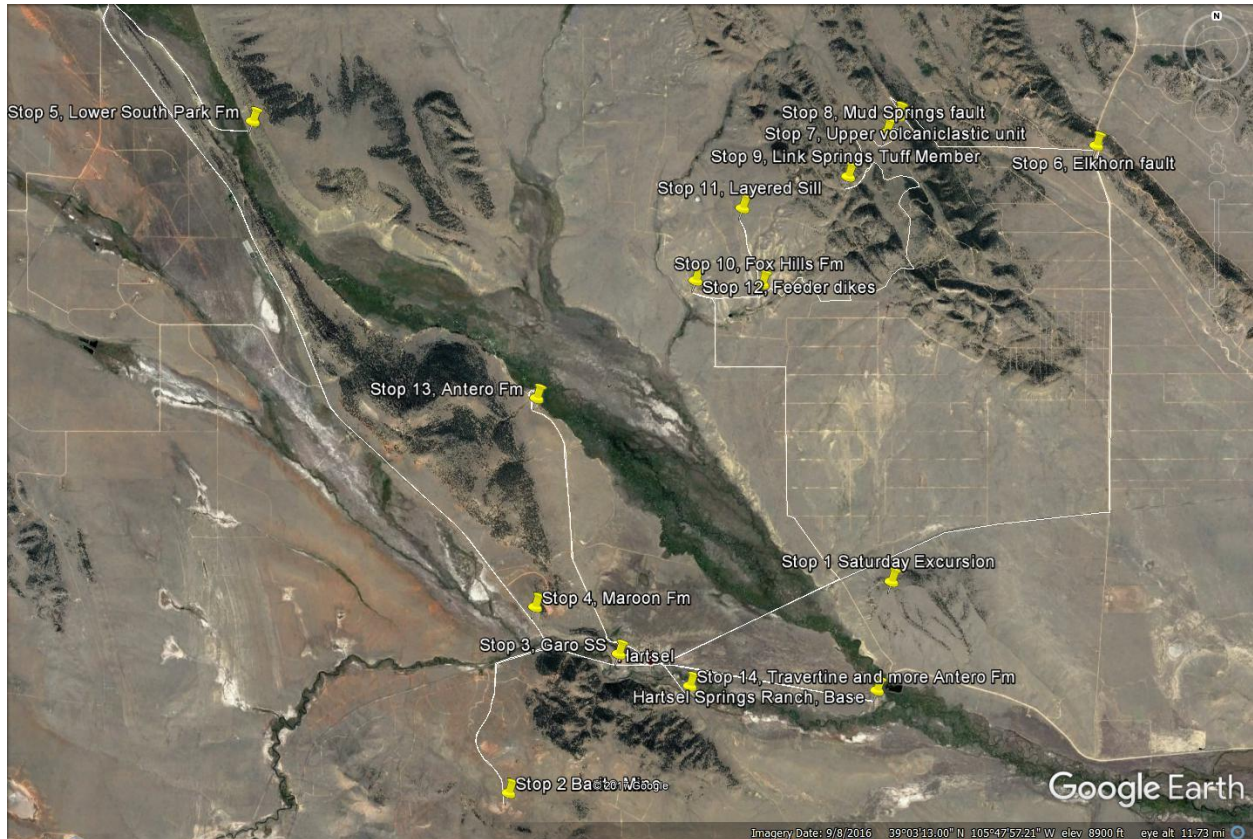


Colorado and Florissant Scientific Societies Spring Field Trip

June 24 and 25, 2017

Hartsel, Colorado: Geographic and Geologic Center of Colorado-It All Comes Together Here



Saturday Evening (weather permitting)

Stop 1-Hill 9,167

Look at deformed Fox Hills Sandstone truncated by angular unconformity below Eocene (?) Tallahassee Creek Conglomerate. Panoramic view of Hartsel area.

Sunday

Stop 2-Barite Mine

Discuss Penn/Perm central Colorado trough and edge of Frontrangia. See onlap of Maroon Formation onto Precambrian. Look for blue barite.

Stop 3-Garo Sandstone

Look at Garo Sandstone directly on Precambrian, with clasts of quartz and feldspar. On the Hartsel Springs homocline (or it is really the flank of a fault-bound fold?).

Stop 4-Maroon Formation

View proximal fluvial facies adjacent to Hartsel fault.

