



List of stratigraphic names used in northwest and central New Mexico

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1959, pp. 100-111. <https://doi.org/10.56577/FFC-10.100>

in:

West-Central New Mexico, Weir, J. E., Jr.; Baltz, E. H.; [eds.], New Mexico Geological Society 10th Annual Fall Field Conference Guidebook, p. <https://doi.org/10.56577/FFC-10>

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LIST OF STRATIGRAPHIC NAMES USED IN NORTHWEST AND CENTRAL NEW MEXICO

by Christina Lochman-Balk¹

This lexicon is an alphabetical listing of the stratigraphic names which have been used in central and northwestern New Mexico for units that are Mississippian through Pleistocene in age. 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. Names preceded by an asterisk have been abandoned for use by the U. S. Geological Survey. Names preceded by a double asterisk are herein recommended for abandonment. (O.) and (G.) preceding the unit name indicate production of oil or gas or both from the unit.

- 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 tenth field conference (1959).

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
char.	characterized, characteristically
comm.	commercial
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
fang.	fanglomerate
fluv.	fluvial
gradat.	gradational
gr.	grain(ed)
gran.	granular
interb.	interbedded
inv.	investigation(s)
L.	lower
lent.	lenticular
lithog.	lithographic
mass.	massive
min.	minimum
occas.	occasional
perst.	persistent
pred.	predominantly
transit.	transitional

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ABO FORMATION—Permian

- 1) Cent. New Mexico
- 2) W. T. Lee, 1909, U. S. Geol. Survey Bull. 389
- 3) Abo Canyon, S end of Manzano Mtns., Socorro Co. (redescribed by Needham and Bates, 1943)
- 4) Drk. red, purple, coarse-gr. ss., cgl. at base, some sh. (300'-800')
- 5) Wolfcampian-Leonardian; conf. and gradat. on Bursum fm., disconf.(?) on upper Madera ls., overlain conf. and gradat. by Yeso fm.; Pray and Otte, 1954, Abo is transit. S with Hueco marine and brackish seq., thin S 1,400' to 250' in S N. Mex. basal tongue is Powwow cgl. and upper tongue is Deer Mtn. red sh.; N. Mex. (wide-spread) and subsurface W Tex.

ALLISON BARREN MEMBER (of Menefee formation) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1925, U. S. Geol. Survey Bull. 767, p. 18
- 3) Near village of Allison, McKinley Co.
- 4) Lt. gry. to wh. lent. sss. interb. with lt. gry. shs. and thin coal seams (600'-800')
- 5) Eagle to Pierre; conf. on U. Gibson coal memb. (Cleary coal memb.), conf. overlain by Cliff House ss.

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 Precam., overlain disconf. by Log Springs fm. or Sandia fm. (Penn.); farthest S exp. in S Sandia Mtns.

Atarque member (of Mesaverde formation) — U. Cretaceous

- 1) W-cent. New Mexico
- 2) W. S. Pike, 1947, Geol. Soc. America Mem. 24, p. 35
- 3) Valley of Horsehead Cr., in secs. 32 and 33, T. 10 N., R. 17 W., 7 mi. SE of Blackrock Agency, Zuni Ind. Res., McKinley Co.
- 4) Gry. and tan interb. sss., sndy. shs., carb. shs., thin coals (127')
- 5) Early Carlile; conf. on lower Mancos sh., conf. overlain by Horsehead memb. of Mancos

ATRASADO MEMBER (of Madera limestone) — Pennsylvanian

- 1) N-cent. New Mexico (Lucero uplift)
- 2) V. C. Kelley and G. H. Wood, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 47
- 3) Lucero uplift, no type sect. desig.
- 4) Med. gry., thin-bed., shly. ls., few mass. beds. interb. with thick gry. shs. (500'-700')
- 5) Missourian-Virgilian; conf. on Gray Mesa memb., conf. overlain by Red Tanks memb.

BACA FORMATION — Tertiary

- 1) Cent. New Mexico
- 2) R. H. Wilpolt and others, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 61
- 3) No type sect. or loc. given; presumably is same as Winchester's - N end of Bear Mtns., Socorro Co.
- 4) Interb. red.-purple to red. ylw. br. ark. sss., cgl., shs. and mudst. (684')
- 5) Eocene(?); unconf. or conf.(?) on Cret., unconf. overlain by Datil fm.; prob. depos. in local basins of various ages; age designation in Wilpolt and Wanek, 1951; red color, well-round. qtzite, pebbles and petrified wood derived from Chinle; is lower 684' of Winchester's (1920) orig. Datil fm. no volcanic frags. found in Baca. thick. range 0'-700'

BARTLETT BARREN MEMBER (of Crevasse Canyon formation) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1925, U. S. Geol. Survey Bull. 767, p. 17
- 3) Near old Bartlett mine shaft, near Dilco village, McKinley Co.
- 4) Lt. gry. to wh. ss., interb. gry. shs. and thin coal seams (330'-400')
- 5) Niobraran; conf. on Dilco coal memb., conf. overlain by lower Gibson coal memb., is local equiv. of Dalton ss. (non-marine) and Mulatto tongue (marine) of Mancos

***Bell Mountain sandstone member (of Miguel formation) — U. Cretaceous**

- 1) Cent. New Mexico
- 2) D. E. Winchester, 1920, U. S. Geol. Survey Bull. 716-A, p. 6
- 3) Near foot of Bell Mountain, in T. 3 N., R. 9 W.
- 4) Thick bed., ylw.-gry. coarse ss. (80')
- 5) Basal Niobraran; conf. on D-Cross memb. of Mancos, conf. overlain by Crevasse Canyon fm.; Dane, and others, 1957, p. 187, name abandon. as unit is an upfaulted duplication of Gallego ss. memb.

BIDAHOCHI FORMATION — Tertiary

- 1) NE Arizona and extreme NW New Mexico
- 2) A. B. Reagan, 1924, Pan-American Geologist, v. 41, p. 366
- 3) Type loc. not given. prob. 15 to 20 mi. E and N Bidahochi, near Twin Buttes, Ariz.
- 4) Interb. lt. gry., lt. gn., pink, buff sss., tuff, bentonite, tuffaceous ss. mudst., aggl. and basalt flows (thick. ranges 500'-1,000')
- 5) Pliocene; unconf. on Cret. rocks, conf. or disconf. overlain by Pleistocene sand and gravel; Reagan, 1932, recog. four subdiv., - Cornfields-Sunrise Springs ser., Ganado ser., White Cone ser., the latter in Hopi Buttes volcanic field; Repenning and Irwin, 1954, recog. three membs. of fm. at White Cone - (1) lower memb., fluv. and lacus. ss., mudst. and few beds of rhy. shards, (2) middle volc. memb., basalt flows, interb. lapilli tuff, aggl. and travert., (3) upper memb. fluv. ss. with some rhy. ash.

BLUFF SANDSTONE (of San Rafael group) — U. Jurassic

- 1) SE Utah

- 2) A. A. Baker, C. H. Dane and J. B. Reeside, Jr., 1936, U. S. Geol. Survey Prof. Paper 183, p. 21. H. E. Gregory, 1938, U. S. Geol. Survey Prof. Paper 188, p. 58
- 3) Bluff, Utah
- 4) Mass., X-bed., gry. to buff, well-sort. ss., minor mudst. lenses (200')
- 5) Conf. and gradat. with Summerville fm., gradat. with Cow Springs ss., conf. and gradat. with Salt Wash memb. of Morrison fm., overlain by Recapture memb.; NE Ariz., SW Colo., NW N. Mex.; thick. ranges 5'-350', is SW cont. (eolian) lateral equiv. of Summerville and Cow Springs

BRUSHY BASIN SHALE MEMBER (of Morrison formation) — U. Jurassic

- 1) SE Utah
- 2) H. E. Gregory, 1938, U. S. Geol. Survey Prof. Paper 188, p. 59
- 3) Brushy Basin, 8 mi. W of Blanding, Utah
- 4) Variegated sandy shs., few thin ls., ss., and chert cgl. lenses (450')
- 5) Conf. and gradat. with Westwater Canyon ss. memb., conf. overlain by Burro Canyon fm. or disconf. by Dakota ss.; W Colo., NE Ariz. and NW N. Mex.; thins progress. SE to 100' at Thorau, N. Mex.; fluv. origin

BURSUM FORMATION — Permian

- 1) Cent. New Mexico
- 2) R. H. Wilpolt, et al., 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 61
- 3) NE ¼ sec. 1, T. 6 S, R. 4 E., Socorro Co. (E. R. Lloyd, 1949, desig. NE¼, sec. 14, T. 2 N., R. 4 E.)
- 4) Drk. purpl.-red and gn. sh. interbed. with arkose, ark. cgl., gry. ls., locally at base a reworked rubbly nodul. ls. (28'-234')
- 5) Wolfcampian; disconf. to gradat. with ark. memb. of Madera ls., overlain conf. and gradat. by Abo fm.; SE N. Mex.

