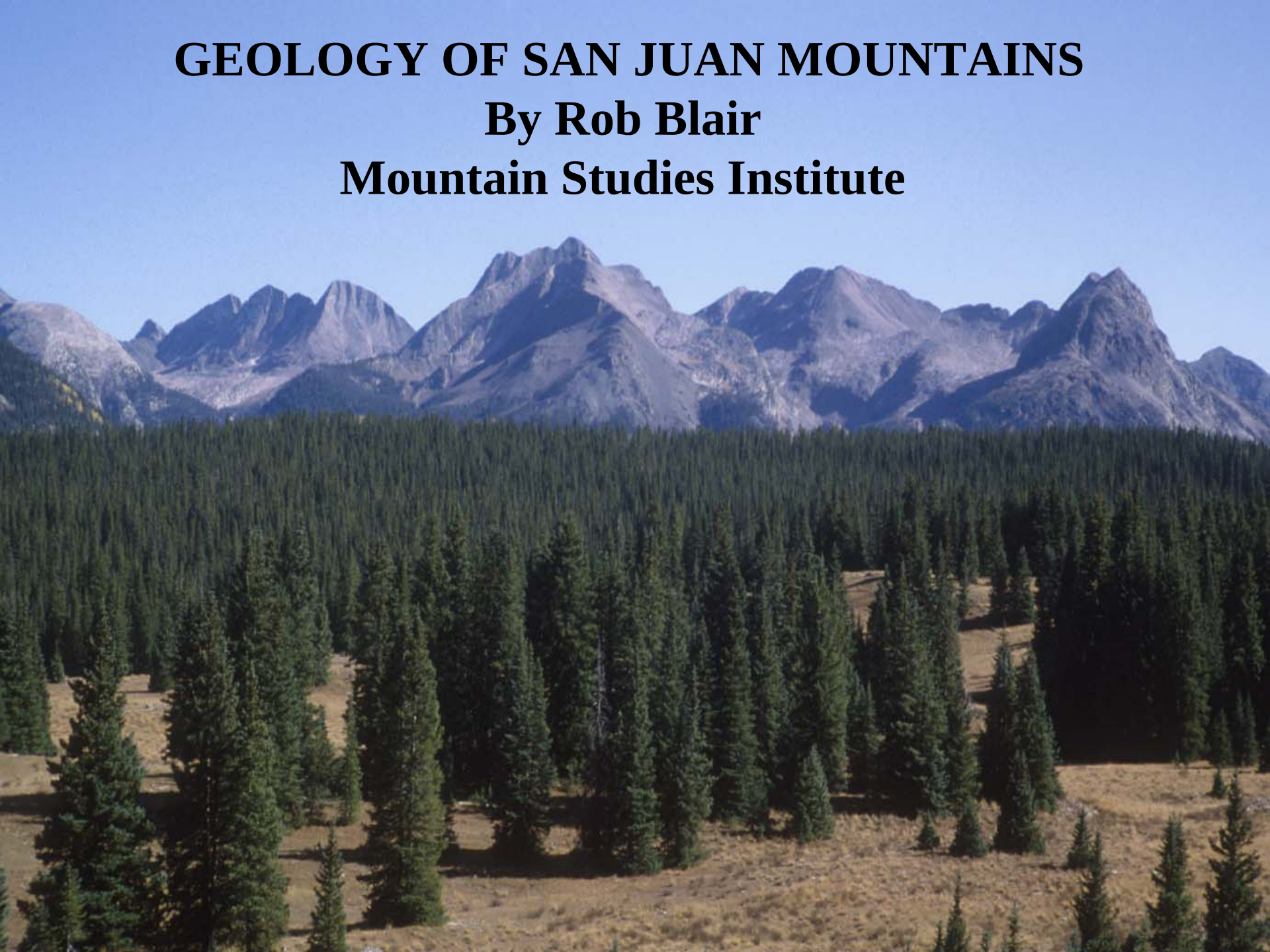
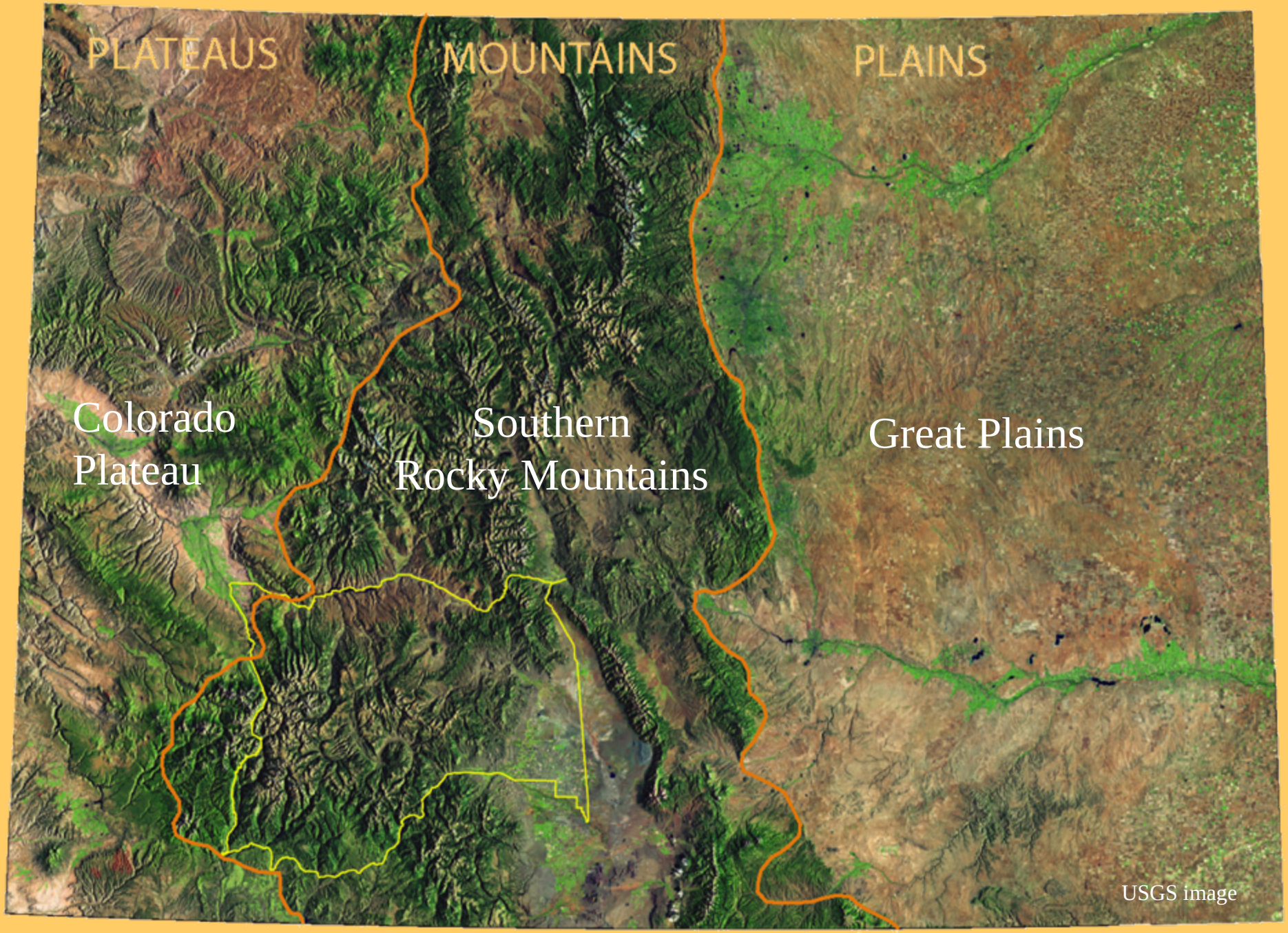
GEOLOGY OF SAN JUAN MOUNTAINS

