Lexicon of stratigraphic names used in east-central New Mexico and adjacent states

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LEXICON OF STRATIGRAPHIC NAMES USED IN EAST-CENTRAL NEW MEXICO AND ADJACENT STATES

by

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This lexicon is an alphabetical listing of the stratigraphic names which have been used in the Guidebook of The New Mexico Geological Society—23rd Field Conference. The form used is as follows:

Unit name (formation or group)—system or period: Names printed in boldface 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. A "†" indicates the name has been officially abandoned by the U.S. Geological Survey.

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 23rd Field Conference (1972).

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 geologists, and are not included in the glossary.

alt	alternating
ascend	ascending, in ascending order
btw	between
calc	calcareous
calcar	calcarenites
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	fluviatile
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
sdy	sandy
slby	slabby
slit	slightly
transit	transitional
U	upper
undif	undifferentiated

ABO FORMATION—Permian

1) Cent New Mexico
2) W. T. Lee, 1909, p. 12; redescribed by Needham and Bates, 1943, p. 1654-1657
3) Abo Canyon, S end of Manzano Mountains, Socorro Co., New Mexico
4) Dark-red, purple, coarse-grained ss, cgl at base, some sh, 300′ to 800′ thick
5) Wolfcampian-Leonardian; lies conf and gradat on Bursum Fm, or disconf on upper Madera Ls; overlain conf and gradat by Yeso Fm. Abo is 1,400′ thick in north and thins abruptly to 250′ in the cent Sacramento Mtns; farther south is composed of two tongues separated by, and transit with southward-thickening, brackish-marine, Hueco Fm; basal tongue is the Powwow Cgl and upper tongue is Deer Mountain red sh. Widespread in New Mexico and in the subsurface of West Texas

ALAMITOS FORMATION—Pennsylvanian

1) N-Cent New Mexico
2) P. Sutherland, in Miller et al., 1963, p. 36-38
3) Alamitos Canyon, 2 miles NW of Pecos, San Miguel Co., New Mexico
4) Drk-gry, gry-green calc ss, sltst, sdy ls cg, all arkosic, some red sh (1,250′-4,000′)
5) U Desmoinesian-Missourian-Virgilian: conf on La Pasada Fm, overlain and lateral and vertical gradat with the Sangre de Cristo Fm. Thickness greatest in Taos trough

Albian Stage

Time division of Lower Cretaceous

ALIBATES DOLOMITE LENTIL (of Quartermaster Formation)—Permian

1) N Texas
2) C. N. Gould, 1907, p. 17-20

3) Alibates Creek, Potter Co., Texas
4) Low 8′ mass wh to buff, wavy lamin dolo, overlain by 4′ red clay, overlain by 2′-3′ of wh mass wavy lamin dolo chert common (15′)
5) Guadalupian: conf on red sh and overlain conf by red sh of Quartermaster Fm

Antlers Sand (in Trinity Group)—L Cretaceous

1) SE Oklahoma, NE Texas
2) R. T. Hill, 1894, p. 303
3) Sect on Antlers Creek, Pushmataha Co., Oklahoma
4) Wh, gry to ylw ferr ss xbed, interbed thin sh (0-800′)
5) Albian: unconf on late Paleozoic rks, conf or disconf overlain by Walnut Fm

†Apishapa Shale Member (of Niobrara Formation)—U Cretaceous

1) E Colorado
2) G. K. Gilbert, 1896, p. 567
3) Apishapa River, Colorado
4) Gry calc sh. (70′-400′)
5) Coniacian-L Santonian: is S shale facies of Smokey Hill Shale Memb, which has priority (Jenkins, 1957); conf on Fort Hayes Ls Memb (Timpas Ls Memb), overlain conf by Pierre Sh

ARROYO PENASCO FORMATION—Mississippian

1) N and Cent New Mexico
2) A. K. Armstrong, 1955, N. Mex. Bur. Mines and Min. Res., Circ. 39, p. 3, 6
3) SW ¼ SE ¼ sec. 5, T. 16 N., R. 1 E., Pinos and Penasco Canyons, Nacimiento Mtns.
4) Base 18′ - 20′ clean, calc ss, interb sh and ls; 31′ fine to coarse gr-gry to br ls; 70′ lithog. to oolitic gry med-bedded ls upper 10′ wh chert (140′ max.)
5) Meramecian; unconf on Precamb, overlain disconf by Log Spring Fm or Sandia Fm (Penn)

ARTESIA GROUP—Permian

1) E New Mexico and W Texas
2) D. B. Tait et al., 1962, p. 504
3) Humble Federal Bogle well No. 1, sec. 30, T. 16 S., R. 30 E., Eddy Co., New Mexico
4) Shelf seq of interb anhydr, dolo, ss, siltst and red sh, (1,710′ in type well)
5) U Guadalupian: unconf on San Andres Fm, overlain unconf by Triassic rks in NE New Mexico, and disconf on shelf and conf in Delaware basin by Ochoan rks. Gp is equiv to beds from top of Tansill Fm, down through Yates, Seven Rivers, Queen, and Grayburg Fms, includ basal Premier Ss. Occurs in surf and subsurf of SE and E-Cent New Mexico Units thin to NW, top ones missing by erosion. Into W Texas and SW Oklahoma marker beds disappear and clastic facies pass into Whitehorse Gp. To S fms pass into Capitan and Goat Seep reefs