Caloso formation — Mississippian

- 1) Ladron Mtns.
- 2) E. A. Noble, 1950, in V. C. Kelley and Caswell Silver, 1952, N. Mex. Univ. Pubs. Geology no. 4, p. 86-87
- 3) Arroyo Caloso, Ladron Mtns., T. 2 N., R. 2 W.
- 4) Ls. sim. to Kelly ls., fossils in br. weather., cherty, gry. ls. (85')
- 5) Earliest Osagian (Fern Glen equiv.); unconf. on Precam., overlain disconf. by Kelly ls.; A. K. Armstrong, 1955, -max. 45'-50', at base 20'-28' ark. ss., shs., thin-bed. fine-gr., gry. ls., overlain by 17'-23' mass. drk. gry., dense to gran. ls. with chert stringers; cent. N. Mex.; correl. with lower pt. of Escabrosa ls.

CANAS GYPSUM MEMBER (of Yeso formation) — Permian

- 1) Cent. New Mexico
- 2) C. E. Needham and R. L. Bates, 1943, Geol. Soc. America Bull., v. 54, p. 1653-1667
- 3) Secs. 4 and 5, T. 2 S., R. 2 E., and sec. 33, T. 1 S., R. 2 E., near Mesa del Yeso, Socorro Co.
- 4) Mass. beds of gyp. mostly pure, locally with thin silt partings or thin lss. disappearing to N, thickens S, W, SE (0'-115')
- 5) Leonardian; conf. on Torres memb., overlain conf. by Joyita ss. memb.; SE N. Mex. in sub-surface

CARMEL FORMATION (of San Rafael group) — M. and U. Jurassic

- 1) S-cent. and NE Utah
- 2) James Gilluly and J. B. Reeside, 1926, U. S. Geol. Survey Press Bull. 6064
- 3) Mount Carmel, W Kane Co., Utah
- 4) Red and buff ss. and dense ls. at base, red and gn. shs., thin sss. and thick gyp. beds (200'-650') Unconf. on Navajo ss., conf. overlain by Entrada ss.; NW N. Mex., N Ariz., W Colo.; in Navajo country only red slty. facies present; littoral, basal ls. locally, to SW wh. sss. common; fm. thins S and SE to zero near N. Mex.-Ariz. state line

***Chamiso formation — U. Cretaceous**

- 1) Cent. New Mexico
- 2) D. E. Winchester, 1920, U. S. Geol. Survey Bull. 716-A, p. 8-9
- 3) N of Blue Mesa in T. 2 N., R. 8 W.
- 4) Ylw. sss., sndy. shs. and coal beds, all non-marine (1,809')
- 5) Montanan; conf. on Miguel fm., unconf. overlain by Datil fm.; Dane, and others, 1957, p. 191, recommend abandoning Chamiso fm. in favor of Crevasse Canyon fm., equiv. in Alamosa Cr. area.

Chavez member (of Morrison formation) — U. Jurassic

- 1) NW New Mexico
- 2) C. T. Smith, 1954, N. Mex. Bur. Mines and Min. Res. Bull. 31, p. 15-16
- 3) Mesa E of Chaco Canyon Rd., 5 mi. N of Chavez siding, sec. 9, T. 14 N., R. 13 W., Thoreau quad.
- 4) Variegated interb. gry. slsts., purple-red sndy. mudst., wh. to buff, coarse-gr., cgl. sss. (160')
- 5) Disconf. on Thoreau fm., conf. and gradat. with overlying Prewitt memb.; thick, range 100'-200'; equiv. of Recapture shale memb.

CHINLE FORMATION — U. Triassic

- 1) N Arizona, S Utah
- 2) H. E. Gregory, 1915, Am. Jour. Sci. (4) v. 40, p. 102
- 3) Chinle Valley, NE Ariz.
- 4) Four units - red sh. and shly. ss., lenses of ls. cgl., and red sh., variegated shs. with ls. cgl., drk.-br. sndy. shs. (named Divs. A, B, C, D) (400'-1,000')
- 5) Unconf. on Moenkopi fm., conf. or disconf. overlain by Wingate ss.; SW Colo., N N. Mex. SE Nev.; Div. A is Rock Point memb. of Wingate, Div. B is Owl Rock memb. named by Stewart, 1957, Div. C named Petrified Forest memb. by Gregory, 1950, Div. D called Lower Red memb.; Akers, Cooley, and Repenning, 1958, recog. ascend. - Shinarump memb., Lower Red or Mesa Redondo memb., Petrified Forest memb. (lower pt., Sonsela ss. bed, and upper pt.), Owl Rock memb.; thickens SE to max. 1,500' at Zuni; fluv. origin

****Chupadera Formation — Permian**

- 1) New Mexico
- 2) E. H. Wells, 1919, N. Mex. Bur. Mines Bull. 3, p. 10-11, 17-18
- 3) No type loc. or sect.

- 4) Drk. gry., ylw. br., pink sss., sndy. shs. overlain by cream, buff, blu. interb. lss. and gyp. beds
- 5) Leonardian; conf. on Abo ss., unconf. overlain by Triassic beds. All recent mapping has recog. the Yeso, Glorieta, and San Andres fms.; the term Chupadera fm. has lapsed from usage and should be abandoned

CLEARY COAL MEMBER (of Menefee formation) — U. Cretaceous

- 1) NW New Mexico
- 2) E. C. Beaumont, C. H. Dane, and J. D. Sears, 1956, Am. Assoc. Petroleum Geologists Bull. v. 40, p. 2157
- 3) Cleary Mine, SW $\frac{1}{4}$, sec. 31, T. 19 N., R. 1 W., 2 mi. W of La Ventana, Sandoval Co.; unit replaces upper Gibson coal memb.
- 4) Interb. lt. gry. to buff ss., drk. gry. shs. with comm. coals (250'-300')
- 5) Telegraph Creek to Eagle; conf. on Point Look-out ss., Hosta tongue or Gibson coal memb., conf. overlain by Allison barren memb.

(G.) CLIFF HOUSE SANDSTONE (of Mesaverde group) — U. Cretaceous

- 1) SW Colorado and NW New Mexico
- 2) A. J. Collier, 1919, U. S. Geol. Survey Bull. 691-K, p. 297
- 3) Echo Cliffs in Mesa Verde Nat'l. Mon., Montezuma Co., Colo.
- 4) Lt. gry., buff, br. thin-bed. sss. (400')
- 5) Pierre; conf. on Menefee fm., conf. overlain by Lewis sh.; Silver, 1951, transgress. ss. in series of sand lenses, imbricated upward to SW as Chacra ss. and La Ventana ss.

COCONINO SANDSTONE — Permian

- 1) N Arizona
- 2) N. H. Darton, 1910, U. S. Geol. Survey Bull. 435, p. 21, 27
- 3) Coconino Plateau, no type sect. desig.
- 4) X-bed, gry. to wh. ss. (50'-610')
- 5) Late Wolfcampian; conf. and gradat. on Hermit sh. and Rico fm., conf. overlain by Toroweap, gradat. into De Chelly; Wengerd and Matheny, 1958, lateral equiv. of upper Supai, Hermit, Halgaito, and Cedar Mesa; S Utah, and SE Nev.

COW SPRINGS SANDSTONE — U. Jurassic

- 1) N Arizona and S Utah
- 2) J. W. Harshbarger, et al., 1951, N. Mex. Geol. Soc. Gdbk. 2nd Field Conf. p. 97
- 3) Cliff on N face of Black Mesa, 4 mi. E of Cow Springs, Ariz.
- 4) Mass., X-bed., fine-gr., gry.-gn. to ylw.-wh. sss. (342')
- 5) Disconf. on Entrada ss., conf. and gradat. with Summerville fm., disconf. overlain by Dakota ss.; NW N. Mex.; thick. 113'-450'; Harshbarger and others, 1957, fm. is S and SE cont. (eolian) lateral equiv. of Bluff and Summerville fms. in lower pt., upper pt. intertongues with at least the lower membs. of Morrison

CREVASSE CANYON FORMATION (of Mesaverde group)**— U. Cretaceous**

- 1) NW New Mexico
- 2) J. E. Allen and Robert Balk, 1954, N. Mex. Bur. Mines and Min. Res. Bull. 36, p. 91
- 3) On a N fork of Catron Cr. about 3 mi. SW of mouth of Crevasse Canyon, San Juan Co.
- 4) Interb. non-marine shs., sltst., coals, and fine-gr. thin buff ss. (700')
- 5) Niobraran; conf. on Gallup ss., conf. overlain by Point Lookout ss.; thick. 420'-700'; divided ascend. - Dilco coal memb., Dalton ss. tongue (equiv. of Mulatto tongue of Mancos and Bartlett barren memb.) and lower Gibson coal memb.

CURTIS FORMATION (of San Rafael group) — U. Jurassic

- 1) SE and Cent. Utah and W Colorado
- 2) James Gilluly and J. B. Reeside, 1926, U. S. Geol. Survey Press Bull. 6064
- 3) Curtis Point, near head of Cottonwood Springs Wash, on NE side of San Rafael Swell, Utah
- 4) Gry.-gn., glau. calc., fossil., x-bed. sss. with basal cgl., gn. sh., lense (193')
- 5) Disconf. on Entrada ss., conf. and gradat. with Summerville; N-cent. Colo.; Baker, Dane, and Reeside, 1936, in SW Utah Curtis is pink-ylw. gypsif. ss. and gyps., to E in Colo. oolitic sndy. ls. common; Harshbarger, Repenning, and Irwin, 1957, consid. lower Summerville the S lateral equiv. of Curtis fm.