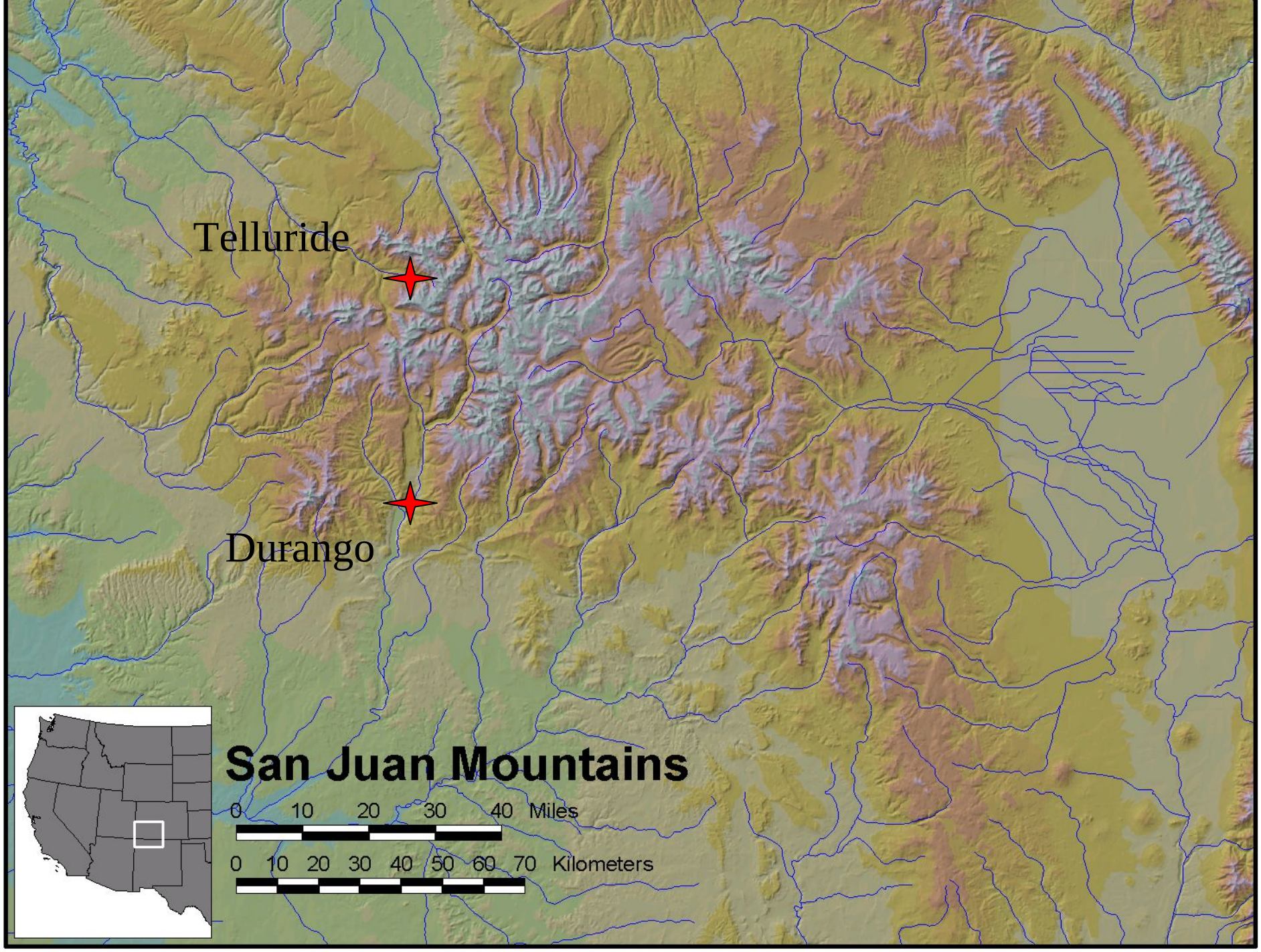
By Rob Blair
Mountain Studies Institute

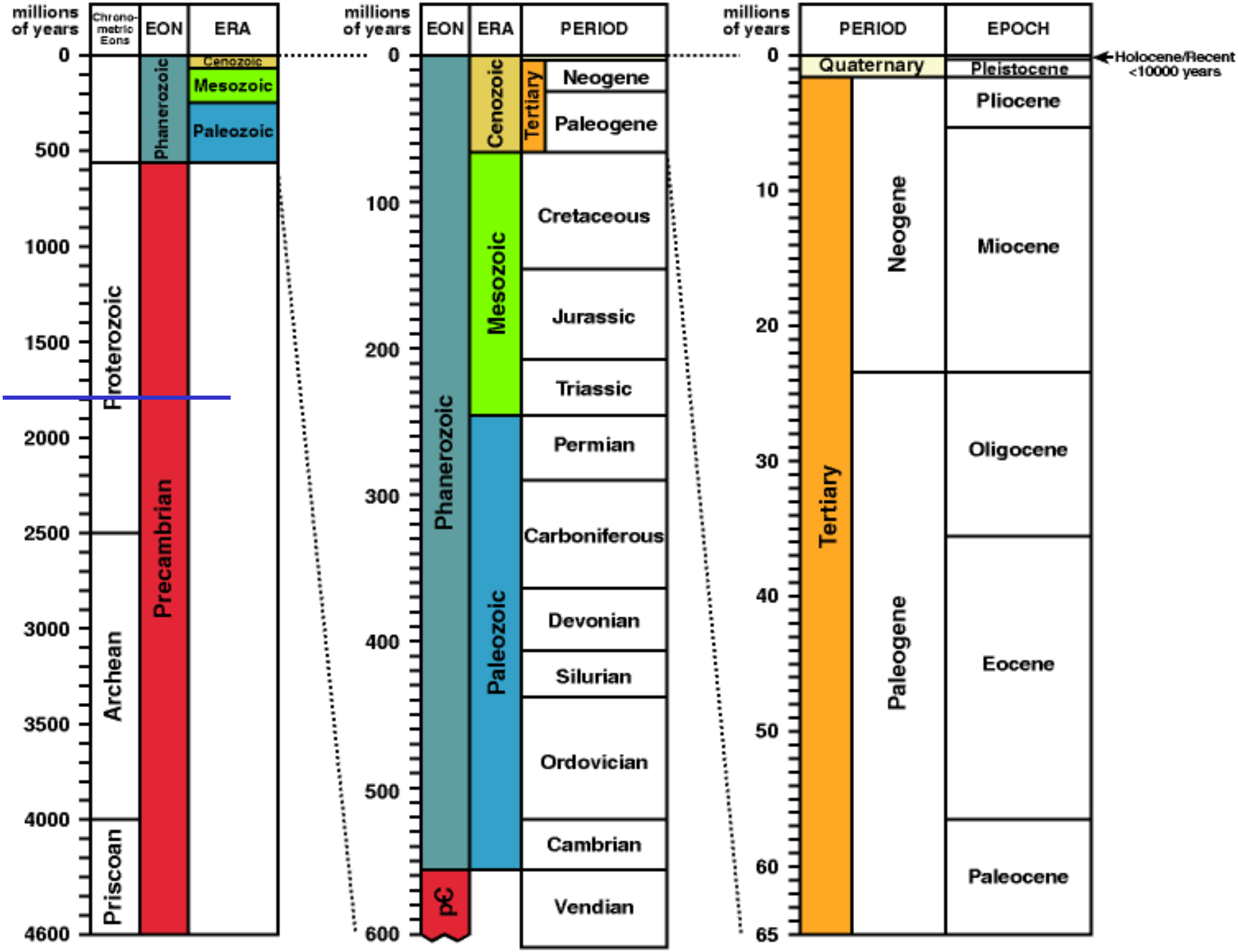


INTRODUCTION

- Overview of geologic history
- Key geomorphic features and processes
- Why the San Juan Mountains are geologically interesting