Baldy Hill Formation (in Dockum Group)—U Triassic

1) NE New Mexico
2) B. Baldwin and W. R. Muehlberger, 1959, p. 31, 35-38
3) Sect 2,000′ N of Baldy Hill, sec. 36, T. 32 N., R. 32 E., Union Co., New Mexico
4) Purple, mott gry, org, red, olive slty ss, sdy mudst and clayst, agate nodule and silicif wood near top (115′)
5) Unconf on Permian Whitehorse beds, or conf in subsurf on Santa Rosa? cglitic ss; overlain disconf or conf by Travesser Fm

BELL RANCH FORMATION (in San Rafael Group)—U Jurassic

1) NE New Mexico
2) R. L. Griggs and C. B. Read, 1959, p. 2006
3) Carpenter's Point, 18 miles SE of Bell Ranch Hdqts., 13 miles NW of Tucumcari, Quay Co., New Mexico
4) Alternat beds of lgt gry ss and br-red sltst, nodule and thin beds of gyp near top (0-66′)
5) Conf on Entrada Ss, overlain disconf by Morrison Fm; was called Wanakah Fm

BERNAL FORMATION—Permian

1) N-Cent New Mexico
2) G. O. Bachman, 1953
3) Sect at Bernal Butte, near Chapelle, T. 13 N., R. 16 E., New Mexico
4) Red-br to yel-br sltst, clayst fine ss with basal buff ss local bed and lenses, few gyp beds in lower pt (30′-355′)
5) U Guadalupian: disconf on San Andres Fm or Glorieta Ss, overlain unconf by Santa Rosa Ss; was up clastic memb of San Andres. Is lateral equiv of Artesia Gp (Tait et al., 1962)

Bonney Canyon Member (of San Andres Formation)—Permian

1) E New Mexico
2) V. C. Kelley, 1971, p. 12-13
3) On N side of Hondo Canyon, sec. 24, T. 11 S., R. 20 E., Lincoln Co., New Mexico
4) Lgt to drk gry, gry-br fine-gr ls, dolo, thin to med bed, few oolite beds and chert nodules (60′-207′)
5) Leonardian: conf on Glorieta Ss or Rio Bonito Memb, overlain conf by Fourmile Draw Memb

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, Co., Colorado.
4) Drk-gry to blk argill sh. with thin ls. beds, fossilif ls nod, and large septarian concret; calc ss and sdy sh (180′-700′).
5) M-U Turonian: onf on Greenhorn Ls, overlain conf or discf by Fort Hays Ls (of Niobrara Fm in N-Cent and NE New Mexico). Kauffman (1967) recogn 4 units ascend—Fairport Chalky Sh Memb (br-buff, speck, cal sh and thin, slab calcar, abund ls conc, 6 bent beds, very fossilif, 220′); Blue Hill Sh Memb (low unit of interb drk-blu-gry to br noncal clay sh slitly slty, large septarian and ls concret: up unit of drk gry to br slty and sdy interb at top with br ss, sdy shs and sltst, 220′, septarian concret); gradat into Codell Ss Memb (mass to slby, tan-

buff, fine to med gr., ss carbonac ss and sdy sh, rapid facies changes—in New Mexico from a drk slty sh to lent thin ss, sltst to mass ss, 0-50′); Juana Lopez Memb (br to br-gry slby to mass calcars local up to 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 fossilif); 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

CHEYENNE SANDSTONE MEMBER (of Purgatoire Formation)—L Cretaceous

1) SW Kansas, SE Colorado, W Oklahoma
2) F. W. Cragin, 1889, p. 65
3) Cheyenne Rock at Belvidere, Kiowa Co., Kansas
4) Wh, gry, buff, fine to med gr ss, lens of sdy sh, carbon sh, qtz cgl (5′-95′)
5) Albian: unconf on Jurassic Morrison Fm to Permian Whitehorse Ss, overlain conf by up memb, Kiowa Shale Memb

CHINLE FORMATION—U Triassic

1) N Arizona, S Utah
2) H. E. Gregory, 1915, p. 102
3) Chinle Valley in NE Arizona
4) Four units—Div A, red sh and shly ss, B, lenses of ls cgl, and red sh, C, variegat sh with ls cgl, D, drk-br sndy sh (400′-1,500′)
5) In western New Mexico and adjacent states, unconform on Moenkopi Fm, overlain conf or disconf by Wingate Ss. In eastern New Mexico, unconform on Santa Rosa Ss, overlain conf or disconf by Redonda Fm, Exeter Ss, and younger beds

Cimarron Anhydrite (in Hennessey Formation—Permian

1) W Oklahoma
2) H. Schweer in O. E. Brown, 1937, p. 1553
3) Not designated
4) Not described
5) Rejected by Oklahoma Geological Survey, name twice preoccupied, C. C. Branson, 1957

Cimarron Anhydrite (see Informal Names)

CLEAR FORK GROUP, FORMATION—L Permian

1) Cent and N-Cent Texas
2) E. T. Dumble and W. F. Cummins, 1890, p. 188
3) Sect on Clear Fork of Brazos River, Jones and Shaokelford Cos., Texas
4) In E outcrop area is predom red to br red sh, with beds of wh gyp, a few interbed wh to gry dolo and red ss. To W in subsurf wh to gry dolo predom with a few anhydrites (1,100′-1,300′).
5) Leonardian: conf on Lueders Fm of Wichita Gp, overlain conf or disconf? by San Angelo Ss of the San Andres Gp Divid ascend-Arroyo Fm (225′-300′) interbed red sh, anhydr, dolo passing W into gry sh, anhydr, dolo; Vale Fm (100′-250′) red-br sh passing W abrupt into dolo; Choza Fm (800′-850′) red-br sh, few dolo, and ss passing W into gry sh, thick ss, anhydr, dolo