CUTLER FORMATION — Pennsylvanian (top) and Permian

- 1) SW Colorado
- 2) C. W. Cross and E. Howe, 1905, U. S. Geol. Survey Silverton Folio 120
- 3) Cutler Creek, 4 mi. N of Ouray, Colo.
- 4) Bright red sss., lt. red to pink grits, cgl., alternating with sndy. shs., earthy or sndy. lss. (1,000')
- 5) Conf. and gradat. on Hermosa fm., unconf. overlain by Triassic to Tertiary; Wengerd and Strickland, 1954, Rico marine facies a basal memb. of Cutler, transit. btw. Cutler cont. strata and Hermosa marine strata; SE Utah, NE Ariz., NW N. Mex., includes Hoskinnini, De Chelly, Organ Rock, Cedar Mesa, Halgaito tongues

(O. G.) DAKOTA SANDSTONE — U. (?) Cretaceous

- 1) Nebraska and Kansas
- 2) F. B. Meek and F. V. Hayden, 1862, Philadelphia Acad. Nat. Sci. Proc. v. 13, p. 419-420
- 3) Hills back of town of Dakota, Dakota Co., Nebr.
- 4) Ylw., red and wh. sss. interb. with variegated clays and lignite (400')
- 5) Unconf. on Morrison or Lower Cretaceous rocks, conf. or disconf. overlain by Mancos; N. and S. Dak., SE Mont.(?), E Wyo.(?), E Colo., NW Okla., cent. and E N. Mex.; basal ss. of Cret. sects. W of Front Range are termed Dakota(?) fm., some units with fossils now known to be Lower Cretaceous - Burro Canyon fm. of SE Utah and SW Colo.; uranium deposits

DATIL FORMATION — Tertiary

- 1) Cent. New Mexico
- 2) D. E. Winchester, 1920, U. S. Geol. Survey Bull. 716-A p. 9-10
- 3) N end of Bear Mtns., Socorro Co.

- 4) Wh. red, purple, ylw.-gry. interb. tuffs, rhy., cgl., sss., and mudst. (1,824')
- 5) Unconf. on Baca fm. or Cret., disconf. or unconf. overlain by Santa Fe fm.; Wilpolt and others, 1946, remove lower 684' into Baca fm.; Tonking, 1957, adds 150' of weld. rhy. tuff and min. of 1,200' of basalt and bas. andesite flows to top of section (2,500'); char. volcanic material, thickness is variable

D-CROSS TONGUE (of Mancos shale) — U. Cretaceous

- 1) NW New Mexico
- 2) C. H. Dane, A. A. Wanek, and J. B. Reeside, 1957, Am. Assoc. Petroleum Geologists Bull., v. 41, p. 187
- 3) D-Cross Mtn. in secs. 17 and 18, T. 3 N., R. 8 W., Socorro Co.
- 4) Lt. gry. to drk. gry. sndy. shs. and shs. with few thin br. ss. (175')
- 5) Latest carlile; conf. with lower Gallup ss., conf. overlain by upper Gallup ss.; referred by Pike to the Pescado tongue.

DILCO COAL MEMBER (of Crevasse Canyon formation) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1925, U. S. Geol. Survey Bull. 767, p. 17
- 3) Dilco mine sect. at Dilco, McKinley Co.
- 4) Lt. gry. to wh. ss., lt. gry. shs. interb. with comm. coal (240'-300')
- 5) Niobraran; conf. on Gallup ss., conf. overlain by Bartlett barren memb. or Dalton ss.; equiv. S of lower Dalton ss. and Mulatto tongue of Mancos

(O.) ENTRADA SANDSTONE (of San Rafael group) — U. Jurassic

- 1) E, SE, and NE Utah
- 2) James Gilluly and J. B. Reeside, 1926, U. S. Geol. Survey Press Bull. 6064
- 3) Entrada Point, in N part of San Rafael Swell, Utah
- 4) Thin-bedded red sh. and ss. at base, mass. red-br., earthy sss. (265'-844')
- 5) Conf. on Carmel or unconf. on Wingate, conf. and gradat. with Todillo ls., disconf. with Summerville; W and cent. Colo., N N. Mex., NE Ariz.; 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 N. Mex.; shallow marine, littoral, and shore (eolian) origin

GALLEGO SANDSTONE MEMBER (of Gallup sandstone) — U. Cretaceous

- 1) Cent. New Mexico
- 2) D. E. Winchester, 1920, U. S. Geol. Survey Bull. 716-A, p. 6
- 3) Pueblo Viejo mesa, sec. 17, T. 4 N., R. 7 W.
- 4) Mass. ylw. ss., friable (50'-90') occurs 900' above Dakota ss.
- 5) Earliest Niobraran; conf. on D-Cross memb. of Mancos, conf. overlain by Crevasse Canyon fm.; Dane and others, 1957, retain the Gallego memb. as indicated but abandoned the Miguel fm.

(O. G.) GALLUP SANDSTONE (of Mesaverde group) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1925, U. S. Geol. Survey Bull. 767, p. 17
- 3) At Gallup, N. Mex.
- 4) Three perst. mass. pink or lt. gry. sss. interb. with gry. shs. and coals (180'-250')
- 5) Carlile-Niobraran; conf. on lower Mancos, including Horsehead tongue and Pescado tongue; conf. overlain by Crevasse Canyon fm.

GIBSON COAL MEMBER (of Menefee formation) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1925, U. S. Geol. Survey Bull. 767, p. 17-18
- 3) At village of Gibson, McKinley Co.
- 4) Lt. gry. to wh. lent. mass. X-bed sss. interb. with fissile gry. shs. and comm. coals (150'-175')
- 5) Niobraran; conf. on Bartlett barren memb. or upper Dalton ss., conf. overlain by Allison barren memb.; Silver, 1951, section thickens to 350' near Catron Cr. and is split in two parts by Hosta ss. and Satan tongues of Mancos; originally included as part of Crevasse Canyon fm.; Beaumont and others, 1956, introduced Cleary coal memb. replacing upper Gibson coal memb.

GILA CONGLOMERATE — Tertiary - Quaternary

- 1) Arizona and SW New Mexico
- 2) G. K. Gilbert, 1875, U. S. Geog. and Geol. Surv. W of 100th Mer., v. 3, p. 540-541
- 3) Gorge of upper Gila River and tributaries of Bonita, Prieto, Gilita, and San Francisco Crs.
- 4) Interb. lent. cgl., sss., siltst., caliche cement, wh. buff to ylw. br. with basalt flows (1,000'-1,500')
- 5) Pliocene and Pleistocene; disconf. to unconf. on Datil and older fms., disconf. overlain by Recent gravels; western equiv. of Santa Fe group; fang. origin

GLEN CANYON GROUP — U. Triassic-Jurassic

- 1) S and E Utah, N Arizona
- 2) J. B. Reeside, Jr., C. E. Dobbin, A. A. Baker, and E. T. McKinght, 1927, Am. Assoc. Petroleum Geologists Bull., v. 11, p. 787
- 3) Glen Canyon of Colorado River, Kane Co., Utah
- 4) Variegated sss., shs., and sltst. (100'-1,000')
- 5) Conf. on Chinle in cent. outcrop area, disconf. both to W and SE, disconf. overlain by San Rafael group; James Gilluly and J. B. Reeside, Jr., 1928, recog. three fms. - ascend. - Wingate ss., Todilto(?) fm., Navajo ss. all cont. (eolian or fluv.) origin; Baker, Dane, and Reeside, 1936, renamed Todilto(?) fm. - the Kayenta fm.; SW Colo., NW N. Mex.

GLORIETA SANDSTONE — Permian

- 1) Cent. N 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 N. Mex., subsurface of W Tex.

GRAY MESA MEMBER (of Madera limestone) — Pennsylvanian

- 1) Cent. New Mexico (Lucero uplift)
- 2) V. C. Kelley and G. H. Wood, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 47
- 3) Along steep E face of Gray Mesa, from Comanche Arroyo to Monte de Belen, T. 5 N., R. 3 W., Valencia Co.
- 4) Thick-bed., occas. mass., cherty gry. lss. (900')
- 5) Lampasan(?) - Desmoinesian; conf.(?) on Sandia fm., conf. overlain by Atrasado memb.

Hells Mesa member (of Datil formation — M.(?) Tertiary

- 1) Cent. New Mexico
- 2) W. H. Tonking, 1957, N. Mex. Bur. Mines and Mineral Resources Bull. 41, p. 29-30
- 3) At Hells Mesa in secs. 17 and 20, T. 1 N., R. 4 W., Socorro Co.
- 4) Wh., lt.-gry., and pink weld. rhy. tuff., xtal rhy. tuff and rhy. aggl. (250')
- 5) Disconf. on Spears memb., conf. overlain by La Jara Peak memb.; max. thick. up to 2,000' in Gallinas Mtns.; corres. to 120' of qtz. rhy. plus overly. 150' of rhy. in Winchester's type section; middle memb. - a rhy. tuff seq.