PLATEAUS
MOUNTAINS
PLAINS
Colorado Plateau
Southern Rocky Mountains
Great Plains
USGS image


Telluride
Durango
San Juan Mountains
0 10 20 30 40 Miles
0 10 20 30 40 50 60 70 Kilometers


millions of years
Chrono-metric Eons
EON
ERA
0
500
1000
1500
2000
2500
3000
3500
4000
4600
Proterozoic
Archean
Priscoan
Phanerozoic
Precambrian
Cenozoic
Mesozoic
Paleozoic
millions of years
EON
ERA
PERIOD
0
100
200
300
400
500
600
Phanerozoic
pЄ
Cenozoic
Mesozoic
Paleozoic
Tertiary
Neogene
Paleogene
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
Vendian
millions of years
PERIOD
EPOCH
0
10
20
30
40
50
60
65
Quaternary
Tertiary
Neogene
Paleogene
Pleistocene
Holocene/Recent
<10000 years
Pliocene
Miocene
Oligocene
Eocene
Paleocene

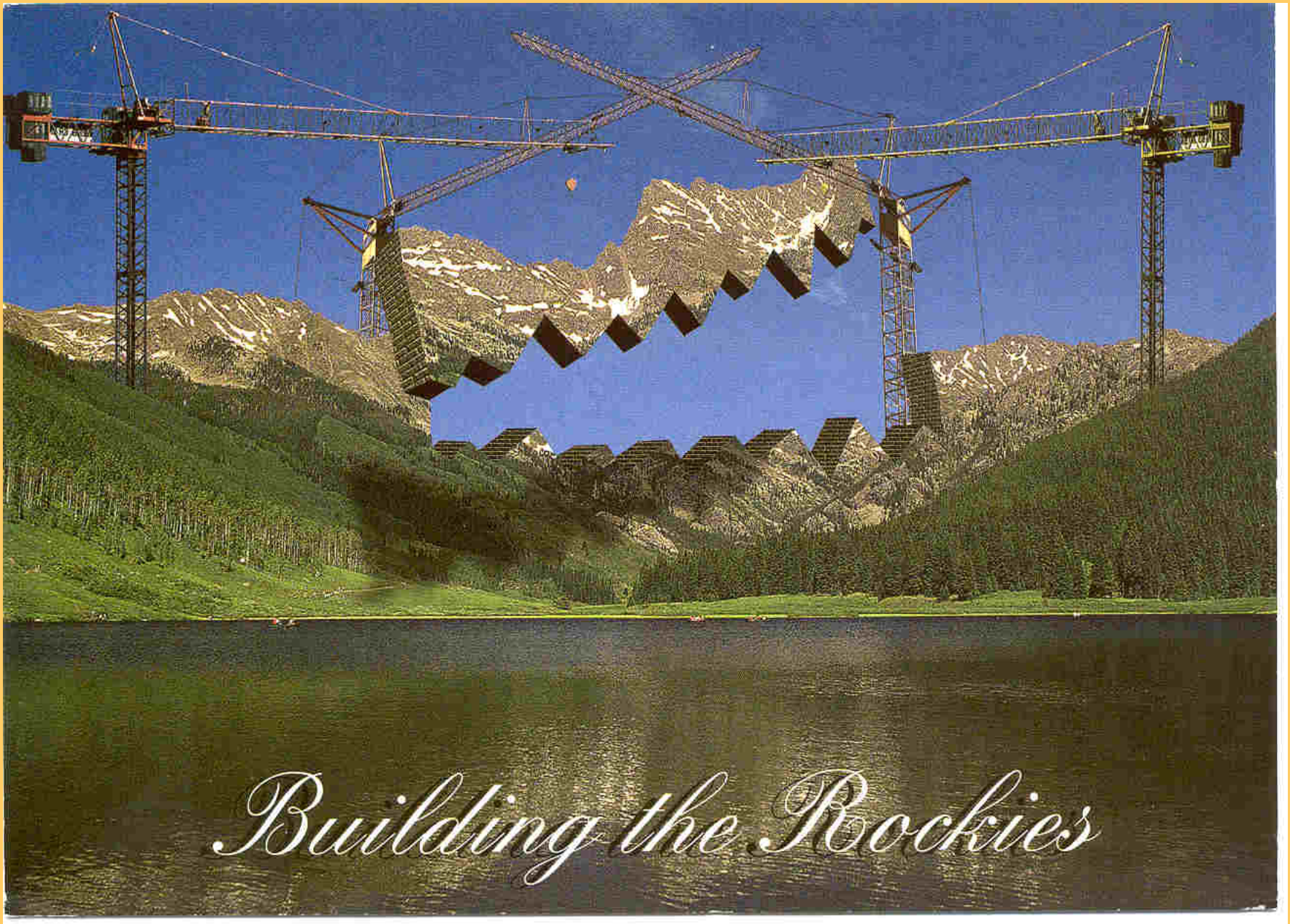
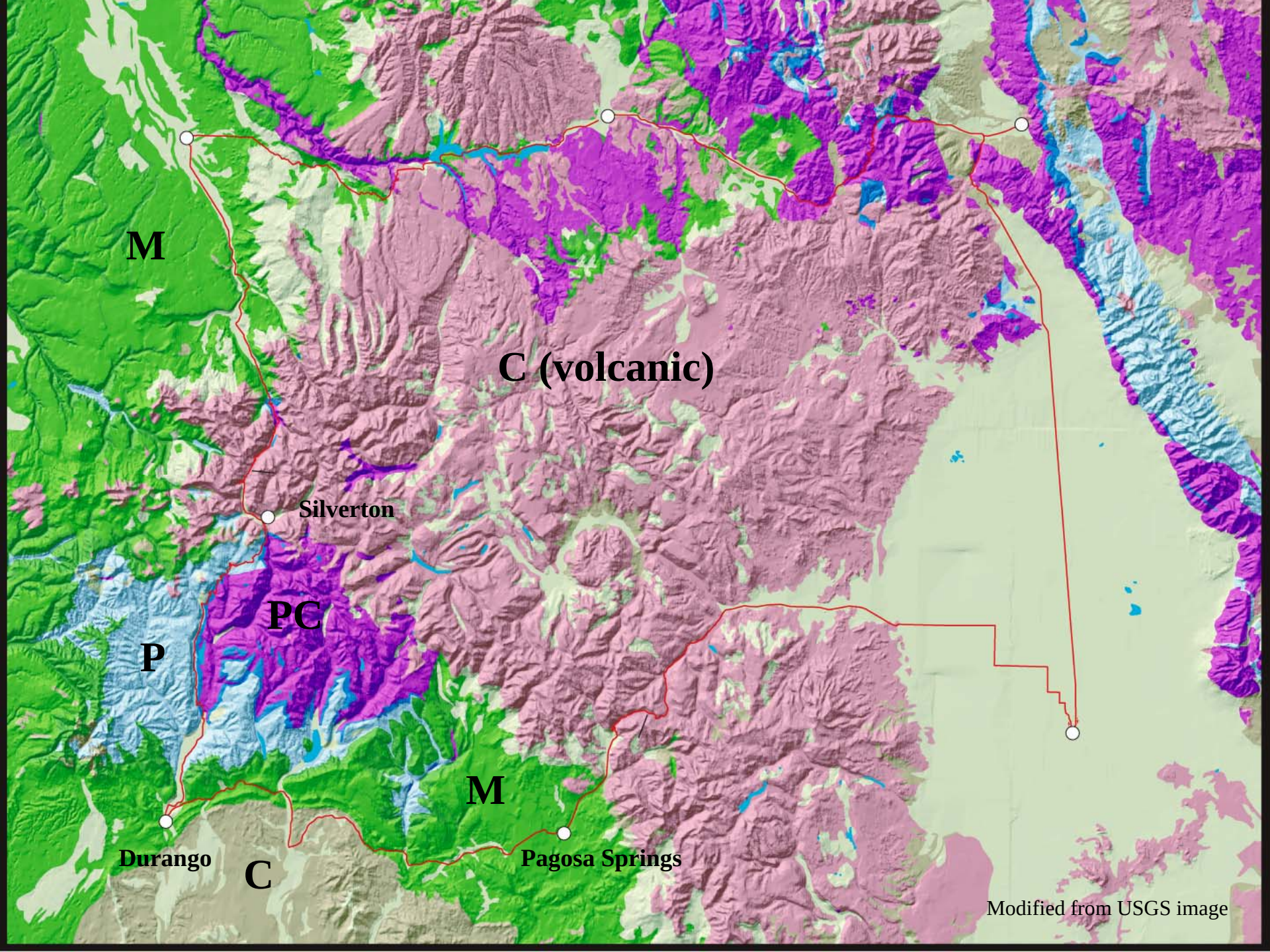
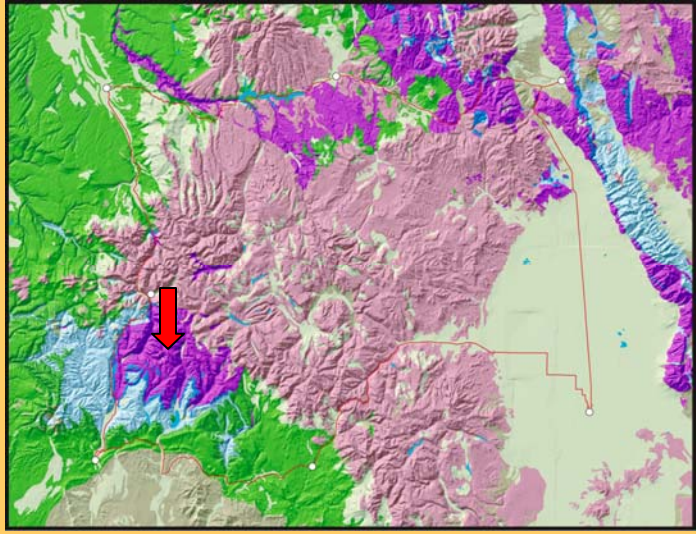


