



## ***Lexicon of stratigraphic names used in south-central Colorado and northern New Mexico, San Luis Basin***

Christina Lochman-Balk and James E. Bruning  
1971, pp. 101-111. <https://doi.org/10.56577/FFC-22.101>

*in:*  
*San Luis Basin (Colorado)*, James, H. L.; [ed.], New Mexico Geological Society 22<sup>nd</sup> Annual Fall Field Conference Guidebook, 340 p. <https://doi.org/10.56577/FFC-22>

---

*This is one of many related papers that were included in the 1971 NMGS Fall Field Conference Guidebook.*

---

### **Annual NMGS Fall Field Conference Guidebooks**

Every fall since 1950, the New Mexico Geological Society (NMGS) has held an annual [Fall Field Conference](#) that explores some region of New Mexico (or surrounding states). Always well attended, these conferences provide a guidebook to participants. Besides detailed road logs, the guidebooks contain many well written, edited, and peer-reviewed geoscience papers. These books have set the national standard for geologic guidebooks and are an essential geologic reference for anyone working in or around New Mexico.

### **Free Downloads**

NMGS has decided to make peer-reviewed papers from our Fall Field Conference guidebooks available for free download. This is in keeping with our mission of promoting interest, research, and cooperation regarding geology in New Mexico. However, guidebook sales represent a significant proportion of our operating budget. Therefore, only *research papers* are available for download. *Road logs*, *mini-papers*, and other selected content are available only in print for recent guidebooks.

### **Copyright Information**

Publications of the New Mexico Geological Society, printed and electronic, are protected by the copyright laws of the United States. No material from the NMGS website, or printed and electronic publications, may be reprinted or redistributed without NMGS permission. Contact us for permission to reprint portions of any of our publications.

One printed copy of any materials from the NMGS website or our print and electronic publications may be made for individual use without our permission. Teachers and students may make unlimited copies for educational use. Any other use of these materials requires explicit permission.

*This page is intentionally left blank to maintain order of facing pages.*

# LEXICON OF STRATIGRAPHIC NAMES USED IN SOUTH-CENTRAL COLORADO AND NORTHERN NEW MEXICO, SAN LUIS BASIN

by

CHRISTINA LOCHMAN-BALK AND JAMES E. BRUNING

New Mexico Institute of Mining and Technology  
Socorro, New Mexico

This lexicon is an alphabetical listing of the stratigraphic names used in the Guidebook of The New Mexico Geological Society—22nd Field Conference. Unit names (formation or group) system or period. Names printed in bold-face are currently accepted by the U.S. Geological Survey. Many of the names printed in caps and lower case are those that the Survey has had no occasion to consider for use.

- 1) Areal distribution given in original description.
- 2) Reference in which unit was first defined or mentioned.
- 3) Type locality.
- 4) Short lithologic description (and thickness) at the type locality or in the type area.
- 5) Age to stage; contacts; emending or refining descriptions of note; additional areal distribution; additional information on thickness, lithology, and character of the beds in the area of the 22nd Field Conference (1971).

The following glossary of abbreviations contains those used in the list of names that are not widely used and known. Most abbreviations used herein for lithologic description are well known to all geologist, and are not included in the glossary.

alt.	.....	alternating
ascend.	.....	ascending, in ascending order
btw.	.....	between
calc.	.....	calcareous
calcar.	.....	calcarenes
char.	.....	characterized
conf.	.....	conformable or conformably. Used also with prefixial "un" and "dis."
cont.	.....	continental
correl.	.....	correlative or correlated
depos.	.....	deposited
descend.	.....	descending, in descending order
desig.	.....	designated
equiv.	.....	equivalent
fang.	.....	fanglomerate
fluv.	.....	fluvialite
gradat.	.....	gradational
gr.	.....	grain(ed)
gran.	.....	granular
grav.	.....	gravel
interb.	.....	interbedded

L.	.....	lower
lent.	.....	lenticular
lithog.	.....	lithographic
mass.	.....	massive
min.	.....	minimum
occas.	.....	occasional
perst.	.....	persistent
por.	.....	porous
pred.	.....	predominantly
sdv.	.....	sandy
slit.	.....	slightly
transit.	.....	transitional
U.	.....	upper
undif.	.....	undifferentiated

## ALBOROTO RHYOLITE—U. Oligocene

- 1) SW Colorado.
- 2) E. S. Larsen, 1917, *Colo. G. Survey Bull.* 13, p. 20, 36; Larsen and Cross, 1956, *U.S.G.S. Prof. Pap.* 258, p. 132-143.
- 3) Alboroto Peak, San Cristobal Quadr., Hinsdale Co., Colo.
- 4) Low. part (1/5) of tridymite rhy. thin flows and assoc. tuffs (0-500') Up. part (4/5) of biotite hornblende latite and rhyolite (0-3,000').
- 5) Disconf. on Sheep Mtn. Qtz. Latite; overlain conf. by Huerto Qtz. Latite; covers over 100 mi. in San Juan Mtns., max. thick. in Creede Quad.; Low. pt. incl. (Campbell Mtn. rhy., Willow Creek rhy.), = Bachelor Mtn. Rhyolite, Outlet Tunnel qtz. latite; Up. pt. incl. Equity and Phoenix Park qtz. latites; = Fish Canyon Tuff-La Garita Qtz. Latite and Andesite of Saguache Cr. (27.8 m.y.).  
L. membs. = Blue Mesa Tuff, Dillon Mesa Tuff. Sapinero Mesa. Tuff. U. memb. = Fish Canyon Tuff (Olson, Hedlund and Hansen, 1968).

## Antero Formation—Oligocene

- 1) Cent. Colorado.
- 2) J. T. Stark et al., 1949, *Geol. Soc. Am. Mem.* 33, p. 63.
- 3) In Ts. 12-15 S., Rs. 75-76 W., south and west of Hartsel, Park Co., Colo.
- 4) Lake sed. —3 mems., ascend.—thin algal lss. at base, tuff, sss., cgl., minor shs., basal cgl. lentic., poor. sort. tuff interb. with shs., up to 100' thick; mid memb. fine gr. pumice, tuffs (50') at base, overlain

by lent. dense shs. and fossil. algal lss.; up memb. cgl. with ss. interb. (600'-2,000').

- 5) White River age; vert. fossils, fresh water gastro., ostracods, algae, wood: Disconf. on Blafour Fm., unconf. overlain by Wagontongue Fm., deposits of Lake Antero.

#### Abiquiu Tuff—Miocene

- 1) N. Cent. New Mexico.
- 2) H. T. U. Smith, 1938, Jour. Geol. v. 46, p. 944.
- 3) Along the Chama Valley west of Abiquiu, Rio Arriba Co., New Mexico.
- 4) Wh., lt. gry. to orange, fin. lamin. to mass. bed. tuff and volc. cgl., stream laid, few interb. lava flows; forms steep cliffs (1,000'-1,250').
- 5) Disconf. on El Rito Fm., unconf. on Precamb. granite; overlain conf. and gradat. by Santa Fe Fm.; E. of El Rito Cr. cgl. and sss. pred. interb. with tuff. layers in up. pt. = up. pt. of Los Pinos Fm. and low. pt. of Santa Fe Fm.; Consid. memb. of Santa Fe Fm. by Budding, Pitrat and Smith (1960).

#### ALAMOSA FORMATION—Pliocene-Pleistocene

- 1) S. Cent. Colorado.
- 2) C. E. Siebenthal, 1910, U.S.G.S. Wat. Sup. Pap. 240, p. 40.
- 3) Hansen Bluff, E. bank Rio Grande Riv., SE. of Alamosa, and logs of test wells, T. 39 N., T. 40 N., R. 11 E., (W. J. Powell, 1958), Alamosa Co., Colo.
- 4) Buff-red uncon. grav., sss., silt, clay; qtz. pebb.; br. to blu-gry. clay in up. pt; all lithol. rapid lat. and vert. changes (0-2,000').
- 5) Siebenthal put top below first perst. fine ss. or clay; Powell includes all Recent ss. and grav.; deepest: grav. at 72'; below blu. clay alter. with fine ss.; great. thick near depo. center of San Luis Valley; fresh water snails and vert. frags. age Late Plio. and/or Early Pleisto.