CODELL SANDSTONE MEMBER (of Carlile Shale—U Cretaceous see CARLILE SHALE

COLORADO GROUP, SHALE, FORMATION—L and U Cretaceous

1) Colorado, Idaho, Iowa, Kansas, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Wyoming
2) F. V. Hayden, 1876, p. 45
3) Sects along eastern base of Front Range, Colorado.
4) Drk gry calc marine sh with interbed br to buff ss beds and lens, local very fossilif (300′-2,500′+)
5) Cenomanian to L Santonian: known as Mancos Shale in New Mexico; Conf on Dakota Ss?, conf and grad overlain by Pierre Sh or Mesa Verde Gp. In Colorado and NE New Mexico divid ascend-Graneros Shale, Greenhorn Limestone, Carlile Shale, Niobrara Fm

COMANCHE PEAK LIMESTONE (in Fredericksburg Group)—L Cretaceous

1) E Texas
2) R. T. Hill, 1889, p. xiv, xvii-xix
3) Sec on Comanche Peak, Hood Co., Texas
4) Gry wh to wh hard, chlky mass bed ls (0-100′).
5) Albian: conf or disconf on Walnut Clay, overlain conf by Edwards Ls, is same facies as Goodland Ls N from Tarrant Co., thins S as Edwards Ls thickens

COMANCHE SERIES—L and U Cretaceous

1) Gulf Coastal Plain
2) R. T. Hill, 1887, p. 298
3) Sects in Comanche Co., Texas
4) Includes ascend-Trinity Gp, Fredericksburg Gp, Washita Gp

Cowles Member of Tererro Formation—Mississippian (Meramecian) see Tererro Formation

Cuervo Sandstone Member (of Chinle Formation)—U Triassic

1) E-Cent New Mexico
2) V. C. Kelley, 1972, p.
3) Sec along and near State Road 104, sec. 4, T. 12 N., R. 25 E., De Baca Co., New Mexico
4) Pred gry-green, buff, red br med to thick bed interbed with few thin-bed gry red sltst, gry small peb cgl (150′-225′).
5) Conf on lower shale memb of Chinle, overlain conf by upper shale memb. Thins to S as Lower Sh Memb thickens

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, p. 419.
3) In Missouri Riv bluffs, NE¼ sec. 13, T. 27 N., R. 4 E., 1 mile SE of Homer, Dakota Co., Nebraska

4) Buff, red, wh, fine-coarse gr ss or qtzite, locally 2 or 3 mass bed sss. separ by thin gry, blk or varieg clay sh, 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 Sh, in Mora Co., New Mexico. 180′ thick

Del Padre Sandstone, Formation—U Devonian?

1) N-Cent New Mexico
2) P. Sutherland, in Miller et al., 1963, p. 22-25.
3) Bluff at junct of Rito del Padre Creek and Pecos River, 11½ miles N of Tererro, in Rio Arriba Co., New Mexico.
4) Orthoqtzite ss and cgl, feldspar only in basal beds on local granite; derived from local Ortega Qtzite; Thick variab, max close to Picuris-Pecos fault (0-754′).
5) Unconf on Precamb granite and metamorphics: overlain cgnf and grad by Espiritu Santo Fm, is basal ss of Espiritu Santo Fm of Baltz and Read, 1960

DOCKUM GROUP—U Triassic

1) W Texas, Colorado, Kansas, Oklahoma, and New Mexico.
2) W. F. Cummins, 1890, p. 189.
3) Vicinity of Dockum, West Dickens Co., Texas.
4) White qtz peb cgl, red, red-br ss, sltst, clays, very lenticular; silicif wood, reptile bones, *Unio* (800′-1,000′)
5) Uncon on Permian down to Precam; overlain unconf by Exeter Ss or Dakota Ss, Occur E New Mexico, Texas and Oklahoma Panhandles. In New Mexico divid ascend—Baldy Hill Fm, Travessor Fm, Sloan Canyon Fm, Sheep Pen Ss, Santa Rosa Ss, Chinle Fm, Pierce Canyon redbeds at base are Dewey Lake redbeds and term abandoned by USGS

Drinkard Sandy Member (of Yeso Formation)—Permian

1) NW to SE New Mexico, W Texas.
2) R. E. King, 1945, p. 13-15.
3) Type well: Texas Co. #1 Blinebry, sec. 19, T. 22 S., R. 38 E., Lea Co., New Mexico.
4) Interbed gry, br red fine to coarse-gr ss sdy sh, pyritic, and br sdy solo (50′-170′).
5) Leonardian: conf on Lower Yeso, overlain conf by Upper Yeso; equiv of informal Tubb sands and Dullerton sands

DUCK CREEK FORMATION, LIMESTONE (in Washita Group)—L Cretaceous

1) Cent and NW Texas, S-Cent Oklahoma.
2) R. T. Hill, 1891, p. 504, 516.
3) Sect on Duck Creek, N of Denison, Grayson Co., Texas.
4) Thick-bed fucoid ls overlain by interbed chlky ls and thin-bed marls (30′-120′).
5) Albian: unconf or disconf on Kiamichi Fm, overlain conf by Fort Worth Ls, in Cent Texas is a memb of Georgetown Ls

EDWARDS LIMESTONE (in Fredericksburg Group)—L Cretaceous

1) S Texas
2) R. T. Hill and T. W. Vaughan, 1898, p. 2
3) Sect on Barton Creek, near Austin, Texas—desig W.S. Adkins, 1932.
4) Wh, buff, gry mass ls, flint nodules (100′-600′).
5) Albian: conf or disconf on Comanche Peak Ls or Walnut Clay, overlain disconf by Kiamichi clay or Duck Creek Ls. Thickens to S