Photo by Peter Runyon, from Mountain Sights Inc.


M
C (volcanic)
Silverton
PC
P
M
Durango
C
Pagosa Springs
Modified from USGS image

PRECAMBRIAN

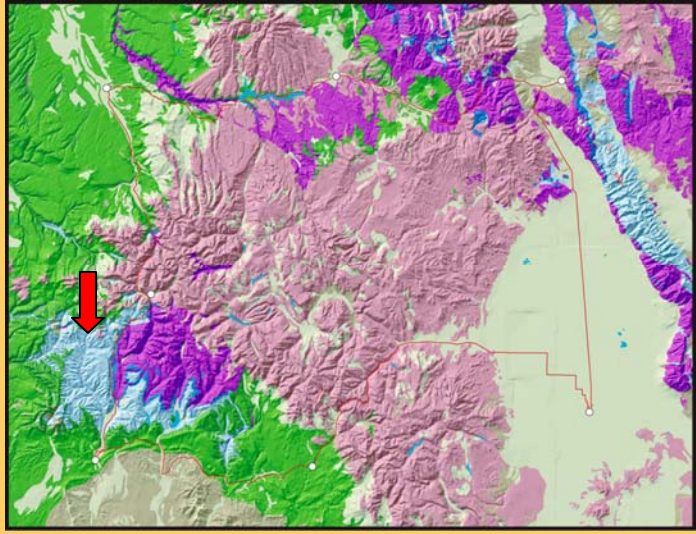


- **t**: 540-1,800 Ma
- **p**: granite, diorite, gabbro, gneiss, quartzite, slate
- **r**: island arc, coastal plain, marine
- **cl**: hot, CO_2, CH_4, H_20, N_2, NH_3 and later cooler, N_2, Ar, O_2, CO_2, H_2O
- **o**: evolution of procaryotes (bacteria) and later eucaryotes

Image by R. Blakey, NAU

Ouray Unconformity
Photo by R. Blair

PALEOZOIC



- **t**: 250-540 Ma
- **p**: shale, limestone, sandstone, conglomerate
- **r**: coastal, plains, lowlands, mountains
- **cl**: maritime to warm & dry, cool alpine
- **o**: bacteria dominant, fish, brachiopods, reptiles, ferns and other woody plants