#### BACHELOR MOUNTAIN RHYOLITE—U.

##### Oligocene

- 1) SW Colorado.
- 2) T. A. Steven and J. C. Ratté, 1965, U.S.G.S. Prof. Pap. 475-D, p. D57.
- 3) Bachelor Mtn. NW of Creede, Mineral Co., Colo.
- 4) Lt. gry. dens. weld. rhy. tuff at base grad. up to compact weld. tuff in mid., to por. nonweld. tuff at top (4,000'+).
- 5) Btw. 26.7 and 27.8 m.y.; intracaldera equiv. of Carpenter Ridge Tuff; 3 membs. ascend.—Willow Cr. Memb., Campbell Mtn. Memb., Windy Gulch Memb.

#### Badger Creek Tuff (see Informal Names List)

#### Beidell Quartz Latite (see Conejos Formation)

#### BELDEN SHALE or FORMATION—Pennsylvanian

- 1) NW Colorado.
- 2) K. G. Brill Jr., 1942, AAPG Bull. 26, p. 1384-1387

- 3) N. side of Rock Cr. along U.S. Hwy. 24 (1938) 0.2 m. N. of Gilman, Eagle Co., Colo.
- 4) Interb. drk. gry. argill. lss. and lam. carbonac. shs., thin sss., and a few imp. coals (25'-200') increase to S. to 1,100' in Chaffee and Gunnison Cos., (Dings and Robison 1957).
- 5) Desmoinesian; raised to Fm. by Brill (1944), replaces Weber Sh. for basal Penn. in Colo.; unconf. on Leadville Ls., overlain conf. and gradat. by Minturn Fm.; Dings and Robinson recogn. 3 membs., ascend.-drk. sh.; interb. lss. and shs.; shs. with qtzite.

#### Big Baldy Andesite (see Informal Names List)

#### Biscara Member (of Los Pinos Formation)—Miocene? or Pliocene?

Biscara—Esquibel member; Biscara intrusive andesite

- 1) N. Cent. N. Mex.
- 2) Fred Barker, 1958, N. Mex. Bur. Min. and Miner. Res. Bull. 45, p. 44.
- 3) In Biscara Canyon 1.5 mi. from mouth, Las Tablas Quad., Rio Arriba Co., N. Mex.
- 4) Interb. tuffac. sss., tuff, cgl. and volc. flow brecc.; low. unit of gry. rhy. tuff, water-laid tuffac. cgl.; up. unit of poor. sort. cgl. of qtzite, pegmat. in ark. matrix (650'-700').
- 5) Unconf. on Precamb. rocks; overlain disconf. by Jarita Memb. and Cordito Memb. overlap from S. to N.; grades N. into Biscara-Esquibel Memb.

#### Biscara-Esquibel Memb.—(of Los Pinos Formation)—Miocene? or Pliocene?

Undif. sss., tuff, cgl., and volc. flow brecc. of low. Los Pinos Fm. below Jarita Bas.; mapp. as single unit by Fred Barker, 1958.

#### BLANCO BASIN FORMATION—Oligocene?

- 1) SW Colorado.
- 2) E. S. Larsen, 1935, U.S.G.S. Bull. 843, p. 48.
- 3) E. side of Chama Riv., near S. edge of Summitville Quad., Archuleta Co., Colo.
- 4) Ark. sss., cgl., shs., no volc. mater.; 3 membs., ascend., brit. red, soft, mdy., sss. and shs.; brok. cliff of interb. wh. sss. and red shs.; cliff of wh. sss. (500'-600').
- 5) Unconf. on Cret. fms. and Animas Fm., overlain conform. by Conejos Fm.; F. B. Houton (1957)—Blanco Basin and equiv. Telluride Fm. are ark. fang. (bord. facies) of U. Paleocene—L. Eocene San Jose Fm. = Wasatch Fm.

#### BLUE MESA TUFF—U. Oligocene

- 1) SW Colorado.
- 2) J. C. Olson, D. C. Hedlund, and W. R. Hansen, 1968, U.S.G.S. Bull. 1251-C p. 15.
- 3) Rim of Blue Mesa, S. side of Black Canyon above Blue Mesa Dam, Gunnison Co. Colo.
- 4) Red br. to wh.-purp. wh. dens. weld. devitr. qtz. latite tuff, up. 40' strati. grades into few ft. of thin por. non-weld tuff (0-240'+).
- 5) Disc f. on old erod. surface, overlain conf. by ash-

fall? and water-laid tuffs.; onsid. equiv. of Treasure Mtn. Rhyolite and Andesite of Ford Creek, (Bruns, Epis, Weimer, and Steven, this guidebook).

#### **BONANZA LATITE, TUFF—U. Oligocene**

- 1) S. Colorado.
- 2) H. B. Patton, 1916, Col. G. Sur. Bull. 9, p. 29; W. S. Burbank, 1932, U.S.G.S. Prof. Pap. 169, p. 21.
- 3) Along Kerber Cr. S. of Bonanza, Saguache Co., Colo.
- 4) Two membs., ascend.: drk. red. br. to bl.-gry. mass. qtz. latite weld. tuff and brecc.; gry.: wh., pink-gry. soft poor weld. qtz. latite tuffs, few breccs. (300' to 1,000').
- 5) Bonanza Latite of Patton applied only to Low Memb.; unconf. on the Rawley Andesite, unconf. overlain by Squirrel Gulch Latite; replac. to S. by Hayden Peak Latite; Bonanza Latite is an ash-flow tuff, overlies Rawley Andesite, (Bruns, Epis, Weimer and Steven, this guidebook).

#### **BREWER CREEK LATITE—U. Oligocene**

- 1) S. Colorado.
- 2) W. S. Burbank, 1932, U.S.G.S. Prof. Pap. 169, p. 29
- 3) Along Brewer Cr. 2-3 mi. W. of Bonanza, Saguache Co., Colo.
- 4) Purp.-gry. to br.-gry. or brick red porphy. qtz.-mica latite mass. flows, up. pt. por. with tridymite (500')
- 5) Conf. on Squirrel Gulch latite in S., and overlies unconf. Porphy. Peak Rhyolite to N.; overlain disconf. by upper andesite flows maybe equiv. to water laid and air-fall tuffs of Saguache Cr., (Bruns, Epis, Weimer and Steven, this guidebook).

#### **CARLILE SHALE (in Colorado Group)—U. Cretaceous**

- 1) E. Colorado, NW Iowa, W. Kansas, SE Montana, W. Nebraska, South Dakota, E. Wyoming, NE New Mexico.
- 2) G. K. Gilbert, 1896, U.S.G.S. 17th Ann. Rept. pt. 2, p. 565.
- 3) Carlile Spring and Carlile Station 21 miles W. of Pueblo, Pueblo Co., Colo.
- 4) Drk.-gry. to blk. argill. shs. with thin lss. beds, fossil. lss. nodds, and large septarian concret.; calc. sss. and sdy. shs. (180'-700').
- 5) M.-U. Turonian: Conf. on Greenhorn Ls., overlain conf. or disconf. by Fort Hays Ls. (of Niobrara Fm. in N. Cent. and NE New Mex.); Kauffman (1967) recogn. 4 units ascend.—Fairport Chalky Sh. Memb. (br.- buff, speck., cal. shs. and thin, slab. calcars., abund. ls. conc., 6 bent. beds, very fossil., 220'); Blue Hill Sh. Memb. (low. unit of interb. drk.-blu.-gry. to br. noncal. clay sh. sltly slty., large septarian and ls. concret.: up. unit of drk. gry. to br. slty. and sdy. interb. at top with br. sss., sdy. shs. and sltst., 220', septarian concret.); gradat. into Codell Ss. Memb. (mass. to slby., tan-buff, fine to med. gr., sss. carbonac. sss. and sdy. shs., rapid facies changes—in N. Mex.

from a drk. slty. sh. to lent. thin sss., sltst. to mass. ss., 0-50'); Juana Lopez Memb. (br. to br.-gry. slby. to mass. calcars. local. upto 60% mature qtz. grs., *Inoceramus* prisms, oyster and fish debris, 1'-4' in E., expands to 200' in San Juan Bas. and pred. cal. clay sh. interb. with calcars., very fossil): Unnamed Sh. Memb. (drk. gry. to drk. br. lam. clay sh., calcars. bents. and lss. concret. in up. pt.) pre-Niobrara erosion may cut out top two membs and part of Codell Ss.