(O. G.) HERMOSA FORMATION — Pennsylvanian

- 1) SW Colorado
- 2) C. W. Cross and A. C. Spencer, 1899, U. S. Geol. Survey La Plata Folio 60, p. 8
- 3) Animas River valley, near Hermosa, Colo.
- 4) Upper pt. shs. with occas. lss., middle pt. bands of mass. drk.-gry. fossil. lss. alternating with sss. and cgl., lower pt. gn.-gry. sss. and shs. (1,800')
- 5) Desmoinesian, Missourian, Virgilian, and Wolfcampian; conf and gradat. on Paradox fm., conf. and gradat. overlain by Rico memb. of Cutler; Wengerd and Strickland, 1954, consists of a carbonate facies (gry. argil. ls. and gry. calc. sh. overlain by gry., fine-gr., slty. to sndy. ls.) and a clastic facies (ark. ss., fine-med. qtzose. ss., sltst., clayst., thin ark. to micaceous lss.) 0'-5,000'; Wengerd and Matheny, 1958, raise Hermosa to group status - contains ascend. - Pinkerton Trail, Paradox, Honaker Trail fms.; SE Utah, NE Ariz. (subsurface), NW N. Mex.

HOLBROOK MEMBER (of Moenkopi formation) — L. Triassic

- 1) NE Arizona
- 2) Dorsey Hager, 1922, Min. and Oil Bull., v. 8, nos. 1 and 3
- 3) Cliffs btw. Winslow and Holbrook, Ariz.
- 4) Red, thin-bed. to thick-bed., x-bed. channel sss. and sltsts., mud-pellet cgl., red mudst. (48'-200')
- 5) Conf. or disconf. on Moqui memb., but to E unconf. on Permian, disconf. overlain by Shinarump memb. of Chinle; upper memb. of Moenkopi

Honaker Trail formation — Pennsylvanian

- 1) Paradox Salt Basin, Four Corners area
- 2) S. A. Wengerd and M. L. Matheny, 1958, *Am. Assoc. Petroleum Geologists Bull.*, v. 42, p. 2075, 2080
- 3) Honaker Trail, sec. 29, T. 41 S., R. 18 E., along San Juan Canyon, San Juan Co., Utah
- 4) Gry.-red, gry., fine-gr. to coarse gr. ls. with gry. and red chert, red.-gry. calc. sandy. sltst. (550')
- 5) Desmoinesian-Virgilian; conf. on Paradox fm., overlain conf. by Rico memb. of Cutler; facies varies across Paradox basin; thick. 0'-1,750'

Horsehead tongue (of Mancos shale) — U. Cretaceous

- 1) W.-cent. New Mexico
- 2) W. S. Pike, 1947, *Geol. Soc. America Mem.* 24, p. 35
- 3) Valley of Horsehead Cr., in secs. 32 and 33, T. 10 N., R. 17 W., 7 mi. SE of Blackrock Agency, Zuni Ind. Res., McKinley Co.
- 4) Drk. gry. marine sh. (408')
- 5) Prob. middle Carlile; conf. on Atarque memb. of Mesaverde, conf. overlain by lower Gallup ss.; lowest tongue

HOSTA SANDSTONE TONGUE (of Point Lookout sandstone) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1934, *U. S. Geol. Survey Bull.* 860-A, p. 18
- 3) Hosta Butte at W side of S end of Dalton Pass, McKinley Co.
- 4) Lt. gry. to ylw. massive ss. (0'-250')
- 5) Lower part - late Niobraran, upper part - Telegraph Creek to middle Pierre; conf. on lower Gibson coal memb., conf. overlain by upper Gibson coal memb. (Cleary coal memb.); Hosta littoral ss. split by Satan tongue of Mancos; Pike, 1947, upper Hosta ss. is lateral equiv. of Point Lookout ss.

JOYITA SANDSTONE MEMBER (of Yeso formation) — Permian

- 1) Cent. New Mexico
- 2) C. E. Needham and R. L. Bates, 1943, *Geol. Soc. America Bull.* v. 54, p. 1653-1668
- 3) Sec. 33, T. 1 S., R. 2 E., near Meso del Yeso, Socorro Co.
- 4) Soft, X-bed. ss. and pink-ylw., orange thin-bed. ss., uppermost unit of Yeso fm. (100'-185')
- 5) Leonardian; conf. on Canas gyp. memb. or Torres memb., conf. overlain by Glorieta ss.

KAIBAB LIMESTONE — Permian

- 1) N Arizona
- 2) N. H. Darton, 1910, *U. S. Geol. Survey Bull.* 435, p. 21, 28, 32
- 3) Kaibab Gulch, 8 mi. SW of Paria, Utah
- 4) Dense, gry., cherty ls. (820')
- 5) Leonardian; conf. and gradat. with Toroweap, unconf. overlain by Moenkopi; S Utah and SE Nev.; probable equivalent of part of San Andres ls.

KAYENTA FORMATION (of Glen Canyon group) — L. Jurassic(?)

- 1) SE and S Utah
- 2) A. A. Baker, C. H. Dane, and E. T. McKnight, 1931, *U. S. Geol. Survey Prelim. Map* unnumbered
- 3) 1 mi. NE of Kayenta, Ariz.
- 4) Pale red-purple to red-br., fine-gr. qtzose. ss. (144')
- 5) Unconf. on Wingate ss. or conf. on Moenave fm., conf. and gradat. with Navajo ss.; unit is more fully described in Baker, 1933; SW of type loc. Kayenta thickens (max. 678' at Ward Terrace) and grades into intercal. sltsts., mudsts., and fine sss.; NE Ariz. and SW Colo., extreme NW N. Mex.; fluv. origin

KELLY LIMESTONE — Mississippian

- 1) Magdalena Mtns.
- 2) C. L. Herrick, 1904, *Am. Geologist* v. 13, p. 310 (*Graphic-Kelly ls.)
- 3) Kelly mining dist., Magdalena Mtns., Socorro Co.
- 4) Lt. blu.-gry., med.-coarse xtall. crinoid., thick-bed. lss. with 5' dense arg. ls. near middle, called "Silver Pipe" because of close assoc. with ore shoots (125')
- 5) Late Osagian (Koekuk equiv.); disconf. on Caloso fm., overlain unconf. by Magdalena group; Armstrong, 1958, restricted unit at type locality to upper 70.1' of lss., including "Silver Pipe" near base, lower 34.9' is Caloso fm.; cent. and SW N. Mex.; 130' on Bear Mtn., W of Silver City, 51' in Lemitar Mtns., 35' near Rio Salado, S Ladrón Mtns., beveled to zero at 3 mi. N of Rio Salado

La Cruz Peak formation — U. Cretaceous

- 1) Cent. New Mexico
- 2) W. H. Tonking, 1957, *N. Mex. Bur. Mines and Min. Res. Bull.* 41, p. 20
- 3) On La Cruz Peak, secs. 13 and 24, T. 2 N., R. 6 W., 4 mi. SW of Puertecito, Socorro Co.
- 4) Interb. marine drk. gry. shs. and three massive ylw.-gry. sss. (600')
- 5) Carlile-earliest Niobraran; conf. on Tres Hermanos(?) ss., conf. overlain by Crevasse Canyon fm.; fm. includes equiv. of lower Mancos sh., lower Gallup ss., Pescado tongue, and Gallego ss. memb. of upper Gallup ss.

La Jara Peak member (of Datil formation) — M. Tertiary

- 1) Cent. New Mexico
- 2) W. H. Tonking, 1957, *N. Mex. Bur. Mines and Min. Res. Bull.* 41, p. 30-32
- 3) In N Bear Mtns. in secs. 27 and 34, T. 2 N., R. 5 W., 3-3½ mi. SW of La Jara Peak, Socorro Co.
- 4) Basalt and porphyritic basalt-andesite flows with interb. vol. ss. and cgl. beds at top (2,000'-2,500')
- 5) Conf. on Hells Mesa memb., disconf. or unconf. overlain by Santa Fe; uppermost vol. ss. and cgl. beds lithologically like Santa Fe; basaltic dikes cut all membs. of Datil fm. but not Santa Fe beds; upper memb. - basalt seq.

LAKE VALLEY LIMESTONE — Mississippian

- 1) Lake Valley mining dist., Sierra Co.
- 2) E. D. Cope, 1882, Eng. Mining Jour. v. 34, p. 214
- 3) No type sect. for fm.; Laudon and Bowsher, 1941, 1949 give type locality and sections for each member
- 4) Coarse xtall., blu. gry., crinoidal ls., blu. sh. in lower pt., cherty near top (200')
- 5) Osagian; disconf. on Percha sh. (Devonian) or Cabellero fm. (Kinderhookian), overlain conf. by Kelly ls., or unconf. by Magdalena gr. or younger units; Laudon and Bowsher, 1949, recog. six membs. scend. - Andrecito memb., thin-bed., gry. fossil. ls. grading up into thin-bed., drk.-gry., cherty ls., Alamogordo memb., mass. blk. cherty, cliff-forming ls., Nunn memb., soft blu.-gry. marls and nodul. crinoid. ls., Tierra Blanca memb., med. to thin-bed. gry. to br. coquina, cherty, Arcente memb., soft sltsts., slope-form., Dona Ana memb., cliff-form. chty. crinoid. ls. (two upper membs. restricted to San Andres and Sacramento Mtns.); S-cent. and SW N. Mex.