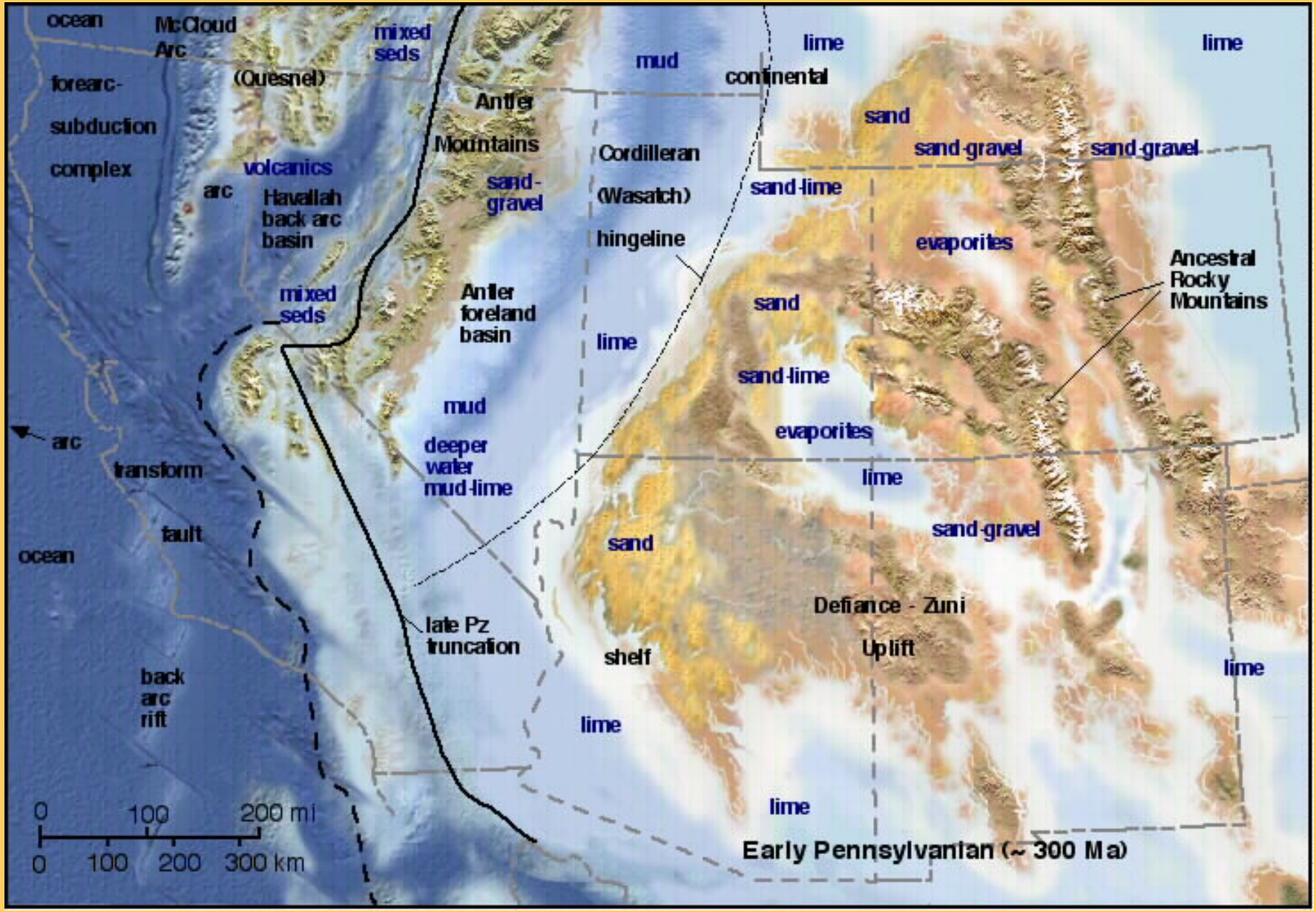
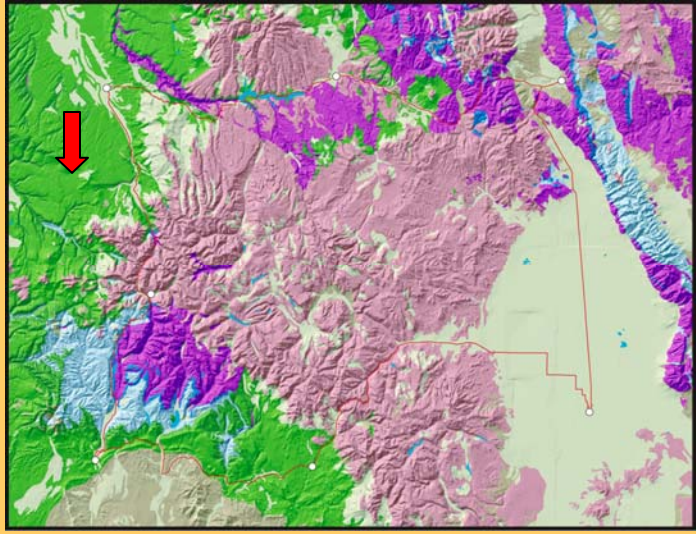


Image by R. Blakey, NAU

Hermosa Cliffs
USGS photo

MESOZOIC

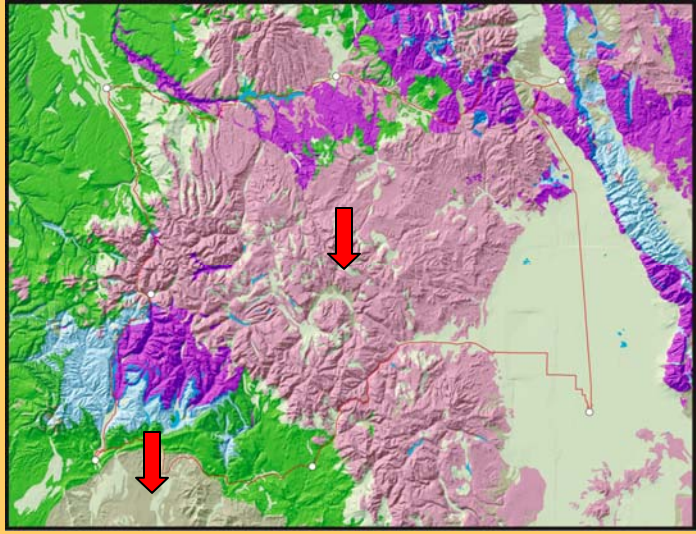


- **t**: 66-250 Ma, Triassic, Jurassic, Cretaceous
- **p**: eolian and coastal sandstones, marine shale, coal
- **r**: interior lowlands and seaways
- **cl**: hot and dry to hot and humid
- **o**: bacteria dominant, evolution of dinosaurs, early mammals, flowering plants

Image by R. Blakey, NAU

Mesa Verde
Photo by R. Blair

CENOZOIC



- **t**: 66 Ma to present, Tertiary, Quaternary
- **p**: sandstones, conglomerates, volcanic rocks
- **r**: floodplains, mountains
- **cl**: Mediterranean to glacial environments
- **o**: bacteria dominant, age of mammals, evolution of grass