#### **CAMPBELL MTN. RYH. (see Bachelor Mtn. Rhy.)**

#### **Carpenter Ridge Tuff—U. Oligocene**

- 1) SW Colorado.
- 2) J. C. Olson, D. C. Hedlund and W. R. Hansen, 1968, U.S.G.S. Bull. 1251-C, p. 23.
- 3) S. end of Carpenter Ridge, cent. Cebolla Quad., Gunnison Co., Colo.
- 4) Two ash-flows of br. red.-lt. gry., devitri. qtz. latite weld tuff, wh. to lt. buff nonweld. pumic. tuff at base, tuffac. brecc. at top (0-300').
- 5) Btw. 26.7 and 27.8 m.y.: Disconf. on Fish Canyon Tuff and older rocks; erupt. from Bachelor caldera and equiv. of Bachelor Mtn. Rhyolite.

#### **CHAFFEE FORMATION—U. Devonian**

- 1) Cent. Colorado.
- 2) E. Kirk, 1931, Amer. Jour. Sci. 5th, v. 22, p. 229.
- 3) On S. side of Arkansas Riv. 5 mi. SE. of Salida, Chaffee Co., Colo.
- 4) Two membs. ascend. Parting Qtzite Memb., lt. gry. to wh. buff, coarse-med. gr., sss., qtzite, cgl., xbed., Dyer Memb. gry.-buff, thin to med. bed. fossil. lss., dolo. (70'-250').
- 5) Famennian: Paraconf. on Manitou Dol., Harding Ss. or Fremont Dol.; overlain disconf. by Leadville Dol., equiv. of Elbert of SW Colorado.

#### **Cisneros Basalt (in Hinsdale Series)—Pliocene**

- 1) N. Cent. New Mexico.
- 2) Fred Barker, 1958, New Mex. Bur. Min. and Miner. Res. Bull. 45, p. 51.
- 3) Cisneros Park in NW¼ T. 29 N., R. 8 E., Rio Arriba Co., New Mex.
- 4) Drk. gry. slit. vesicul., porphy. olivine basalt (10'-30').
- 5) Unconf. on Cordito Memb. of Los Pinos Fm., up. surface erod.

#### **CONEJOS FORMATION (in Potosi Volcanic Group)—M. Oligocene**

Conejos Andesite, Conejos Quartz Latite

- 1) SW Colorado and N. New Mexico.
- 2) E. S. Larsen, 1917, Colo. G. Sur. Bull. 13, p. 38; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 96-102.
- 3) Along Conejos Riv. for 3 mi. downstream from Platoro, Conejos Co., Colo.
- 4) Interb. lavas and breccs. of andesit.-qtz. latite, drk.

rhyodacite, fine-gr. bed. drk. gr. tuffs and tuffac. sss., (1,000'-4,000').

- 5) Btw. 31.1 and 34.7 m.y.: center in Summitville, Conejo and Del Norte Quads. 130 mi. N-S, 50 mil. wide; extends 40 mi. into N. Mex. is thin and pred. ss. and grav. of volc. frags.: Disconf. on Blanco Basin Fm. overlain unconf. by Treasure Mtn. Rhyolite and Fisher Qtz. Latite; age equiv. of Lake Fork Fm., West Elk Breccia and San Juan Fm., Beidel and Tracey Qtz. Latites, and Rawley Andesite (Lipman, Steven and Mehnert, 1970).

#### **Cordito Member (of Los Pinos Formation)—Pliocene**

- 1) N. Cent. New Mexico.
- 2) Fred Barker, 1958, New Mex. Bur. Min. and Miner. Res. Bull. 45, p. 48.
- 3) In Canyon de Cordito, 4 mi. S. of Tres Piedras, Taos Co., New Mex.
- 4) Lt. gry-gry. gr.-buff interb. rhy. cgl., tuffs, tuffac. sss. and slst. a few ash-flows (250'-1,000').
- 5) Disconf. on Jarita, Esquibel and Biscara Membs. and Precam. rocks: Unconf. overlain by Cisneros and Dorado Basalts; along S. bord. of Las Tablas Quad. is equiv. to Abiquiu Tuff of H. T. U. Smith (Budding, Pitrat, Smith, 1960).

#### **CREEDE FORMATION—U. Oligocene**

- 1) SW Colorado.
- 2) W. H. Emmons and E. S. Larsen, 1923, U.S.G.S. Bull. 718, p. 61; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 167-172.
- 3) Valley of Willow Creek at Creede, Mineral Co., Colo.
- 4) Volc. clastics, water-laid; two membs. ascend-wh. lam. shy. tuff, lent. sss., breccs., cgl., interb. with travertine (lake beds with plants and insects); mod. sort. coarse rhy. cgl. interb. with thin lava flows, shy. beds and lens. (0-2,000').
- 5) Older than 26.8 m.y., cut and overlain by Fisher Qtz. Latite.: Disconf. on Potosi Gp. rocks.

#### **Crestone Conglomerate Member (of Sangre de Cristo Formation)—Permian**

- 1) S. Cent. Colorado.
- 2) F. A. Melton, 1925, Jour. Geol. v. 33, p. 812.
- 3) Crestone Peak, near Crestone, Saguache Co., Colo.
- 4) Drk. red, mass. bedd. bould. and cobble cgl. with some thin interb. ark. sss. (500'-5,500').
- 5) Wolfcampian: Disconf. on Low. Memb. of Sangre de Cristo Fm., overlain conf. in subsurf. by Yeso Fm. (Shaw, 1956), in surface unconf. by Entrada Ss.

#### **DAKOTA SANDSTONE, FORMATION or GROUP—L. and U. Cretaceous**

- 1) E. Colorado, Nebraska, Kansas, Minnesota, SE. Montana, E. Wyoming, N. Dakota, W. Oklahoma, NE New Mexico.
- 2) F. B. Meek and F. V. Hayden, 1862, Phila. Acad. Nat. Sci. Proc. v. 13, 419.

- 3) In Missouri Riv. bluffs, NE¼ Sec. 13, T. 27 N., R. 4 E., 1 miles SE of Homer, Dakota Co., Nebraska.
- 4) Buff, red, wh., fine-coarse gr. sss. or qtzite, locally 2 or 3 mass. bed. sss. separ. by thin gry., blk. or varig. clay shs., plant fossil, thin lignit. cliff-form. (100'-400').
- 5) Albian Cenomanian: Disconf. on Morrison Fm. or conf. Purgatoire Fm., overlain conf. by Mowry and Graneros Shs., in Mora Co., N. Mex. 180' thick.

#### **DILLON MESA TUFF—U. Oligocene**

- 1) SW Colorado.
- 2) J. C. Olson, D. C. Hedlund, and W. R. Hansen, 1968, U.S.G.S. Bull. 1251-C p. 17.
- 3) On Dillon Mesa, N. side of Gunnison Riv.; 4 miles above Blue Mesa Dam, Gunnison Co. Colo.
- 4) Lt. br., slit. porphy. weld qtz. latite tuff, up to 55' basal cgl.; up. unit nonweld tuff and tuffac. brecc. (0-180').
- 5) 28.2 m.y.: disconf. on Blue Mesa Tuff, overlain disconf. by Sapinero Mesa Tuff; equiv. to tuff of Masonic Park. (Brunns, Epis, Weimer, and Steven, this guidebook).

#### **Dorado Basalt (in Hinsdale Series)—Pliocene**

- 1) N. Cent. New Mexico.
- 2) Fred Barker, 1958, New Mex. Bur. Min. and Miner. Res. Bull. 45, p. 53.
- 3) In Dorado Canyon, NE of Petaca, Rio Arriba Co., New Mex.
- 4) Drk. fine-gr. olivine basalt, basalt and qtz. basalt (40'-100').
- 5) Unconf. on Cordito Memb. of Los Pinos Fm., up. surface eroded.