Stop 5-South Park Formation, lower volcaniclastic conglomerate

View lower volcaniclastic conglomerate member of the South Park Formation resting on an unconformity above more steeply dipping Pierre Shale. Conglomerate includes intermediate volcanic rocks, fine grained intrusive rocks, white porphyry rocks and rare Paleozoic quartzite and hornfels. Records unroofing of a volcanic center to the west-northwest and emerging uplift.

Stop 6-Elkhorn fault

Elkhorn fault exposure in county road ditch? Weathered biotite gneiss above sandstone (Morrison?) Possible walk to look down Chase Gulch graben.

Stop 7- South Park Formation, upper volcaniclastic conglomerate

On the hanging wall of the Mud Springs fault with dips steeply to west.

Stop 8- Mud Springs fault and San Isabel syncline

Steep to overturned beds with shallow east dipping beds just to the west. Fault is at the surface in here but becomes concealed to the north. Fault overrides the San Isabel syncline.

Stop 9- South Park Formation, Link Springs Tuff Member

Reworked ash beds with plant imprints. Other road cuts expose volcaniclastic sand with lenses of conglomerate and mudstones. Pollen analysis of organic mud indicates late-early Paleocene. Waiting on Ar/Ar on ash.

Stop 10- Fox Hills Sandstone

We crossed the axis of the Hartsel anticline at the gully crossing. Beach facies of the Fox Hills Sandstone are well exposed in the hills where they dip to the southwest. To the west, and above, are shoreface interbedded sand and shale indicating either shingling or repeat by faulting. Backthrusting along the Hartsel anticline is one possibility

Stop 11- Tertiary sill

Short walk up the hillside to see the layered mafic sill in the Fox Hills Sandstone. Mineralogy and wholerock chemistry indicate gabbro to diorite; 6.3 to 10.8% K and Na makes this fairly alkalik. Waiting on Ar/Ar dating. Thickness is up to 200 feet.

Stop 12- Tertiary dikes






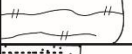








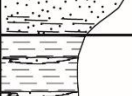




Feeder dikes are exposed in the roadway and lead up the hill.


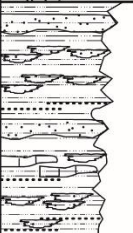


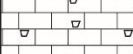






Stop 13- Antero Formation

Volcaniclastic sandstone and redbeds are exposed in the bank above Middle Fork South Platte River. To the north and across the river are bluffs with similar strata that are better exposed. A pollen analysis indicates these are Oligocene.