LOS VALLOS MEMBER (of Yeso formation) — Permian

- 1) Cent. New Mexico (Lucero uplift)
- 2) V. C. Kelley and G. H. Wood, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 47
- 3) Los Vallos, Lucero uplift, no type sect. desig.
- 4) Lower part ylw., pink, gry. slty. shs., a few thin lss. and thicker gyps., upper part thin sss., dark lss., slty. shs., 50 percent gyps. (1,000'-1,400')
- 5) Leonardian; conf. on Meseta Blanca memb., conf. overlain by Glorieta ss.

LUKACHUKAI MEMBER (of Wingate sandstone) — U. Triassic

- 1) Navajo country, NE Arizona, SE Utah, W Colorado, NW New Mexico
- 2) J. W. Harshbarger and others, 1957, U. S. Geol. Survey Prof. Paper 291, p. 10
- 3) Escarp. NE of Lukachukai, Apache Co., Ariz.
- 4) Pale red-br. fine-gr. qtz. ss., mass. and X-bed. (300')
- 5) Disconf. on Chinle fm. or conf. and gradat. on Rock Point memb., conf. overlain by Moenave fm. or unconf. by Kayenta fm.; memb. widespread in Navajo country but pinches out to E near Correo, N. Mex., and also to W and S; eolian origin

MADERA LIMESTONE (of Magdalena group) — Pennsylvanian

- 1) Bernalillo Co.
- 2) C. R. Keyes, 1903, Ores and Metals, v. 12, p. 48
- 3) E slope of Sandia Mtns.
- 4) Blu. to gry. ls. beds (300')
- 5) Desmoinesian-Virgilian; conf. and gradat. on Sandia fm., overlain conf. or disconf. by Bursum or Abo; Thompson, 1942, recommended abandonment, Kelley and Wood, 1946, in Lucero uplift, recog. three membs., ascend. - Gray Mesa, Atrasado, Red Tanks; Wilpolt, et al., 1946, in E Socorro Co., recog. two membs., - ascend. - lower gray ls. memb., and arkosic ls. memb., Baltz and Bachman, 1956, in SE Sangre de Cristo Mtns., recog. two membs., ascend. - interb. gray fossil. xtall. ls., blk. sh., sltst., thin ss., and interb. ark. cgl. ss., fossil. gry. ls., purple-red sh., thick gry., olive sltst.; N. Mex. (widespread)

MAGDALENA GROUP — Pennsylvanian

- 1) Cent. New Mexico
- 2) C. H. Gordon, 1907, Jour. Geology v. 15, p. 807-816
- 3) Magdalena Mtns. — no type sect. desig.
- 4) Divided into - descend. - Madera ls. (300'-700') drk. blu. lss., and Sandia fm. (500'-700') interb. blu. and blk. clay shs., dense earthy lss., cgl., sss. or qtzite. (max. 1,400')
- 5) Restricted to Penn. disconf. on Miss. lss., disconf. or conf. with Permian beds; N. Mex. (widespread) and W Tex.

(O. G.) MANCOS SHALE — U. Cretaceous

- 1) W Colorado
- 2) C. W. Cross, 1899, U. S. Geol. Survey Telluride Folio 57
- 3) Mancos Valley near town of Mancos, SW Colo.
- 4) Drk.-gry. sndy. shs. with ss. lenses and fossil. calc. sh. and thin ls. lenses (2,000')
- 5) Conf. or disconf. on Dakota or Dakota(?), conf. overlain by Mesaverde gr.; E Utah, S and cent. Wyo., NE Ariz., N. Mex. (widespread); oscill. of the shore across W N. Mex. caused intertong. of the marine Mancos with non-marine Mesaverde, marine tongues ascend. - Horsehead tongue, Pescado tongue, D-Cross tongue, Mulatto tongue and Satan tongue

****MANZANO GROUP — Permian**

- 1) Cent. New Mexico
- 2) C. L. Herrick, 1900, Am. Geologist v. 25, p. 337
- 3) No type loc. or sect. given
- 4) Coarse red qtzites, and sss. interb. with drk. earthy lss., shs. (1,000-2,000')
- 5) Wolfcampian-Leonardian; unconf. on Madera ls., unconf. overlain by Triassic beds; all recent mapping has recognized four or five fms., ascend. - Bursum fm., Abo fm., Yeso fm., Glorieta ss. and San Andres ls. in this series of beds, and the term Manzano group has lapsed from usage and should be abandoned

MENEFFEE FORMATION (of Mesaverde group) — U. Cretaceous

- 1) SW Colorado and NW New Mexico
- 2) A. J. Collier, 1919, U. S. Geol. Survey Bull. 691-K, p. 296
- 3) Meneffee Mtn., Mesa Verde Nat'l Mon., Montezuma Co., Colo.
- 4) Interb. gry.-buff, mass. to thin sss., with gry! shs. and coal seams and comm. coal (400')
- 5) Telegraph Creek to Pierre; conf. on Point Lookout ss. or lower Gibson coal memb., conf. overlain by Cliff House ss.; pred. cont. (lagoon, swamp, and fluv.) but does contain marine units; divided ascend. - Cleary coal memb. (equiv. of upper Gibson coal memb.) and Allison barren memb.

Mesa Redondo member (of Chinle formation) — U. Triassic

- 1) NE Arizona
- 2) M. E. Cooley, 1958, Plateau v. 31, p. 7-15
- 3) Along N side of Little Colorado R. 1 to 3 mi. E of Ariz. Hwy. 260, 16 mi. NW of Concho, Ariz.
- 4) Gry., red-purple, fine-gr. slty. ss., sltst. and mudst., a medial cglitic ss. (159')
- 5) Conf. and gradat. on Shinarump memb., gradat. with lower red memb., conf. with Petrified Forest memb.; is S lateral equiv. of lower red memb., Monitor Butte memb. in Monument Valley area, a different facies, is N and W equiv. of lower red memb.

(O. G.) MESAVERDE GROUP — U. Cretaceous

- 1) W Colorado and NW New Mexico
- 2) W. H. Holmes, 1877, U. S. Geol. and Geog. Survey 9th Ann. Rpt. for 1875, p. 245, 248
- 3) Mesa Verde, Montezuma Co., Colo.
- 4) Divided descend. - upper ss., 190' mass. ss., mid. coal group of 800'-900' of ss., sh. marl and lignite, lower ss., 120' mass. ss. (1,200'-1,500')
- 5) Carlile to Pierre; conf. on Dakota ss. or Mancos sh., conf. overlain by Lewis sh.; Collier, 1919, named the divisions descend. - Cliff House ss., Menefee fm., Point Lookout ss.; thick. range - type loc. 1,000'. NE 422' to SW 3,100+; NE Ariz., E Utah, S and Cent. and N Wyo.(?), N. Mex. (widespread)

MESETA BLANCA SANDSTONE MEMBER (of Yeso formation) — Permian

- 1) N New Mexico (Nacimiento Mtns.)
- 2) G. H. Wood and S. A. Northrop, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 57
- 3) Near Canon, in sec. 3, T. 16 N., R. 2 E., and in area immed. N in Canon de San Diego Grant
- 4) Mass.-bed. orange to red, X-bed. ss., cliff-form. (0'-400')
- 5) Leonardian; conf. on Abo fm. to S, tongues with Abo to N and Cutler to NW, conf. overlain by San Ysidro memb. or other membs. of Yeso

***Miguel formation — U. Cretaceous**

- 1) Cent. New Mexico
- 2) D. E. Winchester, 1920, U. S. Geol. Survey Bull. 716-A, p. 6-7
- 3) Two mi. W of I.N.M. ranch, Socorro Co.
- 4) Four mass. perst. sss., interb. with thin-bed ss., sndy. shs., drk. gry. shs. with coal (2,082')
- 5) Coloradoan; conf. on Dakota ss., conf. overlain by Chamiso fm.; Dane, et al., 1957, p. 187, name abandon. because of orig. incorrect definition of fm., and duplication of beds as mapped and measured in type area

MOENKOPI FORMATION — L. Triassic

- 1) N Arizona
- 2) L. F. Ward, 1901, Am. Jour. Sci. (4) v. 12, p. 401-413
- 3) Moenkopi Wash, Grand Canyon, Ariz.
- 4) Drk. br., argill. gypsif. shs., argill. ss. and shs., wh. calc. shs. and thin lss. (700')
- 5) Unconf. on Permian, disconf. overlain by Chinle fm.; McKee, 1954, thick. ranges from 2,000' on the W to zero in E, cont. and marine beds of six lithologic types, recog. three membs. in NE Ariz. ascend. - Wupatki, thin-bed. slty. ss. and red fine-gr. ss., X-bed., Moqui, gry. thin, lent. gypsif. sltst., mudst. and thick-bed. gyp., Holbrook, pale red, thin to thick-bed ss., some sltst., marine ls. only in lower half of fm.; S Utah, SE Nev., SW Colo., NW N. Mex.