#### **Dry Union Formation—U. Miocene-Pliocene**

- 1) Cent. Colorado.
- 2) Ogden Tweto, 1961, U.S.G.S. Prof. Pap. 424-B p. B133.
- 3) Dry Union Gulch, Sec. 23, T. 10 S., R. 80 W., 5 miles S. of Leadville, Lake Co., Colo.
- 4) Mass. br. sdy. sltst. interb. sss. and grav. minor volc. ash; poor. sort. (800'-2,000').
- 5) Unconf. on Mesozoic and Paleogene rocks; lake beds in earlier rept. (Emmons, Irving and Loughlin, 1927); underlies Arkansas Valley from Leadville to Salida; age deter. by vert. fossils (Van Alstine and Lewis, 1960; Van Alstine, 1970); Tenderfoot Hill volcanic sequence (Lowell, 1969) or Tenderfoot Hill facies (Lowell, 1971, this guidebook)—basic lava flows interb. with uncons. grav. (0-450').

#### **DYER DOLOMITE MEMBER (of Chaffee Formation)—U. Devonian**

- 1) Cent. Colorado.
- 2) C. H. Behre, Jr., 1932, Colo. Sci. Soc. Proc. v. 13, p. 60.
- 3) On West Dyer and Dyer Mtns. 5 miles E. of Leadville, Lake Co., Colo.

- 4) Lt. gry., drk. gry.-buff, thin-med. bed., sugary dolo. lss. and dolos. (60'-85').
- 5) Famennian: Conf. on Parting Ss. Memb., overlain disconf. by Gilman Ss. Memb. of Leadville Dol.

**Eagle Nest Formation—Pliocene?**

- 1) N. Cent. New Mexico.
- 2) L. L. Ray and J. F. Smith, Jr., 1941, Geol. Soc. Am. Bull. 52, p. 190.
- 3) Along U.S. Hgwy. 24, N. of Eagle Nest Lake, Colfax Co., New Mex.
- 4) Unconsol. red clay, wh. tuff interb. with coarse wh. to buff ss. and grav. (1,000'+).
- 5) Top and base of fm. not seen; is fang. fill of Moreno Valley after faulting.

**ENTRADA SANDSTONE (in San Rafael Group)—U. Jurassic**

- 1) S. and E. Utah, NE Arizona, W. Cent., SE Colorado, NW New Mexico.
- 2) J. Gilluly and J. B. Reeside, Jr., 1926, U.S.G.S. Press Bull. 6064: 1928, U.S.G.S. Prof. Pap. 150-D, p. 76.
- 3) Entrada Point, north San Rafael Swell, Emery Co., Utah.
- 4) Drk. br., red br., buff to gry., thin to mass. bedd. sss., earthy to clean, well sort., xbed., interb. with a few thin bed. gry.-grn. lam. sdy. chs., cliffs, (200'-850').
- 5) Conf. on Carmel or disconf. Navajo Ss., overlain disconf. by Curtis Fm. or Summerville Fm.; in N. New Mex. overlies paraconf. Chinle Fm.

**Esquibel Member (of Los Pinos Formation)—Miocene? or Pliocene?**

- 1) N. Cent. New Mexico.
- 2) Fred Barker, 1958, New Mex. Bur. Min. and Miner. Res. Bull. 45, p. 45.
- 3) Esquibel Canyon, Las Tablas Quad., Rio Arriba Co., New Mex.
- 4) Gry. interb. fels. tuff., tuffac. sss. and cgl., buff ark. sss. and cgl., sltsts. (600').
- 5) Conf. and gradat. on Biscara Memb., overlain unconf. by Jarita Basalt Memb. or Cordito Memb.

**FARMERS CREEK RHYOLITE (See Huerto Fm.)****FISH CANYON TUFF—U. Oligocene**

- 1) SW Colorado.
- 2) J. C. Olson, D. C. Hedlund and W. R. Hansen, 1968, U.S.G.S. Bull. 1251-C, p. 20.
- 3) In Fish Canyon near south border of Rudolph Hill Quad., Gunnison Co., Colo.
- 4) Lt.-gry., buff to wh., med.-gr., cryst. rich qtz. latite weld. tuff, grad. upward and lateral. into nonweld. tuff, grad. upward and lateral. into nonweld. tuff, large angul. frags. of Precamb. and Mesozoic rocks near base (0-1,280').
- 5) 27.8 m.y.; large air-fall and ash-flow sheet from S. source; traced S. into Rio Grande drainage basin; correl. with Alboroto Rhyolite erupt. from La Garita

caldera, equiv. of La Garita Quartz Latite. (Bruns, Epis, Weimer and Steven, this guidebook).

**FISHER QUARTZ LATITE—U. Oligocene**

Fisher Latite-Andesite

- 1) SW Colorado.
- 2) E. S. Larsen, 1917, Colo. Geol. Sur. Bull. 13, p. 23; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 172-185.
- 3) Fisher Mountain, 12 mi. S. of Creede, Mineral Co., Colo.
- 4) Wh. tuff and tuff brecc. thin lava flows at base, overlain by thick flow of coars. porphy. qtz. latite, gry.-purp. pumice. flow brecc. and pink porphy. vesicu. latite flow (0-2,000'+) (Steven and Ratté, 1965).
- 5) 26.4 m.y.: Disconf. on Snowshoe Mountain ash-flow, local. Overlain disconf. by Hinsdale Fm.; age equiv. of Creede Fm.

**FREMONT LIMESTONE, DOLOMITE—**

U. Ordovician

Fremont Formation

- 1) E. and Cent. Colorado.
- 2) C. D. Walcott, 1892, Geol. Soc. Am. Bull. 3, p. 156
- 3) Harding Quarry, 1 mi. NW of Canyon City, Fremont Co., Colo.
- 4) Two membs. ascend., blu.-gry. to gry. mass. pure dolo. with zone of blk. chert and coral bed near base; thin-bed, shy. to sdy. dolo. (Priest Canyon Memb.) (200'-400').
- 5) Eden-Richmond: Disconf. on Harding Ss., overlain paraconf. by Parting Qtzite.

**GILA CONGLOMERATE—Miocene—Pleistocene**

- 1) SE Arizona, SW New Mexico.
- 2) G. K. Gilbert, 1875, U.S. Geog. & Geol. Sur. 100th Mer., v. 3, p. 540.
- 3) Gorges of upper Gila Riv., Greenlee Co. Ariz., Hidalgo and Grant Cos. New Mex.
- 4) Buff to br. fangs. of interb. cgl., sss. sltst. and clay (200'-500').
- 5) Base 21 m.y.: Disconf. on Oligo. volc.; 3 membs. recogn. in Safford Valley, Ariz. (P. A. Wood, 1959).

**GRANEROS SHALE (in Colorado Group)—**

U. Cretaceous

- 1) NW Iowa, W. Kansas, E. Colorado, SE Montana, Nebraska, South Dakota, E. Wyoming, NE New Mexico.
- 2) G. K. Gilbert, 1896, U.S.G.S. 17th Ann. Rept., pt. 2, p. 564.
- 3) Graneros Creek, Walsenburg Quad., Pueblo Co., Colo.
- 4) Blk., drk. gry. oliv., gry.-br. noncal. to silt. cal., lam. clay shs., many perst. bent. beds, argill. ls. concret., cone-in-cone ls. and thin calcar. in mid. and up. pt., local. thin br. sss. near top (30'-250').
- 5) Cenomanian: Conf. and gradat. on Dakota Ss., overlain conf. by Greenhorn Ls.; perst. mass. argill. fossil.

ls. (Thatcher Ls.) in low. mid. of fm. in SE. Colo. and San Juan Bas., New Mex. and a mass to shy. gry. to tan ss. (20'-50') lens (cf. Tres Hermanos Ss.) in up. pt. in N. New Mex.

### HARDING SANDSTONE, QUARTZITE—

#### Mid. Ordovician

- 1) Cent. Colorado.
- 2) C. D. Walcott, 1892, Geol. Soc. Am. Bull. 3, p. 155.
- 3) Harding Quarry, 1 mi. NW of Canyon City, Fremont Co., Colo.
- 4) Tan, pink, wh. gry., br., blu.-blk., fine-med. gr. sss. or qtzites, fish debris common (120'-200').
- 5) Paraconf. on Manitou Dolo. or unconf. on Precamb.; overlain disconf. by Fremont Dol.