ELBERT FORMATION—U Devonian

1) SW Colorado.
2) W. Cross, 1904, p. 245-252.
3) Elbert Creek, a west tributary of Animas Riv, Colorado.
4) Basal ss and qtzite, interb ls and thin sh (50′-300′).
5) Famennian: paraconf on Ignacio Qtzite, or disconf on Aneth Fm in subsurf, overlain conf by Ouray Fm. Basal ss in subsurf is McCracken Ss Memb of Elbert

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, USGS Press Bull. 6064: 1928, USGS 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 ss, earthy to clean, well sort, xbed, inteb with few thin bed gry-grn lam sdy sh, cliffs, (200′-850′).
5) Conf on Carmel or disconf Navajo Ss, overlain disconf by Curtis Fm or Summerville Fm; in N New Mexico overlies paraconf Chinle Fm. Harshbarger, Repenning, and Irwin, 1957, in Navajo country recog three membs—ascend—clean sndy facies, red slty facies, clean sndy facies, lower sndy memb in W grades E and NE into med slty memb, upper sndy memb prominent in New Mexico; shallow marine, littoral, and shore (eolian) origin

Espiritu Santo Formation—U Devonian?

1) N-Cent New Mexico.
2) E. H. Baltz and C. B. Read, 1960, p. 1752-1759.
3) Small quarry at Tererro, near mouth of Holy Ghost Creek, Pecos Valley, San Miguel Co., New Mexico.
4) Gry, buff, br basal ss, overlain by drk gry to drk br sdy dolo ls, with chert nodules, and thin-bed xtallin cherty ls (0-50′).
5) Restrict by Sutherland, 1963 to carbonate units only-basal ss—Del Padre Ss. Overlies conf Del Padre Ss, overlain unconf by Tererro Fm

EXETER SANDSTONE—U Jurassic

1) W Oklahoma.
2) W. T. Lee, 1902, p. 45-46.
3) Sect near Exter P.O. (now Johnson), Union Co., New Mexico.
4) Mass coarse, lam pink to wh ss (0-80′).
5) Unconf on truncat fms of Dockum Gp, overlain disconf by Todilto? ls or beds of Morrison Fm Johnson (1959). Entrada Ss reportedly traced from Huerfano Park by surf and subsurf to type locality of Exeter Ss. USGS has abandoned usage of Exeter Ss in SE Colo and NE New Mexico in favor of ENTRADA SS

Flechado Formation—Pennsylvanian

1) N-Cent New Mexico.
2) P. Sutherland, in Miller et al., 1963, p. 33-36.
3) Sect on N side of Rio Pueblo Valley from near mouth of Tio Maes Creek E to near mouth of Gallegos Creek, Rio Arriba Co., New Mexico.
4) Predom gry-br ss, cgl, sltst sh, some mass xtall ls in low pt; in up pt sh and sltst dom, ls very rare (2,000′-2,500′).
5) Morrowan-Atokan- to Mid Desmoninesian: unconf on Mississippian, overlain conf by Alamitos Fm; grades S into La Pasada Fm of Pecos shelf

Fort Benton Group

A term applied in early repts on Rocky Mtn region to U Cret deposits now generally called Benton Shale

FORT HAYES LIMESTONE MEMBER (of Niobrara Formation)—U Cretaceous see NIOBRARA FORMATION

Fort Pierre Group

A term applied in early repts on Rocky Mtn region to U Cret deposits ling known as Pierre Shale

Fourmile Draw Member (of San Andres Limestone)—Permian

1) E New Mexico.
2) V. C. Kelley, 1971, p. 13-14.
3) Sect along Fourmile Draw, T. 18 S., R. 19-21 E., Chaves Co., New Mexico.
4) To S interbed gry fossil sdy dolo, ss, thin red sltst, few thin dolo; to N thick bed gyps, few thin gry dolo, clean wh ss at top (342′-800′+).
5) Leonardian: conf on Bonney Canyon Memb, unconf overlain by Grayburg or Bernal Fms

FREDERICKSBURG GROUP—L Cretaceous

1) S Oklahoma, Texas.
2) R. T. Hill, 1887, p. 296-299.
5) Overlies Glen Rose Ls, underlies Duck Creek Fm, includes ascend—Walnut Clays or Paluxy Ss, Comanche Peak Ls (Goodland Ls), Edwards Ls, Kiamichi Fm

FULLERTON SANDSTONE, FORMATION, MEMBER (of Chase Channel Formation)—Pleistocene

1) W Nebraska, W Kansas.
2) A. L. Lugn and G. E. Condra, 1932, p. 190.
3) Sects in vicinity of Fullerton, Nance Co., Nebraska.
4) Gry to gry-green slt, calc clays, and fine ss (8′-30′).
5) Aftonian: grad and conf on Holdrege Fm, or unconf on Permian shale; overlain conf and grad by Grand Island Fm or Meade Fm or disconf by Afton soil. Also consid up memb of Blanco Fm

Fullerton sands (see Informal Names—p.11)

GATUNA FORMATION—Pleistocene

1) SE New Mexico.
2) W. B. Lang, 1938, in T. W. Robinson and W. B. Lang, p. 84-85; Kelley, 1971
3) Gatuna Canyon, NE Eddy Co., New Mexico.

Terrest gry, purp red, fine ss pred, cgl, gravel, gyp, ls (5′-300′).