MOLAS FORMATION — Pennsylvanian

- 1) SW Colorado
- 2) C. W. Cross and E. Howe, 1905, U. S. Geol. Survey Silverton Folio 120
- 3) Molas Lake, Needle Mtns. quad., Colo.
- 4) Red calc. shs. and sss. with chert, ls., and qtzite. pebbles and thin fossil. ls. lenses (75')
- 5) Morrowan-Atokan; unconf. on Leadville ls., conf. overlain by Pinkerton Trail formation; Wengert

and Strickland, 1954, recog. three membs. - lower memb. a ls.-chert. regolith cement. by calc. slty. clayst., mid. memb. sltst. and sh. with some intrafm. cgl., upper memb. (local) fossil. marine red and gn. sh. and ss., 0'-200'; SE Utah, sub-surface NE Ariz. and NW N. Mex.

MOQUI MEMBER (of Moenkopi formation) — L. Triassic

- 1) NE Arizona (S and W Black Mesa basin)
- 2) E. D. McKee, 1954, Geol. Soc. Amer. Mem. 61
- 3) Moqui Wash, S of U. S. Hwy. 66, W of Winslow, Ariz.
- 4) Pale br.-olive gry. sltst., clayst. with gry.-gn. gyp. beds (55')
- 5) Conf. on Wupatki memb., conf. or disconf. overlain by Holbrook memb.; is mid. memb. of Moenkopi, disting. by gyp. and lt. color; name replaced Winslow memb. of Moenkopi fm. of McKee, 1951

(G.) MORRISON FORMATION — U. Jurassic

- 1) Colorado, W S. Dakota, Wyoming
- 2) G. H. Eldridge, 1896, U. S. Geol. Survey, Mon. 27, p. 22-23, 60-62
- 3) Morrison, near Denver, Colo.
- 4) Variegat. calc. mudst., sltst., sss., shs. (200')
- 5) Disconf. on fms. of San Rafael gr., unconf. overlain by Dakota; N N. Mex., NE Ariz., E Utah, S-cent. Mont., W Okla. and W Kans.; divided in SW area into, ascend. - Salt Wash memb., Recapture memb., (equiv. Chavez memb.), Westwater Canyon memb. (equiv. Prewitt memb.), Brushy Basin memb.

MULATTO TONGUE (of Mancos shale) — U. Cretaceous

- 1) NW New Mexico (Mt. Taylor area)
- 2) C. B. Hunt, 1936, U. S. Geol. Survey Bull. 860-B, p. 44 (J. D. Sears, 1934, U. S. Geol. Survey Bull. 860-A, p. 14)
- 3) S end of Canyon Mulatto, 9 mi. NW of San Mateo
- 4) In S lt. tan marine sndy. sh. with thin ss. and local grits, N grading into drk.-gry. shs. (250'-400')
- 5) Mid. Niobraran; conf. on Dilco coal memb., conf. overlain by Dalton ss. memb.

NACO LIMESTONE — Pennsylvanian and Permian

- 1) SE Arizona
- 2) F. L. Ransome, 1904, U. S. Geol. Survey Prof. Paper 21, p. 44-46
- 3) Naco Hills, Bisbee quad. - no type sect. desig.
- 4) Thin - to mass.-bed. lt. gry., fine-gr., fossil. lss., crinoid., chert common (1,500'-2,000')
- 5) Atokan thru Leonardian; appar. conf. on Miss. lss., unconf. overlain by basal Cret.; Gilluly, Cooper, and Williams, 1954, raised to Naco gr.; E-cent. Ariz., SW and W-cent. N. Mex.

NAVAJO SANDSTONE (of Glen Canyon group) — L. Jurassic

- 1) N Arizona
- 2) H. E. Gregory, 1915, Am. Jour. Sci. (4) v. 40, p. 102, 112
- 3) Navajo Canyon, Ariz.
- 4) Lt.-red, mass. X-bed. qtz. sss. (400')
- 5) Conf. and gradat. on Kayenta fm., unconf. overlain by fms. of San Rafael gr.; Harshbarger, Reppening, and Irwin, 1957, max. thick. 1,400' in NW Navajo country, thins S and SE to zero, lent. beds of fresh-water cherty. ls.; S Utah, W Colo., extreme NW N. Mex.; eolian origin

OWL ROCK MEMBER (of Chinle formation) — U. Triassic

- 1) SE Utah
- 2) J. H. Stewart, 1957, Am. Assoc. Petroleum Geologists Bull. v. 41, p. 458
- 3) Owl Rock, N of Kayenta, Ariz.
- 4) Pale red to red-br., sltsts. intercal. with thin to thick lss. (150'-250')
- 5) Conf. on Petrified Forest memb., conf. overlain by Church Rock memb. of Chinle or disconf. by Wingate ss.; thick. ranges from 0'-450'; NE Ariz., NW N. Mex.

(O. G.) PARADOX FORMATION — Pennsylvanian

- 1) SE Utah, SW Colorado
- 2) A. A. Baker, 1933, U. S. Geol. Survey Bull. 841, p. 13-18
- 3) Paradox Valley, Montrose Co., Colo. - no type sect. desig.
- 4) Salt, gyp. and anhyd. interb. with blk. and br. shs., a few lss.
- 5) Lampasan-Desmoinesian; conf. on Pinkerton Trail, conf. overlain by Hermosa fm.; Wengerd and Strickland, 1954, consists of 3 membs. - (1) 0'-200' predom. anhyd., gyp., blk. sh. minor dolo., (2) gyp., salt, interb. blk. shs., calc. sltst., blk. argil. ls., up to 4,500', (3) blk., slty. calc. sh., br. fine-xtall. argil. dolo., wh. anhyd., gry.-wh. gyp., br. argil. fine-gr. ls., 200'-500'; W Colo., NW N. Mex. (subsurface)

Pescado tongue (of Mancos shale) — U. Cretaceous

- 1) W-cent. New Mexico
- 2) W. S. Pike, 1947, Geol. Soc. America Mem. 24, p. 34
- 3) N side of valley of Pescado Cr., below Pescado village, in sec. 32, T. 11 N., R. 17 W. and sec. 5, T. 10 N., R. 17 W.
- 4) Gry. marine sh., (50')
- 5) Mid.-late Carlile; conf. on lower Gallup ss. (35' cliff), conf. overlain by Dilco-lower Gibson or upper Gallup ss.; base of tongue occurs 209' above top of main Mancos sh.

PETRIFIED FOREST MEMBER (of Chinle formation) — U. Triassic

- 1) S Utah and N Arizona
- 2) H. E. Gregory, 1950, U. S. Geol. Survey Prof. Paper 220, p. 67
- 3) E side of Virgin River valley near Springdale, Utah (fig. 36)
- 4) Variegated, red, orange, purple, gn. benton. sltsts. and clay., sss.; fossil wood common (650'-800')
- 5) Conf. on lower red memb., conf. overlain by Owl Rock memb.; Akers, Cooley, and Repenning, 1958 recog. in NE Ariz. - lower pt., med.-red-purple, blu.-gry. mudst. and thin X-bed. ss. and sltst., petrified logs, Middle Sonsela ss. bed, upper pt., variegated mudst., red sndy. sltst., and lent. sss., 800'-1,000'; NW N. Mex.

Pinkerton Trail formation — Pennsylvanian

- 1) Paradox Salt Basin, Four Corners area
- 2) S. A. Wengerd and J. W. Strickland, 1954, Am. Assoc. Petroleum Geologists Bull. v. 38, p. 2178-2169
- 3) Pinkerton Trail, 12 mi. N of Durango, Colo. on W side of U. S. Hwy. 550

- 4) Drk.-gry., fine to coarse-xtall., crinoid. and fusulinid lss. with some dark. sh. (0'-200')
- 5) Atokan-earliest Desmoinesian; conf. on Molas fm., overlain conf. by Paradox fm., merges with and indisting. from Hermosa fm. where Paradox absent; equiv. to lower memb. of Hermosa fm. of Bass, 1944

(O. G.) POINT LOOKOUT SANDSTONE (of Mesaverde group) — U. Cretaceous

- 1) SW Colorado and NW New Mexico
- 2) A. J. Collier, 1919, U. S. Geol. Survey Bull. 691-K, p. 296
- 3) Cliffs at Point Lookout, about 7½ mi. SW of Mancos, Colo.
- 4) Mass. lt. gry. to ylw. sss. (250'-300')
- 5) Telegraph Creek to mid. Pierre; conf. on upper Mancos sh., conf. overlain by Menefee fm.

Popotosa formation — Tertiary

- 1) Cent. New Mexico
- 2) C. S. Denny, 1940, Jour. Geol. v. 48, p. 77-84
- 3) Valley of Silver Cr., T. 1 N., R. 2 W., Socorro Co.
- 4) Interb. red tuff. ss., cgl. sndy. silt and tuff overlain by X-bed ss., cgl., and pink and gry. tuff (3,000'-5,000')
- 5) Late Miocene; locally conf. on Mio.(?) volcs., unconf. overlain by Santa Fe gr.

Prewitt sandstone member (of Morrison formation) — U. Jurassic

- 1) NW New Mexico
- 2) C. T. Smith, 1954, N. Mex. Bur. Mines and Min. Res. Bull. 31, p. 16-17
- 3) S of Mt. Powell in sec. 9, T. 14 N., R. 13 W., Thoreau quad.
- 4) Mass., coarse-gr., X-bed., pink-red, cglitic. ss., sltst. lenses (185'-190')
- 5) Disconf. on Chavez memb., conf. and gradat. with Brushy Basin memb., equiv. of Westwater Canyon ss. memb.