### HAYDEN PEAK LATITE—M. Oligocene

- 1) S. Colorado.
- 2) H. B. Patton, 1916, Colo. Geol. Sur. Bull. 9, p. 21
- 3) On Haydens Peak, 2.5 mi. SE of Bonanza, Saguache Co., Colo.
- 4) Br.-gry., fine-gr. porphy. qtz. latite flows, tuffs and breccs. (1,000'-2,000').
- 5) 33.2 m.y.: Overlies Rawley Andesite, overlain unconf. by Bonanza Tuff; age equiv. of flows in Conejos Fm.

### HINSDALE FORMATION—M. Miocene—

#### M. Pliocene

##### Hinsdale Basalt

- 1) SW Colorado, NW New Mexico.
- 2) W. Cross, 1911, U.S.G.S. Bull. 478, p. 22; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 192-207.
- 3) Divide btw. Lake Fork and Cebolla Creeks, E. of Lake City, Hinsdale Co., Colo.
- 4) Two membs., ascend.:—wh. high sili., alk. rhy. weld. tuffs, breccs., intrusives, volc. cones and thin basalt flows (0-2,000'); flows and volc. cones of alk. olivine basalt (0-1,500').
- 5) Low. memb. 23-21 m.y., up. memb. 17-4 m.y.; Unconf. on Fisher Qtz. Latite and Los Pinos Grav.

### HUERTO QUARTZ LATITE, FORMATION (in Potosi Volcanic Group)—U. Oligocene

- 1) SW Colorado.
- 2) E. S. Larsen, 1917, Colo. Geol. Sur. Bull. 13, p. 20; Larsen and Cross, U.S.G.S. Prof. Pap. 258, p. 143.
- 3) Huerto Peak, 10 mi. SE of Rio Grande Resv., San Cristobal Quad., Hinsdale Co., Colo.
- 4) Drk., fine-gr., pyrox. qtz. latite, dacite, lt. gry. hornbl. qtz. latite, flows, tuffs and breccs. interb. (0-2,500')
- 5) 26.7 m.y.: breccs. and lavas of Huerto underlie Mammoth Mt. Rhyolite (which is later than Farmers Creek Rhyolite), and underlie and overlie Wason Park Rhyolite (Steven and Ratté, 1964)—all units pt. of Lower Memb. of Piedra Rhyolite.

### JACQUE MOUNTAIN LIMESTONE MEMBER (of Minturn Formation)—Pennsylvanian

- 1) W. Cent. Colorado.

- 2) S. F. Emmons, 1898, U.S.G.S. Atlas Folio 48, p. 2 "Tenmile District."
- 3) On lower slopes of Jacque Mtn. near Kokomo, Summit Co., Colo.
- 4) Lt. gry. to drk. blu. fine-gr. lss., some beds ooli. or brecc., cephal. and gastro., (15'-30').
- 5) Virgilian: Top unit of Minturn Fm., good horizon marker, conf. on top brit. red and shy. ss. approx. 900' above White Quail Ls. Memb., overlain conf. by brit. red ark. cgl. of basal Maroon Fm.

### Jarita Basalt Member (of Los Pinos Formation)—U. Oligocene to M. Miocene

- 1) N. Cent. New Mexico.
- 2) Fred Barker, 1958, New Mex. Bur. Min. and Miner. Res. Bull. 45, p. 46.
- 3) West rim of La Jarita Mesa, NE of Vallecitos, Rio Arriba Co., New Mex.
- 4) Drk. gry., br. fine-med. gr. flows of olivine basalt (0-50').
- 5) Conf. on Esquibel Memb., overlain disconf. by Cordero Memb.; vesicles aligned in S.40°W, Barker believes source to NE.

### KERBER FORMATION—Pennsylvanian

- 1) S. Colorado.
- 2) W. S. Burbank, 1932, U.S.G.S. Prof. Pap. 169, p. 13.
- 3) Along Kerber Creek, 6 mi. SE. of Bonanza, Saguache Co., Colo.
- 4) Interb. wh., gry., buff coarse-med. gr. qtz. sss., xbedd., and blk. carbonac. shs. and imp. coal (200'-300').
- 5) Morrowan: Paraconf. on Leadville Ls., overlain disconf. by Minturn Fm.

### LA GARITA QUARTZ—U. Oligocene

- 1) SW Colorado.
- 2) T. A. Steven and J. C. Ratté, 1964, U.S.G.S. Prof. Pap. 475-D, p. D57; Prof. Pap. 487, p. 15-18.
- 3) La Garita Mts., 7 mi. NE of Creede, Mineral Co., Colo.
- 4) Drk. br., drk. gray. cryst. rich, dens. weld. ash-flow tuffs and breccs. (0-2,500+').
- 5) 27.8 m.y.: Two membs, ascend.—Outlet Tunnel Memb. (pre-La Garita Cauldron Subsidence); Phoenix Park Memb. equiv. of low. membs. of Bachelor Mtn. Rhyolite: Formerly in Alboroto Rhyolite.

### LA JARA CANYON MEMBER (of Treasure Mountain Rhyolite, Tuff)—U. Oligocene

- 1) Cent. Colorado.
- 2) P. W. Lipman and T. A. Steven, 1970, U.S.G.S. Prof. Pap. 700-C, p. C21.
- 3) La Jara Canyon, 17.5 mi. SE of Platoro, Conejos Co., Colo.
- 4) Dens. cryst. rich weld. qtz. latite ash-flows and tuffs (300'-2,500').
- 5) 29.8 m.y.: Conf. on lower air-fall and ash-flow tuff, overlain by middle tuff; max. thick within Platoro caldera.



**LAKE FORK QUARTZ LATITE FORMATION—****M. Oligocene**

- 1) W. Cent. Colorado.
- 2) W. Cross and E. S. Larsen, 1923, U.S.G.S. Prof. Pap. 131, tab. opp. p. 184; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 64-68.
- 3) Valley of Lake Fork of Gunnison Riv. 5-15 mi. N. of Lake City, Hinsdale Co., Colo.
- 4) Lt. gry. rhyodacite, drk. br.-blk. dens. andesite, interb. flows, breccs. and tuffs, air-fall tuffs, cgl. (0-4,000').
- 5) 31.1-34.7 m.y.: Unconf. on M. Cret. fms., overlain disconf. by Blue Mesa and younger ash-flow tuffs; 3 units, ascend., 600' grav., volc. cgl., tuff, andesite flows and breccs; 900'-3,000'+ volc. breccs., cgl. depos. as lahars., interb. tuff and thin rhyodacite flows, 900' hornbl. rhyodacite flows and autobreccs., age equiv. of Conejos Fm., San Juan Fm. (Olson, et al., 1968).

**LA SAUSES MEMBER (of Conejos Formation)—****M. Oligocene**

- 1) S. Cent. Colorado.
- 2) R. L. Burroughs, 1971, this guidebook.
- 3) Cliffs along Wildhorse Ridge, 1-7 mi. E. of La Sauses, Conejos Co., Colo.
- 4) Gry.-pink, red br., lt.-drk. gry. interb. tuff breccs., pumice. tuffs, lahars, dens. cryst. tuffs, latite flows, tuffac. sss. and grav. (50'-800').
- 5) Conf. on Wildhorse Memb., overlain disconf. by Manassa Memb.

**LEADVILLE LIMESTONE, DOLOMITE—****Mississippian**

- 1) Colorado.
- 2) G. H. Eldridge in S. F. Emmons, et al., 1894, U.S.G.S. Atlas Folio 9, p. 6.
- 3) Expos. at Leadville, Lake Co., Colo.
- 4) Yel. calc. ss., sdy. chrty. ls. and dol. at base, overlain by drk. gry., thick-bed to mass. chrty. lss. ooli., and chrty.-dolos. (75'-300').
- 5) Kinderhook-Meramac: Disconf. on Chaffee, overlain paraconf. by Belden Fm. with basal Molas Memb.