Unconf on Permian Rustler Fm; deposits in Pecos Valley in post-High Plains time

GLENCAIRN SHALE MEMBER (of Purgatoire Formation)—L Cretaceous

1) E Colorado.
2) G. I. Finlay, 1916, p. 8.
3) Glencairn Land tract, a few miles N of Lytle, Timber Mountain quad, Colorado.
4) Interbed olive-br thin bed ss, gry and black sh, local thin ss cgl at base (10′-100′).
5) Albian: disconf on Lytle Ss Memb, overlain disconf by Dakota Ss

GLORIETA SANDSTONE—Permian

1) Cent New Mexico.
2) C. R. Keyes, 1915, Iowa Acad. Sci. Proc. v. 22, p. 257, 262.
3) S-cent part of T. 15 N., R. 12 E., on Glorieta Mesa, 1 mi. W of village of Rowe, San Miguel Co. (desig by Needham and Bates, 1943).
4) Wh-gry med-coarse qtzitic ss, beds 2′-6′ thick, cliff-form; at base 20′ buff-wh, thin-bed ss (12′-300′).
5) Leonardian; conf on Yeso Fm, conf overlain by San Andres Ls; Cent and SE New Mexico, subsurf in W Texas. Intertongues with Rio Bonito Mbr. of San Andres Fm

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, USGS 17th Ann. Rept., pt. 2, p.564.
3) Graneros Creek, Walsenburg quad, Pueblo, Co., Colorado.
4) Blk, drk gry, oliv, gry-br noncal to silt cal, lam clay sh, many perst bent beds, argill ls concret, cone-in-cone ls and thin calcar in mid and up pt, local thin br ss near top (30′-250′).
5) Cenomanian: conf and gradat on Dakota Ss, overlain conf by Greenhorn Ls; perst mass argill fossilif

GRAYBURG FORMATION (in Whitehorse Group or Artesia Group)—Permian

1) SE New Mexico (surf and subsurf), W Texas (subsurf).
2) R. I. Dickey, 1940, p. 44-47.
3) Type well: Cecil H. Lockhart's Root Permit #2, C SW¼SW¼ sec. 7, T. 17 S., R. 30 E., Eddy Co., New Mexico; type sect: on spur and in canyon above Sitting Bull Spring, NE¼ sec. 9, T. 24 S., R. 22 E., Eddy Co., New Mexico.
4) Pred gry, pink, wh dolo, local sdy dolo, ss, a few anhydr beds (267′-425′).
5) Guadalupian: disconf or conf overlies San Andres Fm, conf overlain by Queen Fm; basinward grades into low pt of Goat Seep Ls

3) Feldt ranch, near Ogallala, Keith Co., Nebraska; desig. 1935 by C. J. Hesse.
4) Calc grit to soft ls, sdy clay, ss with local basal cgl, poor sort, buff to pink (0-300′).
5) Unconf on beveled Mesozoic fms down to Permian fms: overlain unconf by Pleistocene or Quaternary sediments

OURAY FORMATION, LIMESTONE—U Devonian—L Mississippian

1) SW Colorado, NW New Mexico, SE Utah, NE Arizona.
2) W. Cross and A. C. Spencer, 1899, p. 8.
3) Ouray, Colorado at junct of Canyon Creek and Uncompahgre River.
4) Buff, tan gry mass argill ls, streaks of gry-gr clay, sdy ls., thin basal ss (0-238′).
5) Disconf to conf on Elbert Fm, overlain unconf by Madison Fm or conf? by Leadville Fm; faunas indicate unit is transit between Elbert and Leadville

PAJARITO SHALE—L Cretaceous

1) NE New Mexico
2) E. Dobrovolny and C. H. Summerson, 1946, U.S.G.S. Oil and Gas Inv. Map 62.
3) Not designated.
4) Interb soft br ss and gry sh, with *Ostrea quadriplicata* (50′-60′).
5) Albian: conf on Mesa Rica Ss or disconf on Tucumcari Sh; R. L. Griggs and C. B. Read, 1959, raised unit to fm from memb of Purgatoire Fm which was abandoned in Tucumcari-Sabinoso area

PIERRE SHALE (in Montana Group)—U Cretaceous

1) South Dakota, E Colorado, W Minnesota, Montana, Nebraska, New Mexico, North Dakota, E Wyoming.
2) F. B. Meek and F. V. Hayden, 1862, p. 419, 424.
3) Sect at old Fort Pierre, either Stanley or Hughes Co., South Dakota.
4) Pred drk gry marine sh interbed with some sdy sh and ss, and many thin bentonite beds (1,000′-2,700′).
5) Campanian: unconf on Niobrara Fm, overlain disconf or conf and gradat by Trinidad Ss

POPO AGIE MEMBER (of Chugwater Formation)—U Triassic

1) W Wyoming
2) W. C. Knight, 1901, p. 359
3) Sect on Popo Agie River, near Lander, Fremont Co. Wyoming.
4) Interbed ocher oolit, silic, dolom clayst, ls pel cgl, purp and red sh, red slty ss (100′-200′).
5) Conf on Alcova Ls Memb, is youngest memb of Chugwater Fm in Cent Wyoming. Unconf overlain by Nugget Ss

PURGATOIRE FORMATION—L Cretaceous

1) E Colorado, N-Cent and NE New Mexico, W Oklahoma.
2) G. W. Stose, 1912, p. 3-4.
3) Sect in Purgatoire Canyon, Mesa de Maya quad, Colorado.
4) Basal wh, gry to buff ss, sdy sh, carbon sh, qtz cgls, overlain by interb olive-br ss, gry to black sh (75′-225′).
5) Albian: unconf on Morrison Fm, unconf overlain by Dakota Ss. In Colorado, two membs ascend-Lytle Ss, Glencairn Sh. In Oklahoma, two membs, ascend—Cheyenne Ss, Kiowa Sh. Term Purgatiore abandoned in Tucumcari-Sabinoso area, New Mexico