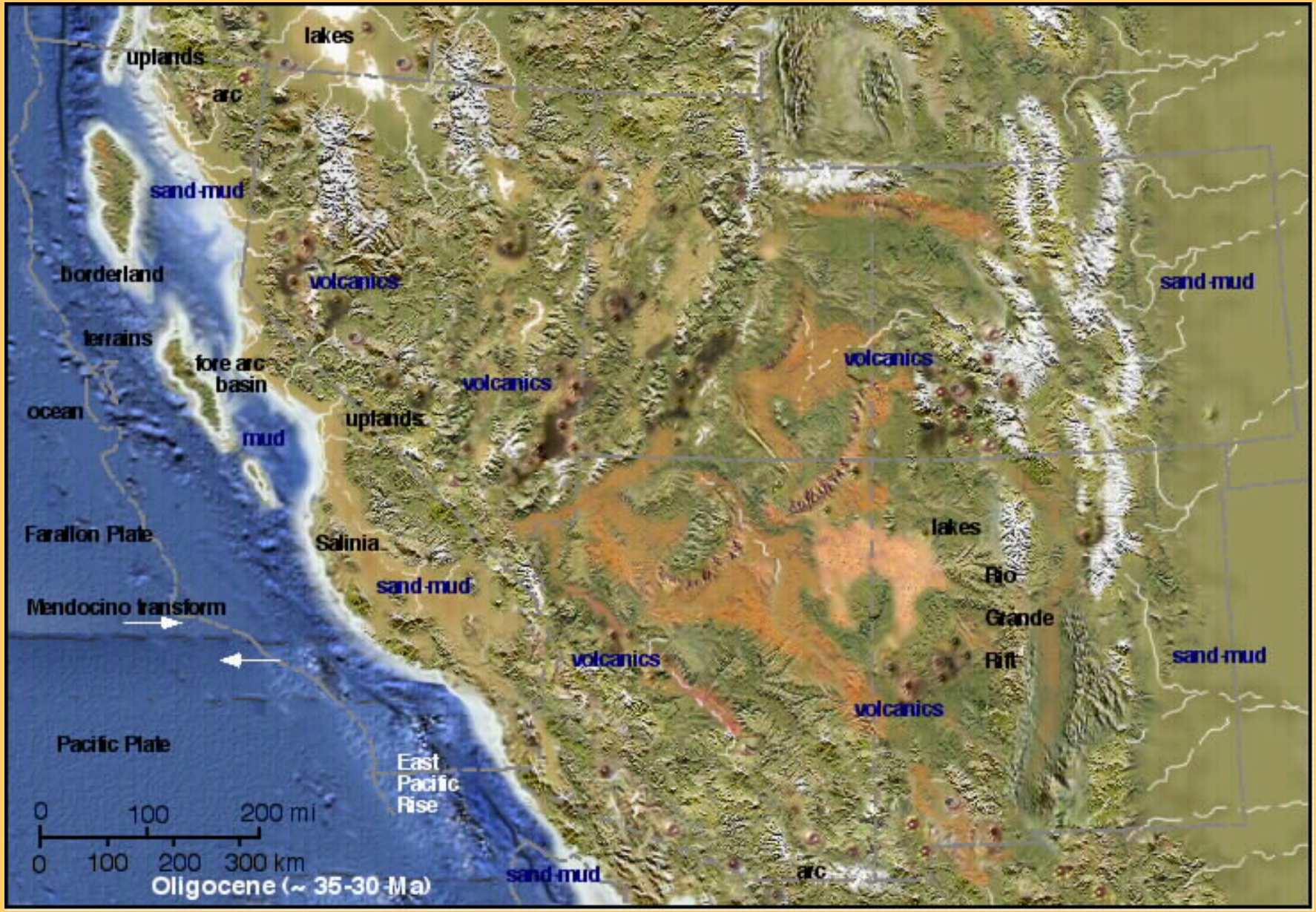
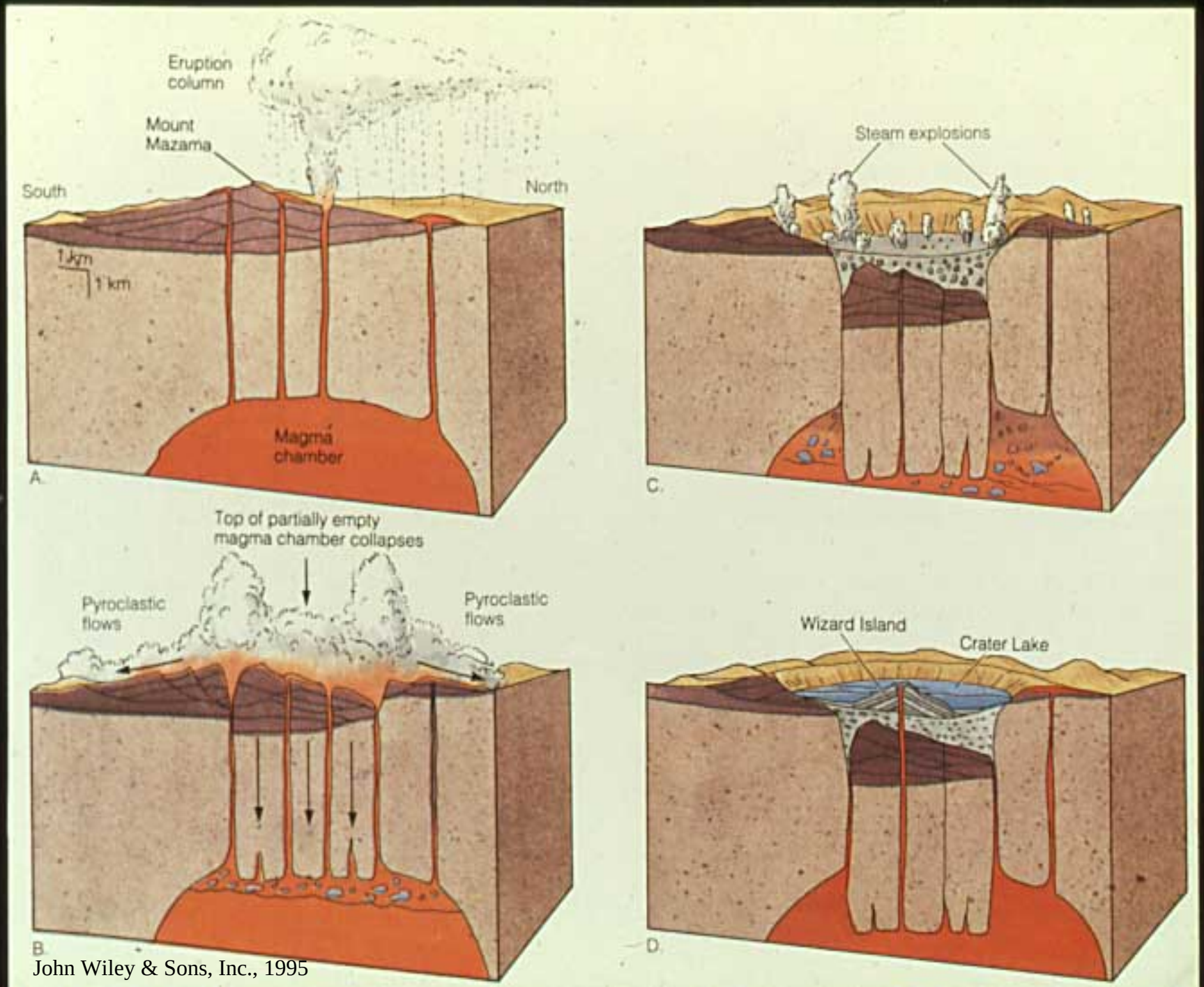