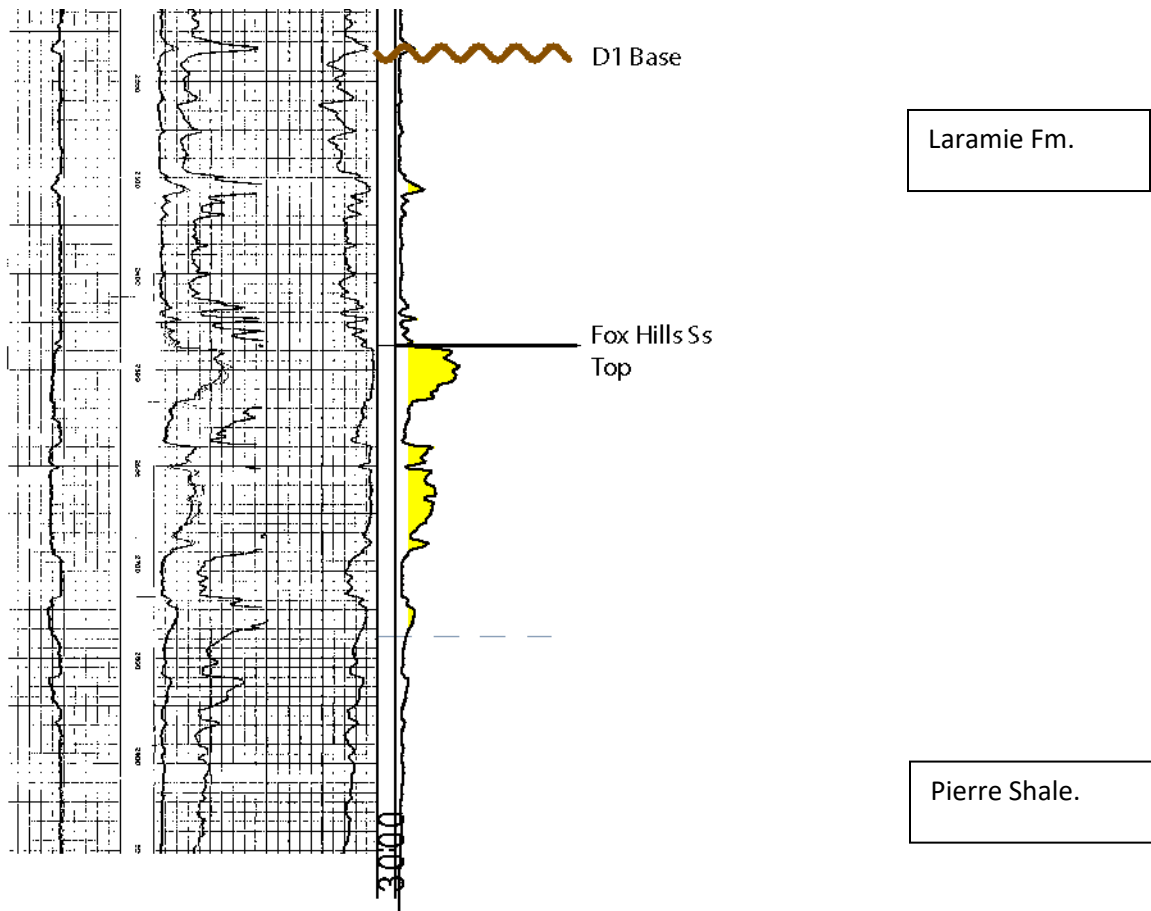
Stop 14- Travertine

If time permits, a short walk up the gully leads to a travertine deposit from an older hot spring located near the northern end of the Carrant Creek fault. There are more exposures of Antero Formation just to the east.

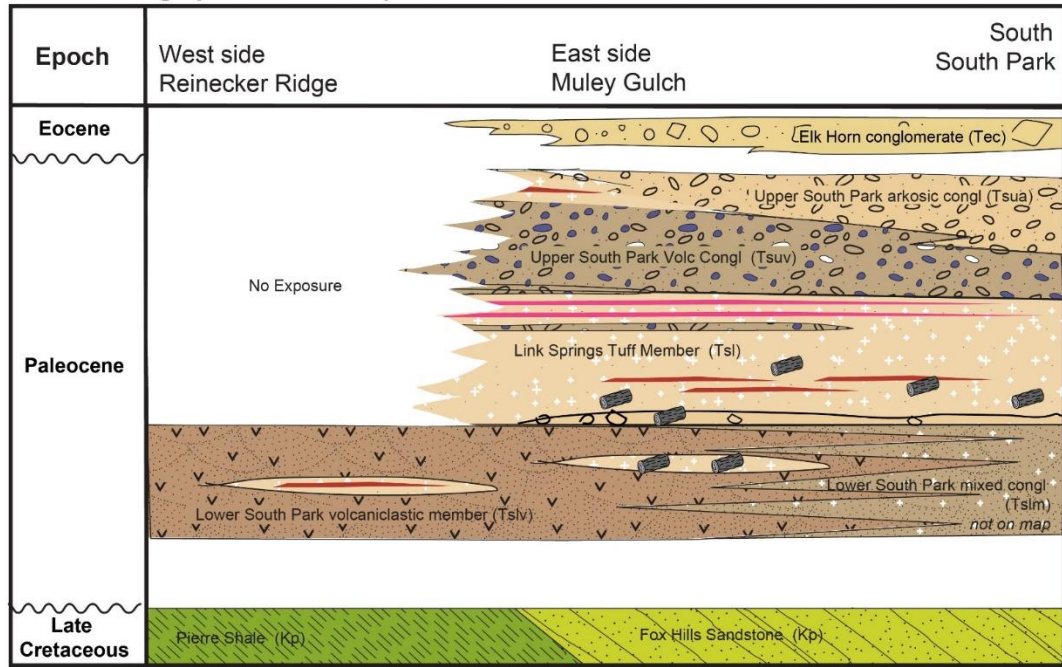
AGE	GEOLOGIC UNIT (THICKNESS IN FT)	LITHOLOGY	
QUATERNARY	Holocene alluvium (up to 20)		gravel, sand, clay, peat; unstratified glacial drift
	Pleistocene alluvium, outwash, and glacial drift (up to 150)		
MIOCENE	Wagontongue Fm. Trump sandstone (500–1,400)		gravel, sandstone, and siltstone
OLIGOCENE	Antero Fm. (up to 2,000)		conglomerate, shale, sandstone, limestone, ash-flow tuff
	Thirty-nine Mile and Guffey Mtn. volcanics (up to 2,600)		andesite and basalt flows, flow breccias, conglomerates, and ash-flows
?	Tallahassee Ck. Congl. (up to 800)		conglomerate with sand and silt
EOCENE	Wall Mtn. Tuff, Gribbles Peak Tuff and Buffalo Peaks andesite (up to 1,200)		rhyolitic ash-flow tuff, andesite, flow breccias
	Echo Park Alluvium (50 to 1,000)		gravel, sand, and boulders
PALEOCENE	?		conglomerate with sand
	Fine-grained arkose member. (up to 3,000)		lenticular sandstone, conglomerate, siltstone and mudstone
	Link Spring Tuff Mbr.. (~200)		laminated tuff, breccia, and andesite flows
	Conglomerate mbr. (1,200 –5,100)		lenticular conglomerate, sandstone, siltstone and mudstone
	Reinecker Ridge Volcanic Member (300 –900)		conglomerate, sandstone, andesite flows and breccia
	Laramie Formation (up to 375)		shale, sandstone, and coal
	Fox Hills Sandstone (up to 350)		sandstone and minor shale
UPPER CRETACEOUS	Pierre Shale (4,200–5,300)		shale, sandstone, bentonitic layers
	Apache Creek Sandstone Mbr. (up to 200)		sandstone, pebble conglomerate, and shale
	Niobrara Formation (400–550)		calcareous shale and limestone
	Benton Group (~250)		shale, limestone, and bentonite beds
LOWER CRET.	Dakota Sandstone (250–300)		sandstone, pebble conglomerate, and shale