QUEEN FORMATION (in Whitehorse Group or Artesia Group)—Permian

1) SE New Mexico, W Texas.
2) F. S. Prout, 1929, p. 656; K. H. Crandall, 1929, p. 940-941.
3) West wall of Dark Canyon, SW¼ sec. 36, T. 24 S., R. 22 E., Eddy Co., New Mexico—desig by W. R. Moran, 1954, p. 1288.
4) Cyclic interbed red-br fine-gr ss, sdy plty dolo, fine-gr unfossilif dolo, with Shattuck Ss Memb at top (300′-400′).
5) Guadalupian: conf on Grayburg Fm; conf overlain by Seven Rivers Fm; basinward grades into up pt of Goat Seep reef

REDONDA FORMATION U Triassic

1) NE New Mexico
2) E. Dobrovolny and C. H. Summerson, 1946, U.S.G.S. Oil and Gas Inv. Map 62.
3) Sect at Redonda (Redondo) Mesa, 15 miles S of Tucumcari, Quay Co., New Mexico.
4) Variegated and red sh, purplish red to gray argillaceous ls and overlying red-orange fine-gr ss and sltst (25′-425′).
5) Latest Trias: conf on Chinle Fm; unconf overlain by Entrada Ss. Orig. described as member of Chinle Fm, elevated to Fm rank by R. L. Griggs and C. B. Read, 1959, p. 2006, and tent correl with Wingate Ss

SAN ANDRES LIMESTONE, FORMATION—Permian

1) Cent, NW, and SE New Mexico.
2) W. T. Lee, 1909, p. 12, 26, 29.
3) Rhodes Canyon, San Andres Mtns, in sec. 29, T. 12 S., R. 2 E., Sierra Co., New Mexico.
4) Lgt to drk gry, mass-bed, often cherty, poorly fossilif ls, dolo ls (15′-1,200′).
5) Leonardian: conf on Glorieta Ss, disconf overlain by Bernal Fm or unconf by younger beds

SANDIA FORMATION (of Magdalena Group)—Pennsylvanian

1) Cent New Mexico.
2) C. L. Herrick, 1900, p. 112-126.
3) S end of Sandia Mtns, Bernalillo Co., New Mexico.
4) Interb red-br to drk br coarse to fine ss, cgl, sh with some br thin sdy ls. Thickness and facies vary laterally (50′-500′).
5) Morrowan-Desmoinesian: unconf on Mississippian or Precamb rks, conf and gradat overlain by Madera Ls

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., Colorado.
4) Red, piedmont cycloth, ark cgl, sltst and ss, sh, thin, nodul non-ark ls (500'-9,500').
5) Missourian-Wolfcampian: conf on Whiskey Cr. Ls Memb or lateral gradat into Madera Fm in New Mexico or disconf on Minturn Fm; overlain conf and gradat by Yeso Fm in New Mexico and Maroon Fm in Colorado; Crestone Cgl upper cgl memb in type area

SANTA ROSA SANDSTONE (of Dockum Group)—U Triassic

1) NE New Mexico.
2) N. H. Darton, 1922, p. 183.
3) Along Pecos River at Santa Rosa, Guadalupe Co., New Mexico.
4) Gry red to red-br, coarse-gr, mass, xbed ss and peb cgl with clayst and sltst partings, local cgl at base and local buff-wh coarse ss at top (50'-300').
5) Equiv to Interval C of Chinle Fm type; unconf on Bernal Fm, conf and gradat or disconf overlain by Chinle Fm

SAN YSIDRO MEMBER (of Yeso Formation)—Permian

1) N-Cent New Mexico (Nacimiento Mtns).
2) G. H. Wood and S. A. Northrop, 1946, U.S.G.S. Oil and Gas Inv. Map 57.
3) Near Canon, in sec. 3, T. 16 N., R. 2 E., and area immed N in Canon de San Diego Grant, Sandoval Co., New Mexico.
4) Thin to med bed orange-red to drk red ss, sltst, few thin ls (0-300').
5) Leonardian: conf on and local intertong with Meseta Blanca Memb, disconf overlain by Glorieta Ss or U Triassic rks

SEVEN RIVERS FORMATION (in Whitehorse Group or Artesia Group)—Permian

1) SE New Mexico and W Texas.
2) O. E. Meinzer, B. C. Renick, and K. Bryan, 1926, p. 6-7.
3) Bluff S of Seven Rivers River, in sec. 17 and 18, T. 20 S., R. 26 E., Eddy Co., New Mexico.
4) At base interb wh to gry gyps and red ss and sh, few dolo, up part interb green calc sh, ls, and ls breccia, near reef pred wh dolo (0-500').
5) Guadalupian: conf on Queen Fm, disconf overlain by Yates Fm. Basinward grades into lower pt of Capitan Reef

Sheep Pen Sandstone (of Dockum Group)—U Triassic

1) NE New Mexico.
2) B. H. Parker, 1933, p. 40-43.
3) E½ NW½ sec. 35, T. 32 N., R. 35 E., Union Co., New Mexico.
4) Red br thin-bed ss and orange fine-gr, med-bed ss (10'-107').
5) Conf on Sloan Canyon Fm, unconf overlain by Exeter Ss

Sloan Canyon Formation (in Dockum Group)—U Triassic

1) NE New Mexico.
2) B. H. Parker, 1933, p. 38-51.
3) Lower part of Sloan Canyon vally, E-Cent part of T. 31 N., R. 35 E., Union Co., New Mexico.
4) Lgt gry, gry red, gry gr, gry br argill and calc mudst and clayey sltst (93'-150').
5) Conf on Travesser Fm, conf overlain by Sheep Pen Fm. Phytosaur found in 20' orange mudst separating Sloan Canyon and Travesser