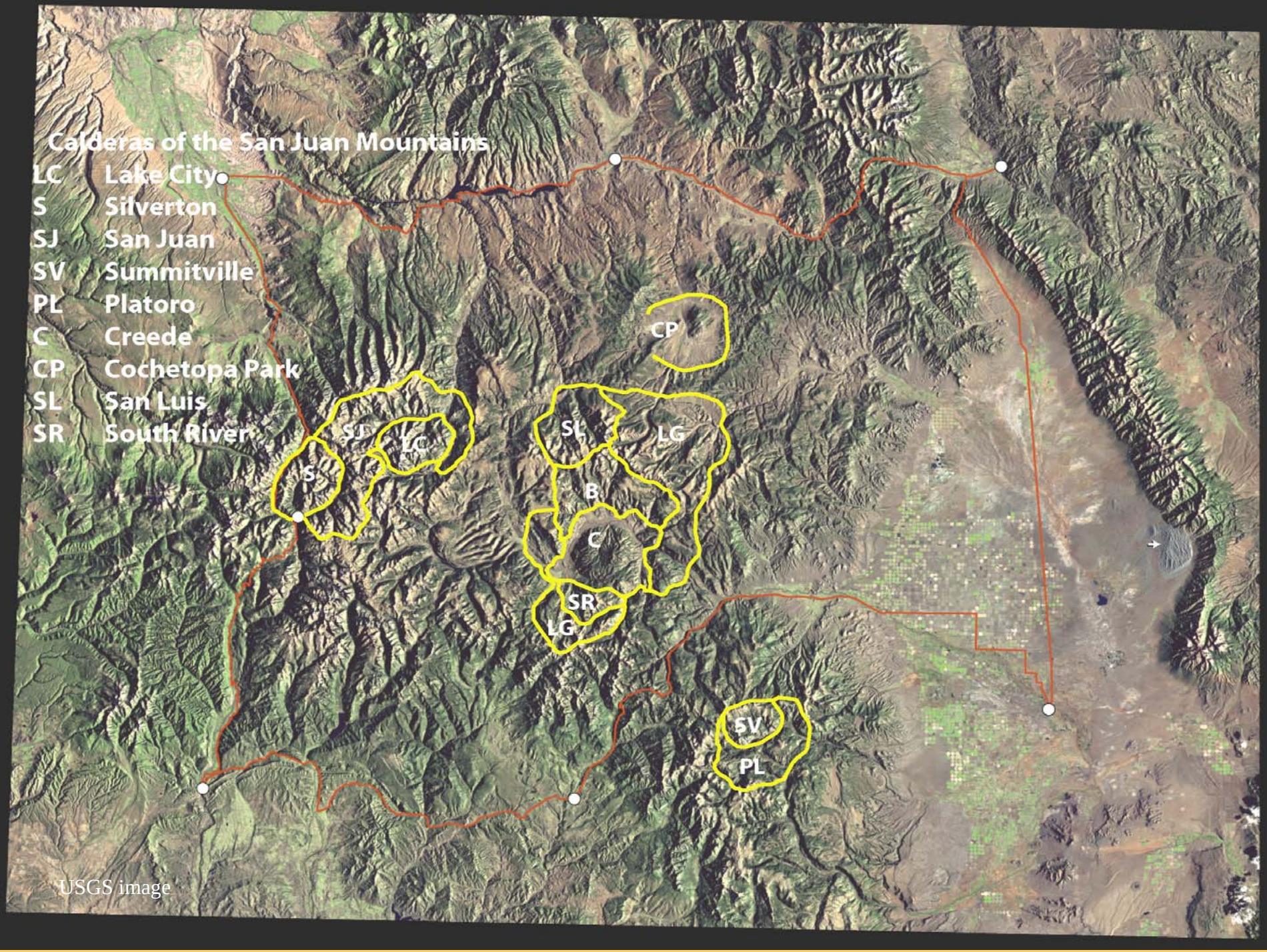
Image by R. Blakey, NAU



John Wiley & Sons, Inc., 1995

Mount St. Helens
Copyright Pevear/ Easterbrook

Crater Lake, OR
Photo by J. Sheldon


Calderas of the San Juan Mountains
LC Lake City
S Silverton
SJ San Juan
SV Summitville
PL Platoro
C Creede
CP Cochetopa Park
SL San Luis
SR South River
CP
SJ
LC
S
SL
LG
B
C
SR
LG
SV
PL