**LOS PINOS GRAVEL, FORMATION—Miocene**

- 1) S. Cent. Colorado, N. New Mexico.
- 2) W. W. Atwood and K. F. Mather, 1932, U.S.G.S. Prof. Pap. 166, p. 92-100.
- 3) Los Pinos Canyon, near San Miguel, Rio Arriba Co., New Mex.
- 4) Fangs. of sss., grav. tuffs, thin olivine basalt flows (0-2,000+').
- 5) 25.9 m.y.: Unconf. on older volc. and Precamb. rocks on San Juan peneplane, overlain disconf. by basalts and fangs. of Hinsdale Fm.: 4 membs. ascend.-Biscara, Esquibel, Jarita Basalt, Cordito.

**MADERA LIMESTONE, FORMATION (in Magdalena Group)—Pennsylvanian**

- 1) S. Colorado, N. and Cent. New Mexico.
- 2) C. R. Keyes, 1903, Ores and Metals, v. 12, p. 48.
- 3) E. slope of Sandia Mtns., Bernalillo Co., New Mex.
- 4) Two membs., ascend., interb. gry., blu.-gry., chrty. lss. and calc. shs.; br. ark. sss., ark. lss. and lt. gry. lss. (0-3,000').
- 5) Desmoinesian-Virgilian: Conf. and grad. on Sandia Fm., overlain conf. or disconf. by Sangre de Cristo Fm., grad. later. N. into Sangre de Cristo or Minturn Fms.

**Manassa Member (of Conejos Formation)—****M. Oligocene**

- 1) S. Cent. Colorado.
- 2) R. L. Burroughs, 1971, this guidebook.
- 3) In Western San Luis Hills, E. of Manassa, Conejos Co., Colo.
- 4) Drk. br., blk. andesite flows, drk. red scoria with fine tuffac. matrix, flow breccs., explosive breccs. (0-1,500').
- 5) Disconf. on La Sauses Memb., overlain unconf. by Santa Fe Fm.

**MAMMOTH MOUNTAIN RHYOLITE—****U. Oligocene**

- 1) SW Colorado.
- 2) W. S. Emmons and E. S. Larsen, 1923, U.S.G.S. Bull. 718, p. 40; redefin. T. A. Steven and J. C. Ratté, 1964, U.S.G.S. Prof. Pap. 475-D, p. D. 59
- 3) Mammoth Mountain, 2-3 mi. NE. of Creede, Mineral Co., Colo.
- 4) Rhy. to qtz. latite, cryst. poor to cryst. rich, red-br. weld. and some non-weld. ash-flow tuffs (0-2,000').
- 5) 26.7 m.y.: Disconf. on Farmers Creek Rhyolite, overlain disconf. by Wasson Park Rhyolite; former. low. memb. of Piedra Rhyolite (Larsen and Cross, 1956).

**MANITOU LIMESTONE, DOLOMITE, FORMATION—Ordovician**

- 1) E. Colorado.
- 2) W. Cross, 1894, U.S.G.S. Geol. Atlas Folio 7, p. 2.
- 3) E. side of canyon, above Narrows of William Canyon, SW ¼, sec. 32, T. 13 S., R. 67 W., El Paso Co., Colo.
- 4) Gry. to blu.-gry., local red, thin bedd.-mass. lss., dolo. lss., dolos. (100'-370').
- 5) Canadian: paraconf. on Peerless Fm., Sawatch Qtzite., or unconf. on Precamb. rocks, overlain paraconf. by Harding ss. or Parting Qtzite. of Chaffee Fm.

**Mesita Member (of Servillita Formation)—Pliocene**

- 1) S. Cent. Colorado.
- 2) R. L. Burroughs, 1971, this guidebook.
- 3) Mesita Crater, near Mesita, Conejos Co., Colo.

- 4) Drk. red trachyandesite scoria and scoriac flows.
- 5) Youngest unit of Servilleta Fm., forms small hills on plateau basalts.

**OJITO CREEK MEMBER (of Treasure Mountain Rhyolite, Tuff)—U. Oligocene**

- 1) SW Colorado.
- 2) P. W. Lipman and T. A. Steven, 1970, U.S.G.S. Prof. Pap. 700-C, p. C21.
- 3) At the head of Ojito Creek, 13.5 mi. E. of Platoro, Conejos Co., Colo.
- 4) Drk. br., dens. weld. Qtz. latite ash-flow tuff (30'-60').
- 5) About 29 m.y.: Conf. on middle air-fall tuff and ash-flows, overlain conf. by Ra Jadero Memb. Outlet Tunnel Member (see La Garita Quartz Latite).

**PARTING QUARTZITE MEMBER (of Chaffee Formation)—U. Devonian**

- 1) Cent. Colorado.
- 2) S. F. Emmons, 1882, U.S.G.S. 2nd Ann. Rept. p. 215.
- 3) On Parting Spur extend. NW from Dyer Mtn., Lake Co., Colo.
- 4) Wh. coarse-gr. mass. Qtzite and Qtzite cgl. (35'-115').
- 5) Famennian: Paraconf. on Harding Ss. or Manitou Dol., conf. overlain by Dyer Memb.

**PHOENIX PARK MEMBER (see La Garita Quartz Latite)**

**PICURIS TUFF—Miocene?**

- 1) N. New Mexico.
- 2) E. C. Cabot, 1938, Jour. Geol. v. 46, p. 91.
- 3) Expos. btw. Badito and Placitas, Taos Co., New Mex.
- 4) Buff tuffac. sss. and tuff, interb. cons. gravs., pink sdy. clay, coarse cgl. (1,250'-1,750').
- 5) Paraconf. on Magdalena Gp.; overlain? unconf. by Santa Fe Fm.

**PIEDRA RHYOLITE (in Potosi Volcanic Group)**

- 1) SW Colorado.
- 2) E. S. Larsen, 1917, Colo. Geol. Sur. Bull. 13, p. 36; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 144-156.
- 3) Piedra Peak, 21 mi. SW of Creede, Hinsdale Co., Colo.
- 4) Name not used by Steven and Ratté, 1964; four membs. of Larsen and Cross, 1956 = ascend.-Low Rhy. = Farmers Creek Rhy., Mammoth Mtn. Rhy., Shallow Creek Qtz. Latite, Windy Gulch Memb. of Bachelor Mtn. Rhy. (0-2,000'); Tridymite Latite Memb. = Wason Park Rhy., (0-700'); Tuff Memb. = Rat Creek Qtz. Latite, (0-1,000'); Rhyolit. latite Memb. = Nelson Mtn. Qtz. Latite (0-4,000').
- 5) 27.8-26.5 m.y.: Unconf. on Campbell Mtn. Memb. of Bachelor Mtn. Rhy., disconf. overlain by Fisher Qtz. Latite and Creede Fm.

**POPOTOSA FORMATION—U. Miocene**

- 1) Cent. New Mexico.
- 2) C. S. Denny, 1940, Jour. Geol. v. 48, p. 77.
- 3) Valley of Silver Creek, T. 1 N., R. 2 W., Socorro Co., Colo.
- 4) Red to gry. br., buff xbedd. tuffac. sss., grav. lens., tuff, sdy. silt xbedd. sss., volc. clasts. pred. (0-5,000').
- 5) 16 m.y.: Disconf. and conf. on Miocene? volcs., overlain disconf. of Santa Fe Fm.

**PORPHYRY PEAK RHYOLITE—U. Oligocene**

- 1) S. Cent. Colorado.
- 2) W. S. Burbank, 1932, U.S.G.S. Prof. Pap. 169, p. 26
- 3) Porphyry Peak, 4.5 mi. N. of Bonanza, Saguache Co., Colo.
- 4) Wh., lt. gry. to br. gry. mod. cryst. rich ash-flow tuffs, some air-fall tuffs and breccs., Qtz. latite to rhyolite (0-1,000').
- 5) Disconf. on Brewer Cr. Latite or Squirrel Gulch Latite.

**POTOSI VOLCANIC GROUP—U. Oligocene**

- 1) SW Colorado.
- 2) W. Cross, 1899, U.S.G.S. Geol. Atlas Folio 57. Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 90-166; R. G. Luedke, W. S. Burbank, 1963, U.S.G.S. Prof. Pap. 475-C, p. C43, redefin. and name restrict to type area.
- 3) Potosi Peak, 5 mi. SW of Ouray, Ouray Co., Colo.
- 4) Two memb., ascend., Gilpin Peak Tuff, 6 mod. cryst. rich weld. ash-flow tuffs and 1 rework. air-fall fossil. Tuff. pred. Qtz. latite, range rhyodacite to rhyolite (0-3,500'); Sunshine Peak Rhyolite, mod. cryst. rich weld. ash-flow tuff, Qtz. latite to rhyolite (0-300').
- 5) Btw. 28.4 m.y. and 27.8 m.y.: Unconf. on Silverton Volcanic Gp., overlain disconf. by Fish Canyon Tuff (Lipman et al., 1970).