SMOKEY HILL CHALK, MARL, SHALE MEMBER (of Niobrara Formation)—U Cretaceous

1) W Kansas, E Colorado, NE New Mexico, SE South Dakota.
2) F. W. Cragin, 1896, p. 51.
3) Sect on Smokey Hill River, Kansas.
4) To N and E is interbed wh thin ls, med-bed ylw orange chlk, some thin bentonite; to W and S grades into interbed gry calc sh, a few thick shly chlk (77'-900').
5) Coniacian-L Santonian: conf on Fort Hayes Ls Memb, disconf or conf and gradat overlain by Pierre Sh

TANSILL FORMATION (in Whitehorse Group or Artesia Group)—Permian

1) SE New Mexico, W Texas.
2) R. K. DeFord and G. D. Riggs, 1941, p. 1713-1728.
3) On U.S. 285, 3.7 miles N of Eddy Co. courthouse in Carlsbad, W½ sec. 26, T. 21 S., R. 26 E., Eddy Co., New Mexico.
4) Interbed lgt gry thin dolo, qtz sltst, few anhydr, grades reefward into calcar, then into up pt of Capitan reef (123'-320').
5) Guadalupian: disconf on Yates Fm, unconf overlain by Salado Fm

TECOVAS FORMATION (in Dockum Formation)—U Triassic

1) NW Texas.
2) C. N. Gould, 1907, p. 20-29
3) Sects on Tecovas Creek, Potter Co., Texas.
4) Variegat wh ylw, purp maroon sdy sh and drk red sh (90'-220').
5) Unconf on Quartermaster Fm, overlain conf by Trujillo Fm or disconf by Tertiary sediments

Tererro Formation—Mississippian

1) N-Cent New Mexico.
2) E. H. Baltz and C. B. Read, 1960, p. 1759-1768.
3) Bluff at Tererro, W side of Pecos River, 100 yds upstream from mouth of Holy Ghost Creek, San Miguel Co., New Mexico.
4) Ls (0-86') divid into three persist membs by Baltz and Read, ascend—Macho Memb, a ls bould cgl, sdy ls matrix, boulds of diff kinds of ls, micrite and sparite, top karst surface (0-28'); Manuelitas Memb, gry irregular-bed oosparite to biosparite (8'-20'), overlaps Macho Memb to lie on Espiritu Santo Fm; Cowles Memb, lgt gry, yel gry to yel bio-, oo-, or pelsparites, slty or sdy to 50%, xbed and thick bed, some chert nodules, unconf on Manuelitas Memb (0-62').
5) Meramecian: unconf on Espiritu Santo Fm, overlain unconf by La Pasada Fm or Flechado Fm

Timpas Limestone Member (of Niobrara Formation)—U Cretaceous see NIOBRARA FORMATION

TODILTO LIMESTONE (of San Rafael Group)—U Jurassic

1) NW New Mexico and extreme NE Arizona.
2) H. E. Gregory, 1916, U.S. Geol. Survey Water-Supply Paper 380 and 1917, U.S. Geol. Survey Prof. Paper 93, p. 55, 56.
3) Todilto Park, McKinley Co., New Mexico.
4) At base mudst with lenses ylw-orange ss, olive-gry, fine-gr ls, pebbles at base, fetid, upper pale red-purple mudst (25′).
5) Conf and gradat or locally disconf (?) on Entrada, disconf overlain by Summerville; calc mudst predom in W, eastward to Prewitt, New Mexico ls reach max thick 25′, and 111′ gyp found near San Ysidro, New Mexico, shallow marine and littoral

Travesser Formation (in Dockum Group)—U Triassic

1) NE New Mexico.
2) B. Baldwin and W. R. Muehlberger, 1959, p. 35, 38.
3) Sect near Travesser Creek, 2 miles S of Baldy Hill, sec. 12, T. 31 N., R. 32 E., Union Co., New Mexico.
4) Red-br, orange mass to thinbed parall lamin to xbed ss, calc cgl, clayey sltst (245′-550′).
5) Disconf or conf on Baldy Hill Fm, overlain conf by Sloan Canyon Fm

TRINITY GROUP or SAND—L Cretaceous

1) S Oklahoma, SW Arkansas, NW Louisiana, Texas.
2) R. T. Hill, 1888, p. 21.
3) Overlies unconf Triassic; overlain unconf by Walnut Fm, includes ascend—Sycamore Sand, Hammet Sh, Cow Creek Ls, Hansel Sand, Glen Rose Ls

TRUJILLO FORMATION (in Dockum Group)—U Triassic

1) NW Texas.
2) C. N. Gould, 1907, p. 20-29.
3) Sects on Trujillo Creek, Oldham Co., Texas.
4) Interbed mass red br xbed ss and cgl, and red, gry sh (20′-250′).
5) Conf on Tecovas Fm, overlain unconf by Tertiary sediments

Tubb sands (see Informal Names—p.11)

†Tucumcari Beds

TUCUMCARI SHALE—L Cretaceous

1) NE New Mexico
2) W. F. Cummins, 1892, p. 201-209.
3) Sect at Mount Tucumcari, NW Quay Co., New Mexico.
4) Interbed gry fossil sh, buff calc ss, with nodules of argill ls (0-60′).
5) Albian: unconf on Morrison Fm, Entrada Ss, or fms of Dockum Group; overlain disconf by Mesa Rica Ss; R. L. Griggs and C. B. Read, 1959, raised unit to fm from memb of Purgatoire Fm which was abandoned in Tucumcari-Sabinoso area; zone of *Gryphaea tucumcari* equiv to Kiamichi and Duck Creek age