USGS image

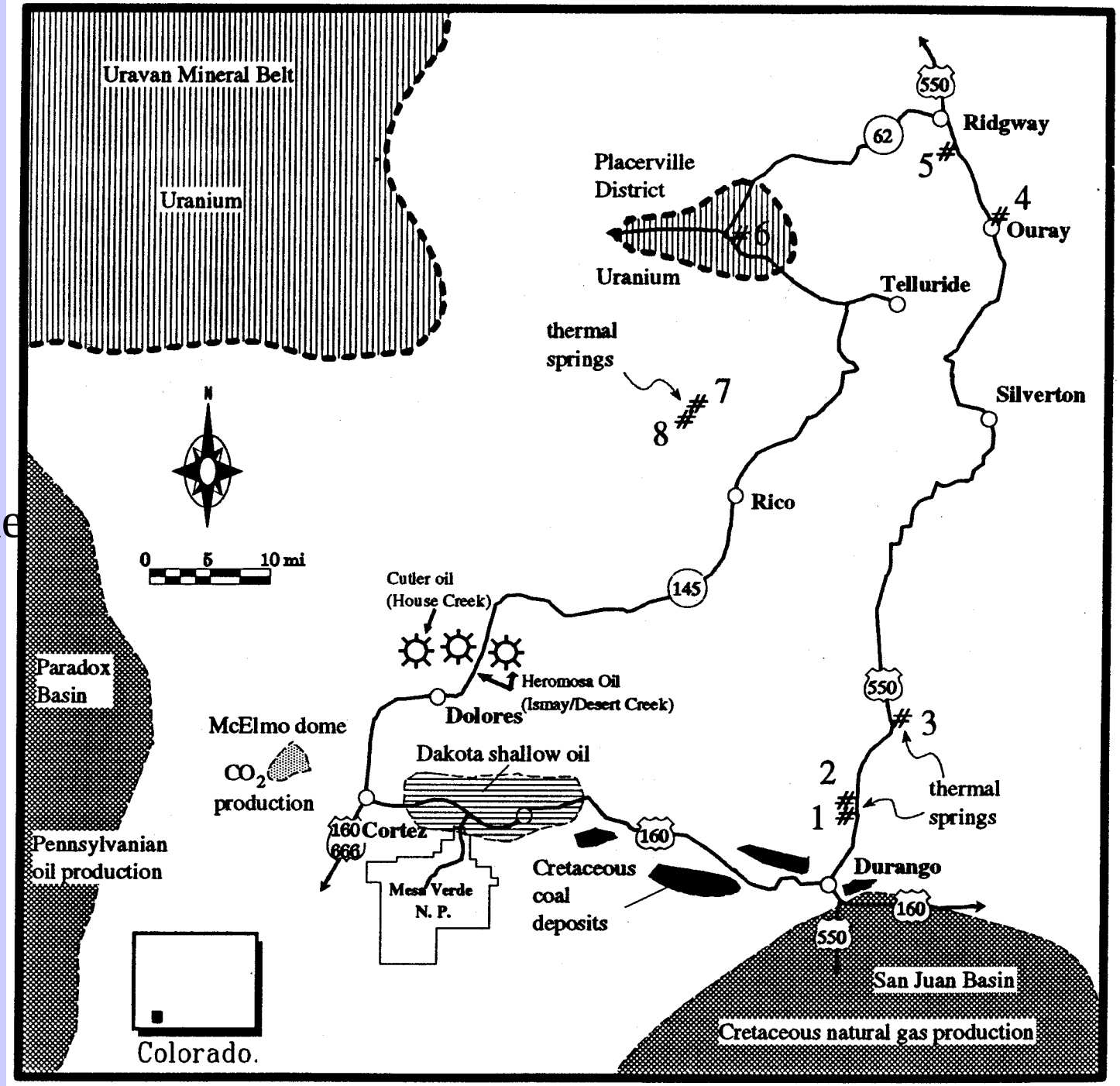
Ophir
Photo by R. Blair

Au, Ag, Zn, Cu, Fe

Red Mountain 1 & 2, Ironton Park
Photo by R. Blair

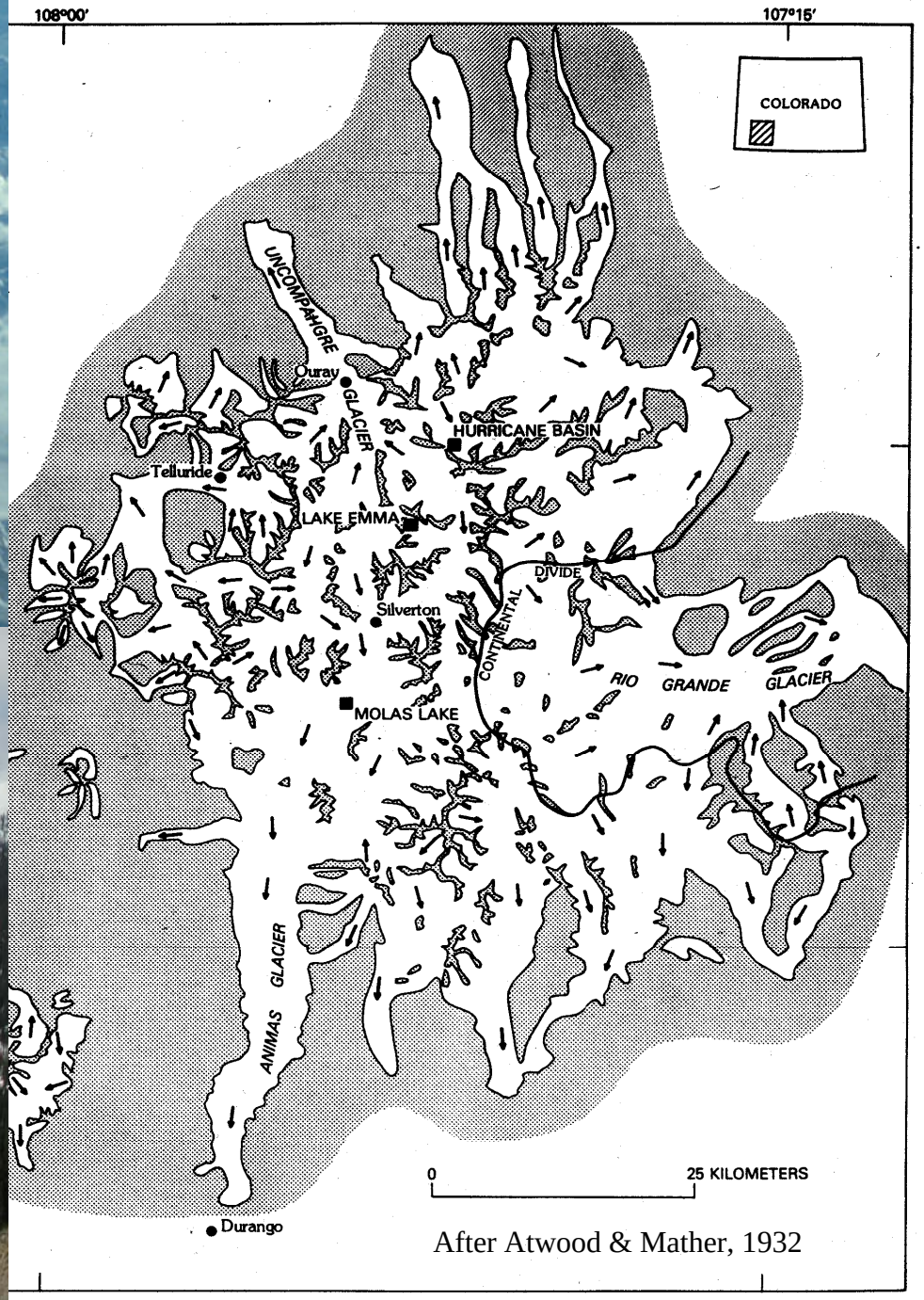
ENERGY RESOURCES

-Geothermal
-Uranium
-Coal
-Oil
-Natural gas
-Coalbed methane
-Helium
-Carbon dioxide



East Greenland
Photo by Peter Knight

Mineral Creek and Bear Mountain



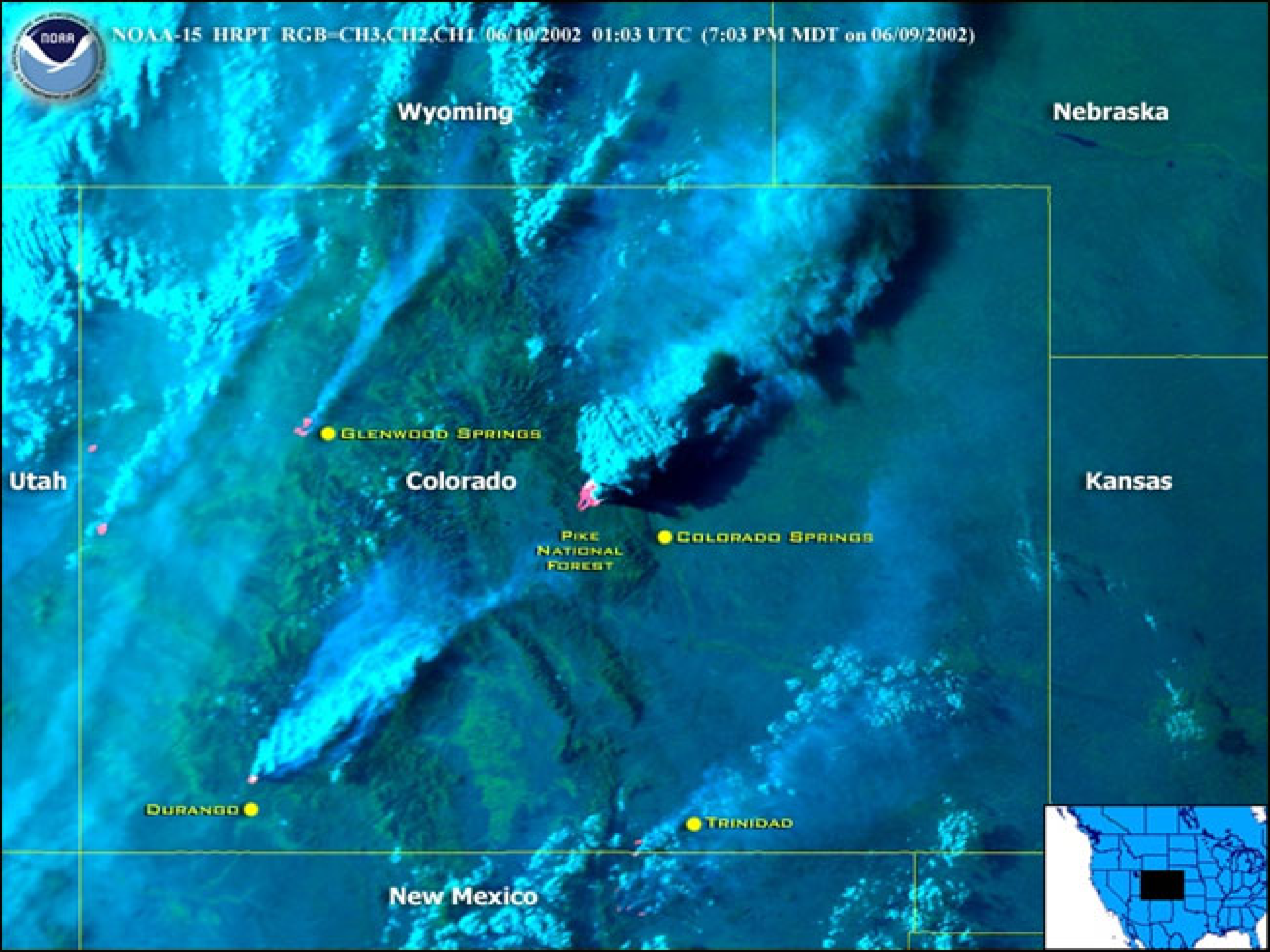
After Atwood & Mather, 1932

Silverton
Photo by R. Blair

nt Sneffles
o by R. Blair

SAN JUAN MOUNTAINS

- **Extraordinary geologic record (PC-Holocene)**
- **Repository of Au, Ag, Zn, Cu, Fe**
- **Outliers of coal, oil, natural gas, U, He, CO_2**
- **Geothermal resources**
- **Extensive glacial history**
- **Outstanding scenery**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Wyoming
Nebraska
Glenwood Springs
Utah
Colorado
Kansas
Pike National Forest
Colorado Springs
Durango
Trinidad
New Mexico