**RA JADERO MEMBER (of Treasure Mountain Rhyolite, Tuff)—U. Oligocene**

- 1) SW Cent. Colorado.
- 2) P. W. Lipman and T. A. Steven, 1970, U.S.G.S. Prof. Pap. 700-C, p. C21.
- 3) In Ra Jadero Canyon, 17 mi. SE of Platoro, Conejos Co., Colo.
- 4) Drk. br., dens. weld. Qtz. latite, abund. sanidine, ash-flow tuff (30'-60').
- 5) About 28.9 m.y.: Conf. on Ojito Creek Memb., overlain conf. by the upper air-fall tuff and ash-flows, or disconf. by the tuff of Masonic Park (28.2 m.y.).

**RAWLEY ANDESITE—M. Oligocene**

- 1) S. Cent. Colorado.
- 2) W. S. Burbank, 1932, U.S.G.S. Prof. Pap. 169, p. 16-21.
- 3) Rawley Gulch, and in Rawley Mine, 2.5 mi. NE of Bonanza, Saguache Co., Colo.
- 4) Dr. gry., red br., grn. gry. interb. andesite flows, breccs., air-fall tuffs and cgl. (0-2,000')

- 5) 31.3-34.7 m.y.: Unconf. on Precam. rocks, grads. lateral into Hayden Peak Latite, overlain disconf. by Bonanza Tuff.

#### Ritito Conglomerate—Miocene

- 1) N. Cent. New Mexico.
- 2) Fred Barker, 1958, New Mex. Bur. Min. and Miner. Res. Bull. 45, p. 42.
- 3) Ritito Canyon, secs. 11 and 14, T. 27 N., R. 7 E., Rio Arriba Co., New Mex.
- 4) Gry. cgl. of Precam. bould. and grav., friab. (0-400').
- 5) Unconf. on Precamb. rocks, overlain disconf. by Cordito Memb. of Los Pinos Fm.

#### SANGRE DE CRISTO FORMATION—Pennsylvanian and Permian

- 1) S. Colorado and N. New Mexico.
- 2) R. C. Hills, 1899, U.S.G.S. Geol. Atlas Folio 58, p. 1.
- 3) E. of Crestone on W. flank of anticline btw. Crestone Needle and Eureka Mtn., Saguache Co., Colo.
- 4) Red, piedmont cycloth., ark. cgl., sltst. and sss., shs., thin, nodul. non-ark. lss. (500'-9,500').
- 5) Missourian-Wolfcampian: Conf. on Whiskey Cr. Ls. Memb. or later. gradat. into Madera Fm. in New Mex. or disconf. on Minturn Fm.; overlain conf. and gradat. by Yeso Fm. in New Mex. and Maroon Fm. in Colo.: Crestone Cgl. upper cgl. memb. in type area.

#### SAN JUAN BRECCIA, FORMATION—

##### M. Oligocene

##### San Juan Tuff

- 1) SW Colorado.
- 2) W. Cross, 1896, Colo. Sci. Soc. Proc. v. 5, p. 225-228; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 69-75; R. G. Luedke and W. S. Burbank, 1963 U.S.G.S. Prof. Pap. 475-C, p. C39.
- 3) Vicinity of Telluride, San Miguel Co., Colo.
- 4) Drk. gry. to gry. br. rhyodacite tuff brecc., volc. cgl., air-fall tuffs; rhyobasaltic-rhyodacitic lava flows, flow breccs., rhyodacite-qtz. latite weld. ash-flow tuffs (0-3,000').
- 5) 31.1-34.2 m.y.: Conf. on Telluride Fm. or unconf. on Paleoz. fms., overlain disconf. by Silverton Volcanic Group.

#### SANTA FE FORMATION or GROUP—

##### M. Miocene—Pleistocene

- 1) N. New Mexico and S. Cent. Colorado.
- 2) V. F. Hayden, 1869, U.S. Geol. and Geog. Sur. Terr. 3rd Ann. Rept. p. 66.
- 3) Btw. Sangre de Cristo and Jemez Mtns., N. of Santa Fe, Santa Fe and Sandoval Cos., New Mex.
- 4) Varigat. fangs. of mod. coarse grav. lens., coarse-fine sss. sdy. silt., slty. clays, tuffac. sss. and local drk. interb. basalt flows (500-6,000+').
- 5) Unconf. on Miocene and older volcanics, Cret. fms.

and Precamb. rocks; in Chama Basin grad. with Abiquiu Tuff and equiv. to up. pt. of Los Pinos Fm. (Budding, Pitrat and Smith, 1960); Nambe Tuff, 18 m.y. (Kottowski, Weber, and Willard, 1969), vert. fossils (Galusha and Blick, 1971).

#### Sapinero Mesa Tuff—U. Oligocene

- 1) SW Colorado.
- 2) J. C. Olson, D. C. Hedlund and W. R. Hansen, 1968, U.S.G.S. Bull. 1251-C p. 19.
- 3) Tenmile Springs at southern Sapinero Mesa, south central Cebolla Quad., Gunnison Co., Colo.
- 4) Thin lt. gry. poor. weld. base grading up into red-br. devitri. qtz. latite weld. tuff with lt. gry. nonweld. tuffs at top (0-200').
- 5) 28.0 m.y.: Unconf. or disconf. on Precam. rocks, Blue Mesa Tuff, Dillon Mesa Tuff, andesite of Ford Cr. and local grav. at its base, overlain disconf. by Fish Canyon Tuff.

#### Servilleta Formation—U. Pliocene—L. Pleistocene

- 1) N. Cent. New Mexico.
- 2) A. Montgomery, 1953, New Mex. Bur. Min. and Miner. Res. Bull. 30, p. 53.
- 3) Along NE and N. Cent. edge of Picuris Range, Taos Co., New Mex.
- 4) Buff, gry. clays, sss., grav. interb. with olivine tholeiite basalt flows (0-1,500').
- 5) 3.6-4.5 m.y.: Unconf. on Hinsdale Fm. and Picuris Tuff, disconf. on Santa Fe Fm.; flows aver. 50' thick, are undeform. and underlie the Taos Plateau of Upson (1939).

#### Sharpsdale Formation—Pennsylvanian

- 1) SW Colorado.
- 2) D. W. Williamson and L. Burgin, 1960 Colo. Sch. Min. Miner. Indust. Bull. 3, p. 11.
- 3) No type desig.; somewhere in Fremont Co., Colo.
- 4) Red-gry. interb. sss., sltst., cgl. and a few fossil. lss. (400').
- 5) Conf. on Kerber Fm., overlain conf. and grad. by Madera Fm.: prob. tongue of Sangre de Cristo Fm.

#### SHEEP MOUNTAIN QUARTZ LATITE (in Potosi Volcanic Group)

- 1) SW Colorado.
- 2) E. S. Larsen, 1917, Colo. Geol. Surv. Bull. 13, p. 36; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 124-132: not recogn. Lipman and Steven, 1970.
- 3) Sheep Mountain, 4 mi. N. of Jasper, Rio Grande Co., Colo. (error original designation by Larsen and Cross, 1956).
- 4) Drk. br. qtz. latite flows and breccs.
- 5) Errors in naming and designating type loc. require name be aband. type area map. as andesite and rhyodacite lava flows assoc. with up. pt. of Treasure Mtn. Tuff (Lipman and Steven, 1970).

**SNOWSHOE MOUNTAIN QUARTZ LATITE—****U. Oligocene**

- 1) SW Colorado.
- 2) T. A. Steven and J. C. Ratté, 1964, U.S.G.S. Prof. Pap. 475-D, p. D61.
- 3) Snowshoe Mtn., 7 mi. S. of Creede, Mineral Co., Colo.
- 4) Drb., cryst. rich. dens. weld. qtz. latite ash-flows with local talus breccs. (0-6,000').
- 5) Btw. 26.7 and 26.4 m.y.: forms core of Creede Caldera; young. than Nelson Mtn. Qtz. Latite, older. than Fisher Qtz. Latite.