****Puertecito formation — Triassic-L. Cretaceous**

- 1) Cent. New Mexico (Socorro and Valencia Cos.)
- 2) E. H. Wells, 1919, N. Mex. Sch. Mines Bull. 3
- 3) Puertecito dist., Socorro and Valencia Cos. - no type sect. desig.
- 4) Sed. beds btw. Perm. and Cret., purple-red and purple-gry. sss., shs., few cgl. (1,150'-1,250')
- 5) N. Mex. Bur. Mines recommends abandoning term; has not subsequently been used

RECAPTURE SHALE MEMBER (of Morrison formation) — U. Jurassic

- 1) SE Utah
- 2) H. E. Gregory, 1938, U. S. Geol. Survey Prof. Paper 188, p. 58-59
- 3) Near mouth of Recapture Creek, 6 mi. E of Bluff, Utah
- 4) Red to variegated calc., gypsif. shs., thin wh. ss. (100'-300')
- 5) Disconf. on San Rafael gr., conf. and gradat. with Cow Springs ss., Salt Wash memb., and overly. Westwater Canyon memb.; NE Ariz., NW N. Mex.; Harshbarger, et al., 1958, max. thick. 483' in Chuska Mtns., thins S to 59' at Ft. Wingate, then thickens E to Thoreau; equiv. of Chavez memb.; fluv. origin

RED TANKS MEMBER (of Madera limestone) — Permian and uppermost Pennsylvanian (?)

- 1) Cent. New Mexico (Lucero uplift)
- 2) V. C. Kelley and G. H. Wood, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 47
- 3) W side of Red Tanks Arroyo, NW $\frac{1}{4}$ sec. 4 and NE $\frac{1}{4}$ sec. 5, T. 3 N., R. 3 W., 1 mi. W of Saladito ranch, Valencia Co.
- 4) Locally base buff ss., ls. cgl., lower pt. - drk. red-br., sltst., sss. and shs., upper pt. - gry., thin-bed., nodul. ls. and gry. sh. with marine fossils, intertongues at top with cont. Abo beds (200'-300')
- 5) Wolfcampian (approx. equiv. of Bursum fm.); conf. on Atrasado memb., conf. and gradat. with overlying Abo

ROCK POINT MEMBER (of Wingate sandstone) — U. Triassic

- 1) Navajo country, NE Arizona (Black Mesa basin)
- 2) J. W. Harshbarger, et. al., 1957, U. S. Geol. Survey Prof. Paper 291, p. 8
- 3) Little Round Rock, 15 mi. S of Rock Point School, Ariz.
- 4) Pale red.-br. slty. ss. and sltst., thin-bed. (344')
- 5) Conf. on Chinle in type sect., conf. and gradat. overlain by Lukachukai memb.; NW N. Mex.; deposited in shallow basin, max. thick., 804' at Hopi Buttes area; known early as Div. A of Chinle (Gregory, 1917); fluv. origin

SAN ANDRES LIMESTONE — Permian

- 1) Cent. New Mexico (San Andres Mtns.)
- 2) W. T. Lee, 1909, U. S. Geol. Survey Bull. 389
- 3) Rhodes Canyon, San Andres Mtns., in sec. 29, T. 12 S., R. 2 E.
- 4) Lt. to drk. gry., mass.-bed. often cherty, poorly fossil. lss. (15'-1,200')
- 5) Leonardian; conf. on Glorieta ss., disconf. overlain by Bernal fm. or younger Permian beds; SE, cent., and NW N. Mex.

SANDIA FORMATION (of Magdalena group) — Pennsylvanian

- 1) Cent. New Mexico (Sandia, Manzano, and San Andres Mtns.)
- 2) C. L. Herrick, 1900, Jour. Geol. v. 8, p. 112-126
- 3) S end of Sandia Mtns. — no type sect.
- 4) Sss., cgl., and shs. with occas. bands of sndy. ls. (150')
- 5) Morrowan-Desmoinesian; unconf. on Miss. lss. or Precam., conf. overlain by Madera ls.; Sandia fm. is now used as defined by C. H. Gordon, 1907 (see Magdalena gr.); in Zuni Mtns. basal ark. red beds (called Abo) locally contain fossil. ls. lenses, with Desmoinesian, Missourian, or Virgilian faunas

SANTA FE GROUP — Tertiary - Quaternary

- 1) N New Mexico and S-cent. Colorado
- 2) F. V. Hayden, 1869, U. S. Geol. and Geog. Surv. Terr. 3rd. Ann. Rpt. p. 66, 90
- 3) Valley of Rio Grande at Santa Fe, N. Mex.
- 4) Interb. lent. sss., siltst., and cgl., wh., buff to ylw. br. (1,200'-1,500')
- 5) Latest Miocene-Pleistocene; conf. and gradat. (?) on La Jara Peak memb. of Datil fm., unconf. over-

lain by Recent gravels; interb. with young basalt flows and caliche beds; thick. range 500'-8,000'; gravels deriv. from Datil and older fms.; fang. origin; cent. and S N. Mex.

SAN RAFAEL GROUP — late M. and U. Jurassic

- 1) S and E Utah
- 2) J. B. Reeside, et al, 1927, Am. Assoc. Petroleum Geologists Bull. v. 11, p. 787
- 3) San Rafael Swell, Utah
- 4) Variegated shs., sss., sltsts. and some lss. (100'-1,000')
- 5) Unconf. on Navajo ss., disconf. overlain by Morrison fm.; includes, ascend. - Carmel, Entrada, Todilto, Curtis, Thoreau, all marine, littoral, or shore (eolian) facies; W Colo., NE Ariz., N N. Mex.

SAN YSIDRO MEMBER (of Yeso formation) — Permian

- 1) N New Mexico (Nacimiento Mtns.)
- 2) G. H. Wood and S. A. Northrop, 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 57
- 3) Near Canon, in sec. 3, T. 16 N., R. 2 E. and in area immed. N in Canon de San Diego Grant
- 4) Thin to med.-bed. orange-red to drk.-red ss. and sltst. with few thin lss. (0'-200')
- 5) Leonardian; conf. on Meseta Blanca memb., locally tongues with underlying Meseta Blanca memb., disconf. overlain by U. Triassic

SALT WASH SANDSTONE MEMBER (of Morrison formation) — U. Jurassic

- 1) E-cent. Utah and W-cent. Colorado
- 2) C. T. Lupton, 1914, U. S. Geol. Survey Bull. 541, p. 127
- 3) Salt Wash, 30 mi. SE of Green River, Utah
- 4) Gry., coarse-gr. ss. with cgl. lenses (150'-175')
- 5) Disconf. on San Rafael gr., conf. and gradat. with Recapture memb.; NE Ariz.; Harshbarger, Repenning, and Irwin, 1958, memb. thickens to 616' at Navajo Point, Ariz. thins SE to zero, intertongues S with overlying Recapture, Cow Springs, and upper Bluff ss.

SATAN TONGUE (of Mancos shale) — U. Cretaceous

- 1) NW New Mexico
- 2) J. D. Sears, 1934, U. S. Geol. Survey Bull. 860-A, p. 14
- 3) Satan Pass, 12 mi. W of Mt. Taylor coal field
- 4) Drk. gry. marine shs. (200'-300')
- 5) Late Niobraran to earliest Montanan; conf. on lower Hosta ss., conf. overlain by upper Hosta ss.

SHINARUMP CONGLOMERATE MEMBER (of Chinle formation) — U. Triassic

- 1) W Utah and N Arizona
- 2) G. K. Gilbert, 1875, U. S. Geol. and Geog. Surv. W. 100th Mer. v. 3
- 3) Shinarump Cliffs, S of Vermilion Cliffs, Kane Co., Utah
- 4) Ylw.-wh., coarse to fine, cgl., ss., sh., (0'-125')
- 5) Disconf. on Moenkopi fm., conf. and gradat. with Monitor Butte memb. of Chinle fm.; recog. as basal memb. of Chinle, Camp, et al, 1947, J. H. Stewart, 1957; entire S Utah, NW N. Mex., SE Nev.; max. thick. 225', thins E and NE; uranium producer; cont. origin

Sonsela sandstone bed (of Petrified Forest member) — U. Triassic

- 1) SE Utah and NE Arizona
- 2) J. P. Akers, M. E. Cooley, and C. A. Repenning, 1958, N. Mex. Geol. Soc. Gdbk. 9th Field Conf. p. 93
- 3) 3½ mi. N of the western Sonsela Butte, E flank of Defiance uplift
- 4) Two lt.-gry., fine to coarse-gr. qtz. sss. separated by blu.-gry. sltst. (120'-200')
- 5) Absent W of Chinle valley

Spears member (of Datil formation) — Tertiary

- 1) Cent. New Mexico
- 2) W. H. Tonking, 1957, N. Mex. Bur. Mines and Min. Res. Bull. 41, p. 27-29
- 3) One mi. S of Guy Spears ranch Hdq., in sec. 8, T. 1 N., R. 4 W., Socorro Co.
- 4) Med. gry. to gry. purple thin-thick bed. tuffac. ss., cgl., flow breccias aggl., thin beds of silt and clay (1,350')
- 5) Appar. conf. to unconf. on Baca fm., disconf. overlain by Hells Mesa memb.; corres. to the 1,020' of strata below "qtz. rhy." in Winchester type sect.; flow breccias consp. contain Perm., Trias., and Baca blks.; basal memb. - a qtz. latite tuff seq.