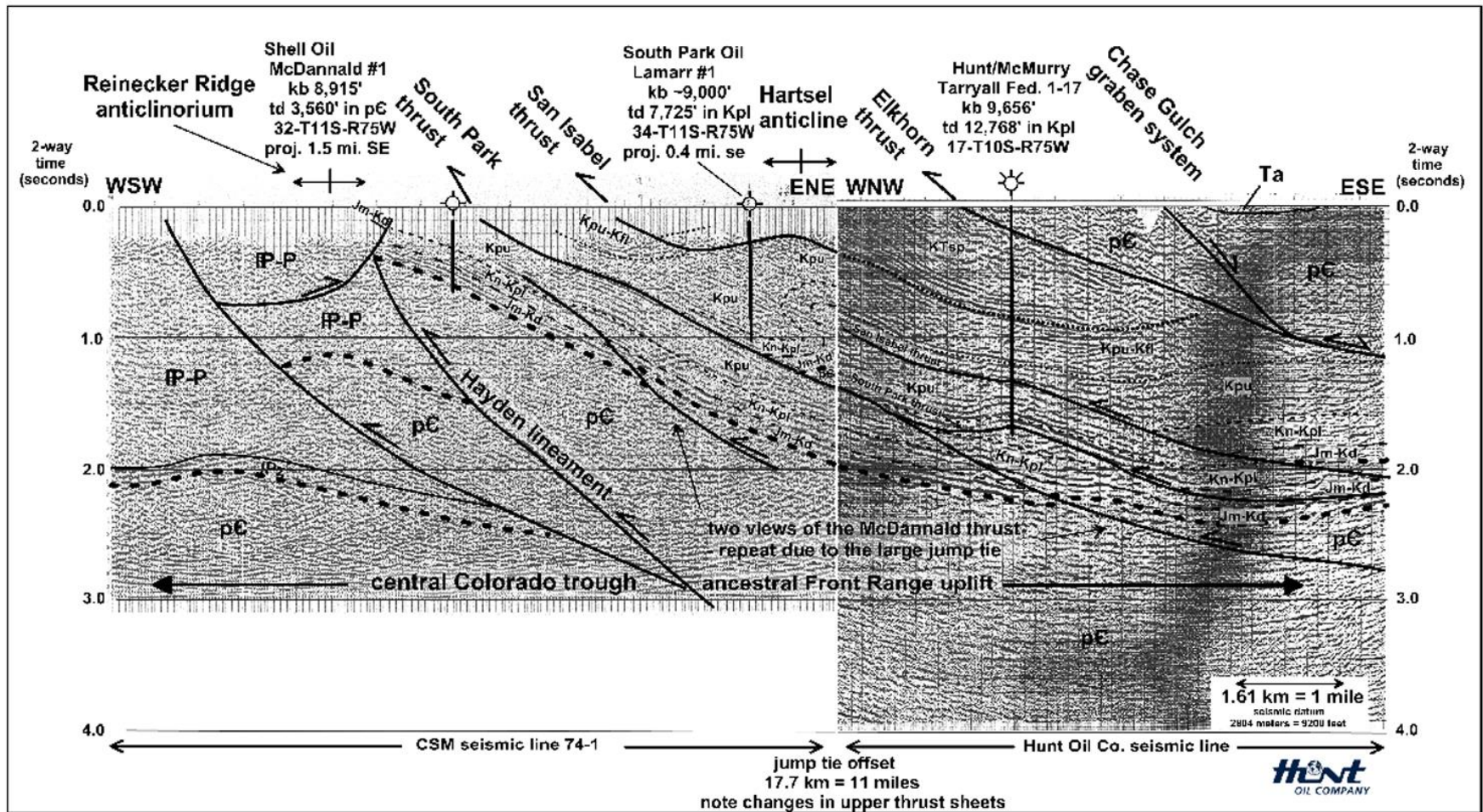
AGE	GEOLOGIC UNIT (THICKNESS IN FT)	LITHOLOGY			
JURASSIC	Morrison Formation 180–360		shale, sandstone, siltstone, basal limestone		
	Garo Sandstone (60-230)				
?	Maroon Formation (up to 3,300)		sandstone, siltstone, shale, conglomerate, and rare limestone		
PERMIAN					
?	Minturn Formation		sandstone, siltstone, shale, conglomerate, and limestone		
PENNSYLVANIAN				Upper interval (up to 5,000)	
				Evaporite facies (up to 1,000)	includes beds of gypsum and halite
				Coffman Conglomerate Member (up to 800)	sandstone, siltstone, shale, conglomerate, and limestone
				Lower Interval (200)	
Belden Formation (750-850) [Kerber/Sharpsdale Fms.]		shale with minor limestone and siltstone; sandstone and conglomerate			
MISSISSIPPIAN	Leadville Limestone (100-400)		limestone and dolomite with chert and beds of quartz sandstone		
DEVONIAN	Chaffee Group (80-200)		quartzite, dolomite, and limestone		
	Fremont Dolomite		dolomite		
ORDOVICIAN	Harding Sandstone 80–200		quartzite		
	Manitou Formation 65–230		dolomite and shale		
	Dotsero Formation and Sawatch Sandstone 10–250		quartzite and dolomitic sandstone		
CAMBRIAN	Precambrian igneous and metamorphic rocks		igneous plutons of varying composition and age with felsic gneiss and biotite gneiss		
PRECAMBRIAN					