WALNUT CLAY (in Fredericksburg Group)—L Cretaceous

1) NE Texas, S Oklahoma.
2) R. T. Hill, 1891, p. 504, 512.
3) Sect at Walnut, Bosque Co., Texas.
4) Ylw gry lamin clay marls and shell beds, *Exogrya texana* and *Gryphaea mucronata* (25′-100′).
5) Albian: unconf on Glen Rose Lss or Antlers Ss, overlain conf and lateral gradat by Comanche Peak Ls (Goodland Ls)

WANAKAH FORMATION (in San Rafael Group)—U Jurassic

1) SW Colorado, NW New Mexico.
2) W. S. Burbank, 1930, p. 172.
3) Sect at Wanakah mine, Ouray district, Colorado.
4) Red, hard calc, sdy sh, concretions, some thin ss (25′-150′).
5) Conf on Entrada Ss (Ocate Ss); conf overlain by Junction Creek Ss Memb and/or Morrison Fm. Harshbarger, Repenning, and Irwin, 1957, in Navajo county reject term Wanakah Fm in favor of Todilto Ls and Summerville Fm; Griggs and Read, 1959, apply term Bell Ranch Fm to beds in Tucumcari-Sabinoso area formerly consid Wanakah equiv

WASHITA GROUP—L and U Cretaceous

1) S Oklahoma, SW Arkansas, NW Louisiana, Texas.
2) R. T. Hill, 1887, p. 298.
3) Overlies Kiamichi Fm, underlies Woodbine Gp, includes ascend—Duck Creek Ls, Fort Worth Ls, Denton Clay, Weno Ls, Pawpaw Fm, Mainstreet Ls, Grayson Fm, Buda Ls, and Maness Sh

WINGATE SANDSTONE (of Glen Canyon Group)—U Triassic

1) W New Mexico (Zuni Plateau).
2) C. E. Dutton, 1885, U.S. Geol. Survey 6th Ann. Rpt. pl. 16, p. 136.
3) Fort Wingate, McKinley Co., New Mexico.
4) Mass, bright red to red-br ss, sltst, and sh (450′).
5) Conf on Chinle in cent outcrop area, disconf to W and SE, disconf overlain by Kayenta Fm or San Rafael Gp; Baker, Dane, and Reeside, 1947, recommended abandon type loc; Harshbarger, Repenning, and Irwin, 1957, divide Wingate in Navajo country into two map units—ascend, Rock Point Memb, and Lukachukai Memb, lower 355′ of type sect is Lukachukai Memb; max thick in Navajo country 1,700′; NE Arizona, SE Utah, and W Colorado

YATES SANDSTONE, FORMATION—Permian

1) E New Mexico, W Texas.
2) G. C. Gester and H. J. Hawley, 1929, p. 487-488; S. Lanphere, 1972, p.
3) Type well: in Yates Oil field, Pecos Co., Texas. Type sec: in Lower Dark Canyon, sec. 26 and 27, T. 23 S., R. 25 E., Eddy Co., New Mexico.

4) Gry to buff, br fine-gr qtz ss with frost grs interbed with thin argill ls, red, gry-gr sh, sltst, and dolo (50′-350′).
5) Leonardian: disconf on Seven Rivers Fm, overlain disconf by Tansill Fm, basinward grades into up Capitan reef

YESO FORMATION—Permian

1) Cent New Mexico.
2) W. T. Lee, 1909.
3) 11.2 miles N. 46°E. of Socorro, where E edge of Socorro quad intersects 34°10′ parallel—NE in sec. 4 and 5, T. 2 S., R. 2 E., and sec. 33, T. 1 S., R. 2 E., Socorro Co., New Mexico.
4) Variegat sss, soft, friable to hard, pink-ylw, often gypsif stlst and sh, earthy ls, mass wh gyp (1,000′-4,250′).
5) Leonardian: conf and gradat on Abo Fm, conf and gradat or disconf overlain by Glorieta Ss or equiv. Widespread in New Mexico and subsurf in W Texas. 4,255′ of Yeso in Standard of Texas-Heard Oil test well has 1,000′+ of halite and a thick gyp sect (Carrizozo dome site of evaporite basin during Yeso time—Kottlowski, 1963). Divid ascend—Meseta Blanca Ss Memb, mass red-orange calc ss, few very thin ls, San Ysidro Memb or Torres Memb, cyclic interb wh pink-ywl ss, sltst, lgt-gry to drk-gry ls, wh gyp, Canas Gyp Memb, mass wh gyp, Joyita Ss Memb, pink-ywl, orange soft xbed ss

INFORMAL NAMES USED IN THIS GUIDEBOOK

Cimarron Anhydrite—Permian (Leonardian)

Found in subsurf of NE New Mexico, a tongue of anhydr with dolo, (35′-155′); lies above arkos cgl and below thick interval of red ss and mudst placed either below or within Yeso Fm (B. Baldwin and W. R. Muehlberger, 1959)

Fullerton sands—Permian (Leonardian)

Subsurf marker zone, near middle to lower Yeso Fm, named for occur in Fullerton oil field, NW Andrews Co., Texas. Equiv of Drinkard Sdy Memb of Yeso

Tubb sands—Permian (Leonardian)

Interbed ss and dolo (50′), import subsurf marker zone, near middle to lower Yeso Fm, named for occur in Sand Hills (Tubb) oil field, Crane Co., Texas. Equiv of Fullerton sands and Drinkard Sdy Memb of Yeso E New Mexico, W Texas—widespread