SUMMERVILLE FORMATION (of San Rafael group) — U. Jurassic

- 1) SE Utah and SW Colorado
- 2) J. Gilluly and J. B. Reeside, 1926, U. S. Geol. Survey Press Bull. 6064
- 3) Summerville Point, San Rafael Swell, Utah
- 4) Thin-bed., drk. br. sss., earthy red-br. sltst., shs., some gyp., few gry. lss (125'-331')
- 5) Disconf on Todilto, gradat. and conf. with Curtis, conf. and gradat. with Cow Springs ss.; NW N. Mex., and NE Ariz.; Harshbarger, Repenning, and Irwin, 1957, recog. lower slty. facies, and upper sndy. facies, lower facies is near-shore deposit. equiv. of Curtis; to S upper sndy. facies predom., grades into eolian shore deposits of Cow Springs ss.

SUPAI FORMATION — Pennsylvanian and Permian

- 1) N Arizona
- 2) N. H. Darton, 1910, U. S. Geol. Survey Bull. 435, p. 21, 22, 25
- 3) Supai village, Cataract Creek, N Ariz.
- 4) Top 400' red sndy. sh., thin red ss., lower pt. coarse to fine red ss., slabby to X-bed., 75' of red sh. and ss. at base (1,400')
- 5) Desmoinesian - Leonardian; conf. on Naco or unconf. on Redwall ls., overlain disconf. or gradat. by Hermit sh. or Rico memb. of Cutler; Noble, 1922, placed top 317' in Hermit sh., added 200'-500' of Penn. red sndy. sh., gry. ls. with red chert, red calc. ss., at base; oldest beds in W-cent. Ariz., base rises in sect. in all direct. from here; correl. with Abo and Yeso fms. of N. Mex.

Thoreau formation (of San Rafael group) — U. Jurassic

- 1) NW and W-cent. New Mexico
- 2) C. T. Smith, 1954, N. Mex. Bur. Mines and Min. Res. Bull. 31, p. 14-15

- 3) Cliffs N of Thoreau, N. Mex. in secs. 9 and 17, T. 14 N., R. 13 W., Thoreau quad.
- 4) Lower pt. thin, interb. red, br., wh. sltst. and ss., local ls. lense at base, upper pt. mass., X-bed., med.-gr. ss. (384')
- 5) Conf. and gradat. with Todilto ls., disconf. overlain by Morrison fm.; lower memb. equiv. of upper sndy. memb. of Summerville, thins E, upper memb. equiv. of Cow Springs ss.

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., N. Mex.
- 4) At base mudst. with lenses ylw.-orange sss., olive-gry., fine-gr. ls., pebbles at base, fetid, upper pale red-purple mudst. (25')
- 5) Conf. and gradat. or local. disconf. (?) on Entrada, disconf. overlain by Summerville; calc. mudst. perdom. in W, eastward to Prewitt, N. Mex. ls. reach max. thick. 25', and 111' gyp. found near San Ysidro, N. Mex.; shallow marine and littoral

TORRES MEMBER (of Yeso formation) — Permian

- 1) Cent. New Mexico
- 2) R. H. Wilpolt, et. al., 1946, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 61
- 3) In tributary of Agua Torres Canyon (on Sevilleta Grant), 7 mi. S of Black Butte, Socorro Co.
- 4) Alternat. beds of orange-red and buff ss. and slts., gry. ls. and gyp., basal memb. of upper div. of Yeso fm. (350'-600')
- 5) Leonardian; conf. on lower clastic div. of Yeso, conf. overlain by Canas gyp. memb.; informally known as the middle evaporites, ls. and gyp.; thickens SE

Tres Hermanos sandstone — U. Cretaceous

- 1) W-cent. New Mexico
- 2) C. L. Herrick, 1900, Am. Geol. v 25, p. 331-346
- 3) No type sect. or loc. given; on pl. 9, Herrick shows Cret. outcrop at Tres Hermanos Buttes, N of Alamosa Cr.; Pike, 1947, orig. type loc. may be sss. 1 mi. E of Tres Hermanos Buttes in sec. 26, T. 3 N., R. 7 W. (now ref. to Rio Salado)
- 4) Mass. ylw. ss. (75'); lies 150' to 250' above Dakota
- 5) Name has been applied to one or more of the Mesa Verde ss tongues which extend east across N and cent. N. Mex. into the Mancos sh. (W. T. Lee, 1912, 1915, 1917; D. E. Winchester, 1920; C. B. Hunt, 1936) but because no type loc. was given, each subseq. author has refer. to diff. sss.

Twowells sandstone lentil (of Mancos shale) — U. Cretaceous

- 1) W-cent. New Mexico
- 2) W. S. Pike, 1947, Geol. Soc. America Mem. 24, p. 35-36
- 3) Near Two Wells, T. 12 N., R. 19 W.
- 4) Mass., tan-pink, ss. with drk.-br. lenses of *Inoceramus labiatus* (0'-35')
- 5) Prob. Greenhorn; lies 30'-75' above base of Mancos sh.

WESTWATER CANYON SANDSTONE MEMBER (of Morrison formation) — U. Jurassic

- 1) SE Utah
- 2) H. E. Gregory, 1938, U. S. Geol. Survey Prof. Paper 188, p. 59
- 3) Westwater Canyon, 15 mi. SW of Blanding, Utah
- 4) Lt. gry. to gn.-ylw. coarse to med. ss., few cgl. and red mudst. lenses (222'-295')
- 5) Conf and gradat. with Recapture and with overlying Brushy Basin memb.; NE Ariz., NW N. Mex.; Harshbarger, et al, 1958, max. thick. 277' at Todilto Park, thins SE to 127' at Thoreau; equiv. of Prewitt memb.; fluv. origin

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., N. Mex.
- 4) Mass., bright red to red-br. sss., sltsts., and shs. (450')
- 5) Conf. on Chinle in cent. outcrop area, disconf. to W and SE, disconf. overlain by Kayenta fm. or San Rafael gr.; Baker, Dane, and Reeside, 1947, recommend 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 Ariz., SE Utah and W Colo.

WINSOR FORMATION — U. Jurassic

- 1) S and SW Utah
- 2) H. E. Gregory, 1950, U. S. Geol. Survey Prof. Paper 220, p. 96-98
- 3) Winsor Cove, 3 mi. S of Mount Carmel, W Kane Co., Utah
- 4) Thin even-bed., wh., ylw.-wh., red sss., few cgl. lenses (180'-300')
- 5) Disconf. on Curtis or Entrada, disconf. overlain by Dakota; max. thick. in Paria Valley, 450'-

800'; Harshbarger, et al., white sndy. facies of Carmel and Entrada in SW Navajo Country similar to Winsor, but Winsor prob. younger, Cow Spring ss. may be cont. equiv. of at least part of Winsor

WUPATKI MEMBER (of Moenkopi formation) — L. Triassic

- 1) NE Arizona (S and W Black Mesa basin)
- 2) E. D. McKee, 1951, N. Mex. Geol. Soc. Guidebook, 2nd, Fld. Conf. p. 86
- 3) Wupatki Nat. Mon., Ariz. (Wupatki Pueblo)
- 4) Interb. mass. ss., thin-bed. sltst., soft mudst. (95')
- 5) Unconf. on Kaibab ls., conf. overlain by Moqui memb.; basal memb. of Moenkopi, thins to zero to E and S

YESO FORMATION — Permian

- 1) Cent. New Mexico
- 2) W. T. Lee, 1909, U. S. Geol. Survey Bull. 389
- 3) 11.2 mi. N46°E of Socorro, at point where E edge of Socorro quad. intersects the 34°10' parallel; from this point NE in secs. 4 and 5, T. 2 S., R. 2 E., and in sec. 33, T. 1 S., R. 2 E., Socorro Co.
- 4) Variegated sss., soft, coarse-gr., friable to hard, fine-gr., pink-ylw., often gypsif. shs., earthy ls., mass. wh. gyps. (1,000'-2,000')
- 5) Leonardian; conf. and gradat. on Abo fm., conf. overlain by Glorieta ss.; N. Mex. (widespread) and subsurface of W Tex.; R. L. Bates et al., 1947, no general agreement on position of boundary btw. Abo and Yeso fms., 100'-300' difference, all beds of apparent marine origin considered in Yeso

ZUNI SANDSTONE — U. Jurassic

- 1) W New Mexico
- 2) C. E. Dutton, 1885, U. S. Geol. Survey 6th Ann. Rpt. pl. 16, p. 137
- 3) Along SW flanks of Zuni Plateau, btw. Zuni and Wingate, N. Mex.
- 4) Variegated, band. to mass. sss. and sndy. shs. with occas. gyp. beds (800'-1,300')
- 5) Divid. into Morrison and San Rafael group from Cow Springs thru Todilto