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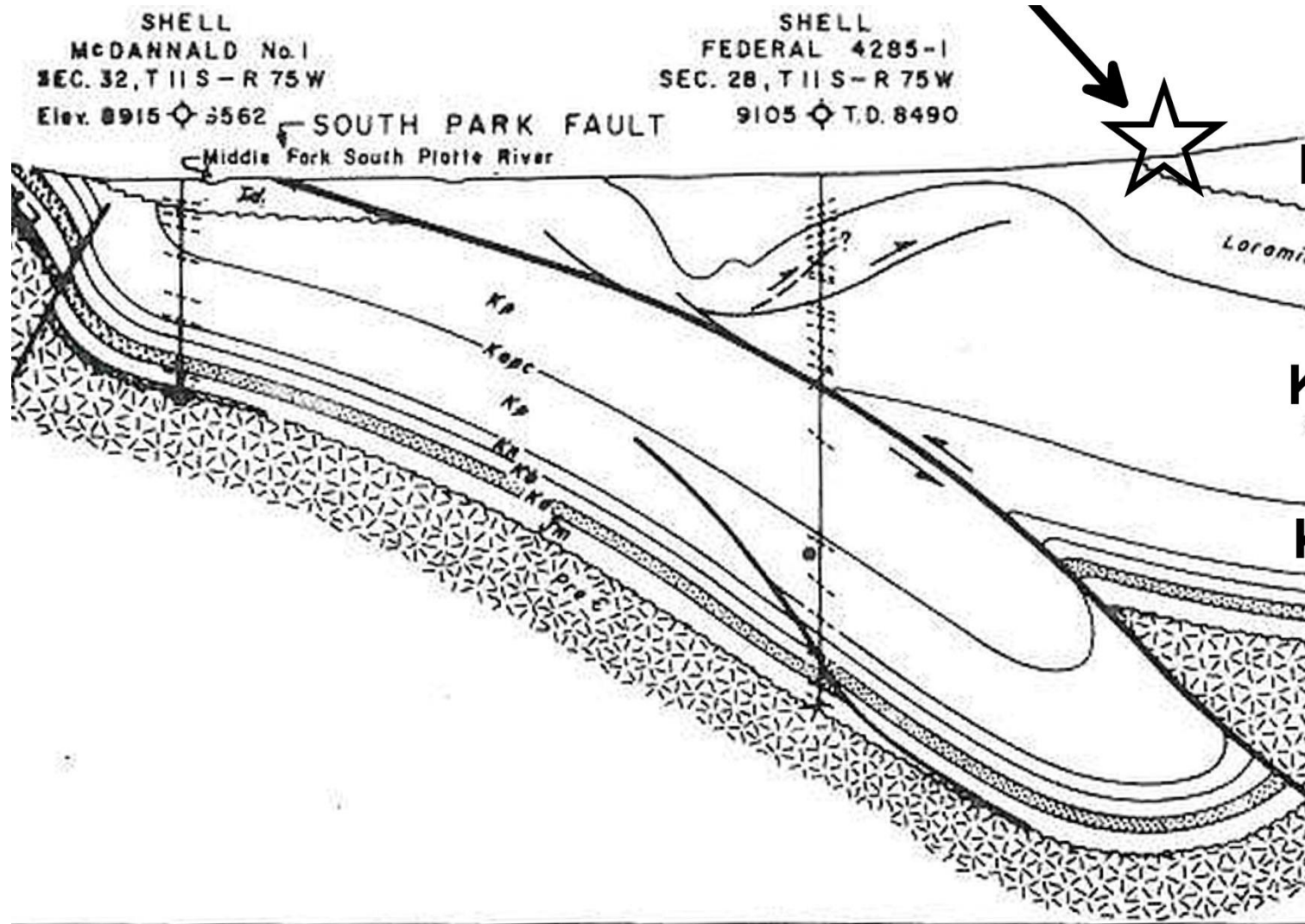