**SQUIRREL GULCH LATITE—U. Oligocene**

- 1) S. Colorado.
- 2) W. S. Burbank, 1932, U.S.G.S. Prof. Pap. 169, p. 25.
- 3) Along head of Squirrel Gulch, 3 mi. N. of Bonanza, Saguache Co., Colo.
- 4) Drk. gry. dens. weld. ash-flow of hornbl. latite (300'-500').
- 5) Disconf. on Bonanza Tuff, overlain disconf. by Brewer Creek Latite Tenderfoot Hill facies, Tenderfoot Hill volcanic sequence (see Dry Union Formation).

**TESUQUE FORMATION (in Santa Fe Group)—****U. Miocene to L. Pliocene**

- 1) N. Cent. New Mexico.
- 2) F. E. Kottlowski, 1953, New Mex. Geol. Soc. Gdbk. 4th Fld. Conf. p. 148.
- 3) In Sangre de Cristo Mtns., 10 mi. N. of Santa Fe, Santa Fe Co., New Mex.
- 4) Ledges of soft, pink-tan sss. (0-10,000').
- 5) Unconf. on old. Mioc. volcanics; unconf. overlain by Puye Grav., Ancha Fm. or Tuerto Grav. of Santa Fe Gp.

**Thurman Formation—Oligocene—NOT VALID**

- 1) SW New Mexico..
- 2) V. C. Kelley and Caswell Silver, 1952, New Mex. Univ. Publ. in Geol. 4, p. 121.
- 3) Along rd. to Palm Park Barite mine, secs. 35 and 36, T. 18 S., R. 3 W. Dona Ana Co., New Mex.
- 4) Wh., tan, buff, at base dens. rhy. tuff-brecc., above interb. pink sdy. clay, cryst. tuff, tuffac. sss. with local drk. amygdal. basalt. (0-2,100').
- 5) 31.1 m.y.: Conf. on Palm Park Fm., unconf. overlain by Santa Fe Fm.

**Tracey Quartz Latite (See Conejos Formation)****TREASURE MOUNTAIN QUARTZ LATITE, RHYOLITE, TUFF—U. Oligocene**

- 1) S. Cent. Colorado.
- 2) H. B. Patton, 1917, Colo. Geol. Surv. Bull. 13, p. 33-35; Larsen and Cross, 1956, U.S.G.S. Prof. Pap. 258, p. 117-124; redefin. by P. W. Lipman and T. A. Steven, 1970, U.S.G.S. Prof. Pap. 700-C, p. C21.

- 3) Treasure Mtn., 13 mi. W. of Summitville, Mineral Co., Colo.
- 4) Gry. cryst rich qtz. latite weld. tuffs and air-fall tuff, Ojito Cr. ash-flow, Ra Jadero ash-flow, up. tuff (0-3,000').
- 5) 29.8-28.8 m.y.: Unconf. on Conejos Fm., overlain disconf. by tuff of Masonic Peak; relat. largely to Platoro Caldera.

**Trump Conglomerate—U. Miocene—Pliocene?**

- 1) Cent. Colorado.
- 2) J. T. Stark, et al., 1949, Geol. Soc. Am. Mem. 33, p. 70.
- 3) On pediments below Coffman Ridge, T. 14 S., R. 76 W., 10 mi. S. of Antero Reservoir, Park Co., Colo.
- 4) Poor. strat. to bedd. fang. with qtz. ss. matrix (0-500').
- 5) Unconf. on Antero Fm. and older fms.; lateral equiv. Wagontongue Fm. (DeVoto, 1964).

**Wagontongue Formation—U. Miocene—Pliocene**

- 1) Cent. Colorado.
- 2) J. H. Johnson, 1937, Colo. Univ. Stud. v. 25, p. 77; J. T. Stark, et al., 1949, Geol. Soc. Am. Mem. 33, p. 68-69.
- 3) Along Wagontongue Cr. in NE ¼, sec. 6, T. 15 S., R. 75 W., Park Co., Colo.
- 4) Poor. cons. interb. buff ark. sss. xbedd., yell-br. calc. sdy. clays, tuffac. and pumic. sss., lens. of cgl. (110'-500').
- 5) Unconf. on Antero Fm., lateral equiv. of Trump Fm. (DeVoto, 1964); vert. bones and teeth, perfect jaw of equid. dates fm., ilic. wood.

**WASON PARK RHYOLITE—U. Oligocene**

- 1) SW Colorado.
- 2) T. A. Steven and J. C. Ratté, 1964, U.S.G.S. Prof. Pap. 475-D, p. D-59.
- 3) Wason Park on S. flank of La Garita Mtn., 5 mi. NE of Creede, Mineral Co., Colo.
- 4) Drk. to lt. gry. cryst. rich dens. weld. ash-flow tuff, rhyolitic with char. tridymitic streaks (0-700').
- 5) Btw. 26.7 and 26.4 m.y.; tong. of Huerto Fm. separ. Mammoth Mtn. Rhy. from Wason Park Rhy. S. of Bristol Head, overlain unconf. by Fisher Qtz. Latite and Creede Fm.

**WEST ELK BRECCIA—M. Oligocene**

- 1) W. Cent. Colorado.
- 2) W. Cross, in S. F. Emmons, et al., 1894, U.S.G.S. Atlas Folio 9, col. sect.
- 3) West Elk Mountains, 9 mi. S. of Crested Butte, Gunnison Co., Colo.
- 4) Lt. gry.-purp. gry. coarse to fine gr. volc. brecc. and cgl. beds, depos. as lahars, interb. local. with air-fall and weld. ash-flow tuff and thin rhyodacite flows (0-2,000').
- 5) 31.1-34.7 m.y.: Age equiv. of mid. unit of Lake Fork

Fm.: Unconf. on Up. Cret. fms., overlain disconf. by Blue Mesa Tuff (Olsen, et al., 1968).

**Willow Creek Rhyolite (See Bachelor Mountain Rhyolite)**

**Whiskey Creek Pass Limestone Member (of Madera Formation)—Pennsylvanian**

- 1) S. Cent. Colorado and N. Cent. New Mexico.
- 2) K. G. Brill, Jr., 1952, Geol. Soc. Am. Bull. 63, p. 819
- 3) At 13,000' on the N. side of the N. Fork of Whiskey Cr., Las Animas Co., Colo.
- 4) Perst. horiz. of interb. gry. sdy. lss., cal. sss. and ooli. lss. (150'-200').
- 5) Desmoinesian: Conf. on Arkos. Memb. of Madera Fm., overlain conf. by Up. Madera or disconf. by Maroon Fm.

**Windy Gulch Rhyolite (See Bachelor Mountain Rhyolite)**

**INFORMAL NAMES USED IN THIS GUIDEBOOK**

Andesite of Ford Creek—Bruns, Epis, Weimer and Steven.

Andesite of Saguache Creek—Bruns, Epis, Weimer and Steven.

Andesite of Trickle Mountain, Bruns, Epis, Weimer and Steven.

Ash Flow 7—Thirty-nine Mile volcanic field, Bruns, Epis, Weimer and Steven.

Badger Creek Tuff—G. Lowell.

Big Baldy Andesite—G. Lowell.

Rhyolite of No Agua Mtn. (4.8 m.y.), A. P. Butler, Jr. Summer Coon volcanic center—Mertzman.

Tuff of Masonic Park, Bruns, Epis, Weimer and Steven.

Water laid and air-fall tuffs of Saguache Creek—Bruns, Epis, Weimer and Steven.

Waugh Mountain Latite—G. Lowell.

**Wildhorse Member (of Conejos Formation)—M. Oligocene**

- 1) S. Cent. Colorado.
- 2) R. L. Burroughs, 1971, this guidebook.
- 3) N. end of Wildhorse Ridge, 1.7 mi. E. of Las Sauses, Conejos Co., Colo.
- 4) Dr. br. porphy. andesite flows, lahars and flow breccs., autobrecc., interb. sort. bedd. tufface sss. and grav. (650+').
- 5) Base not expos., overlain conf. by La Sauses Memb.