Stratigraphic Relationships of South Park Formation Units in the Hartsel Area

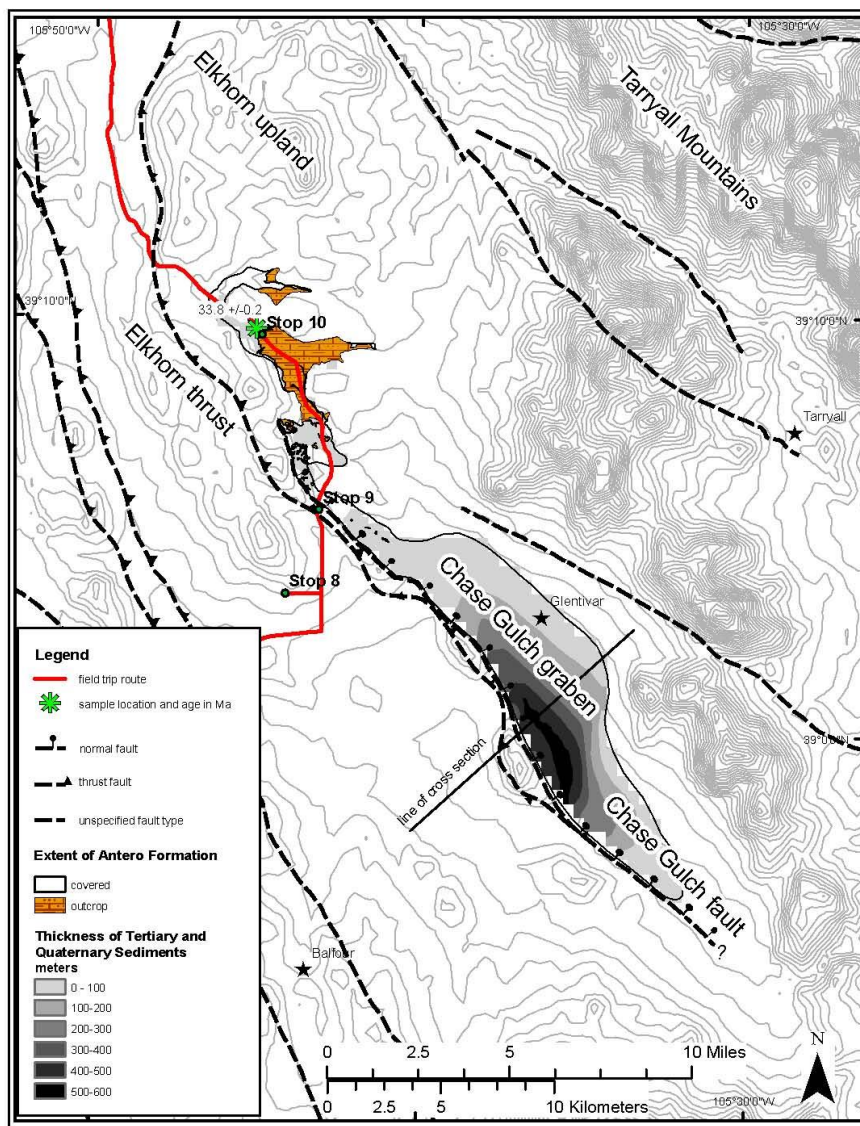




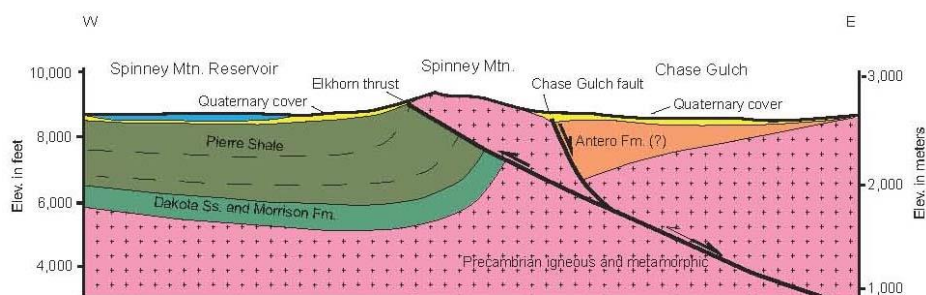
Jump-section from Ned Stern, out of Barkmann and others, 2016

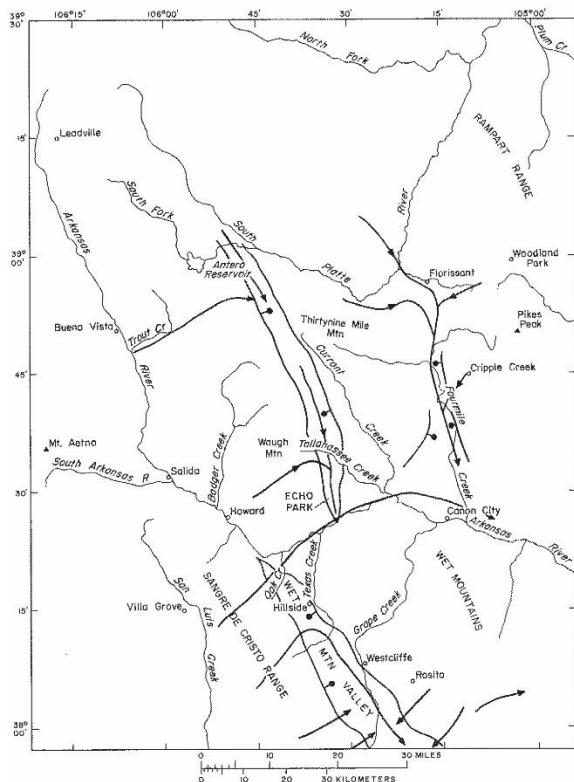


Clement and Dolton (1970)

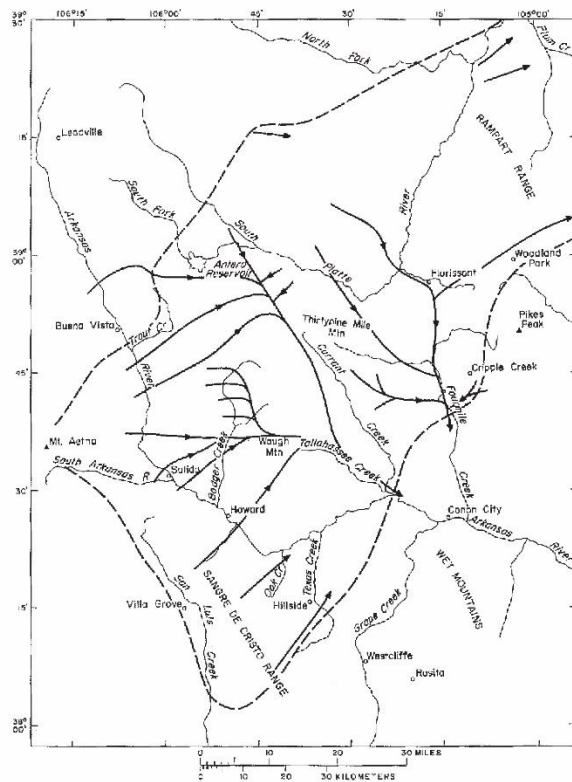


Barkmann et al. Figure S10-1 Chase Gulch graben

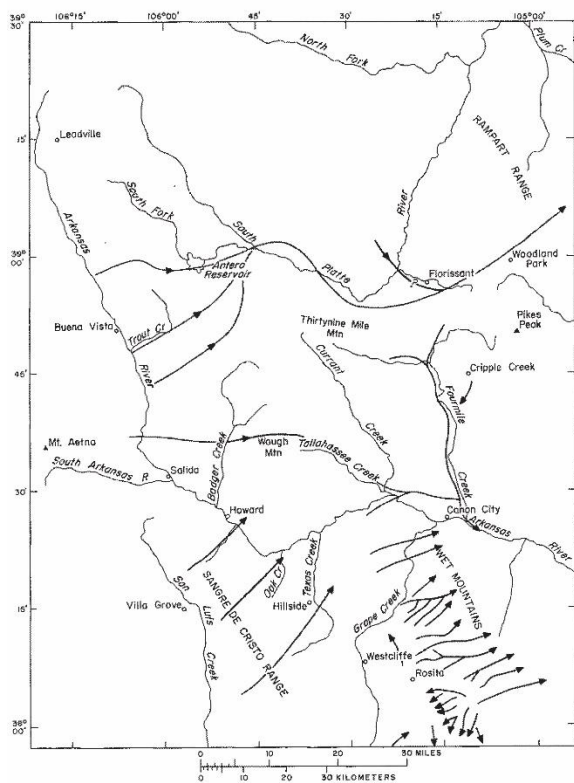




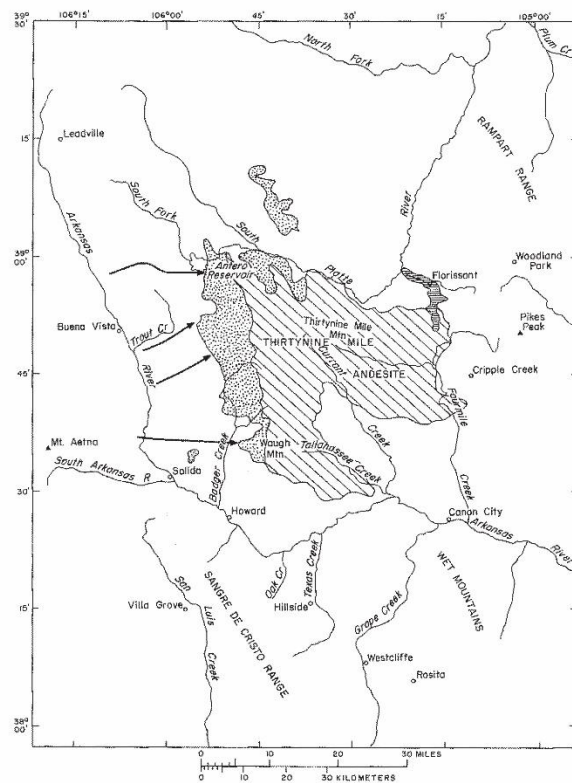
Eocene-Echo Park Alluvium



Eocene-Wall Mtn Tuff



Eocene/Oligocene-Tallahassee Ck Congl.



Oligocene-Antero Formation