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Lexicon of stratigraphic names used in northwest New Mexico and adjacent states

Christina Lochman-Balk
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NOMENCLATURE CHART*

ERA	PERIOD	EPOCH	EASTERN SIDE OF DEFIANCE UPLIFT ROUTE: GALLUP TO LUKACHUKAI		NORTH FLANK OF ZUNI UPLIFT ROUTE: GALLUP-ZUNI MTS-SMITH LAKE		MT TAYLOR AREA ROUTE: GALLUP-GRANTS-PAGUATE	
			FORMATION	MEMBER	FORMATION	MEMBER	FORMATION	MEMBER
U_ N, UN z W o	I- 4)	RECENT	Alluvium		Alluvium and basalt		Alluvium and basalt	
		PLEISTOCENE	Gravel and sand		Silt. sand, and gravel			
	L - . : , R . c c ILlj	PLIOCENE	Fo rmation / Chuska Sandstone		Mt. Taylor sheet basalts		Mt. Taylor sheet basalts	
		MIOCENE			Mt. Taylor cone volcanics		Mt. Taylor cone volcanics	
		OLIGOCENE	Volcanic Rocks		Rocks of this interval are not present in the area traversed the second day		Rocks of this interval are not present in the area traversed the third day	
		EOCENE	San Jose Formation					
		PALEOCENE	Nacimiento Fm / Animas Fm.					
C..3 U NI o Li) 2	in S 0 bt 0 15 tat CC 0	MONTANAN	Oto Alamo Formation					
			McDermott Formation					
			Kirtland Shale					
			Fruitland Formation					
			Pictured Cliffs Sandstone					
			Lewis Shale					
			Tohatehi Formation					
			Cliff House Sandstone		Cliff House Sandstone		Cliff House Sandstone	
			Menefee Formation	Allison Member / Cleary Member	Menefee Formation		Menefee Formation	
		COLORADAN	Point Lookout Sandstone		Point Lookout Sandston	H osta tongue / Satan tongue	Point Lookout Sandstone	
			Crevasse Canyon Formation	Gibson Coal Mem. / Mulatto tongue / Dalton Ss Mem. / Bartlett Bar ren me.	Crevasse Canyon Formation	Gibson Coal Mem. / Dalton Ss / Dileo Coal Mem / Muiat to tongue		upper Mancos
			Gallup Sandstone	Gallegos Mem. / D-Cross tongue / er G- Ilu i / Peseado tongue	Gal/up Sandstone	Gallegos Member / lower Gallup / D-Cross tongue	Gallup Sandston e	lower Mancos
			Manc os Shal a	Sonastee Member / Tower Mancos Shale / Greenhorn Member / Graneros Member	Mancos Shale		Shale	Tres liermanos Sandstone Member (of Hunt)
		DAKOTAN	Dakota Sandstone		Dakota Sandstone	TwowhglosthSeajidstont / see & T r ' 1 ni s Mem	Dakota Sandstone	
	‹ N- K	UPPER	Morr ison Formation	Brushy Basin Member / Westwater Canyon Mem. / Recapture Mem. / Sal Wash Member	Morrison Formation	Casirmero pro„it, Mem. / Brushy Basin Mem. / Westwater Canyon Mem. / Recapture Shale Mem. / Chavez Mem.	Morrison Formation / Cow .	Brushy packpile Ss. / Basin Mein. Poison Cy. T. / Westwater Canyon Mem. / Recapture Shale Mem. —
			Zuni I Bluff Sandstone / Bluff Sandstone		Cow '---------'- Springs / Sandstone Bluff Ss. / Thoreau Fm.	Upper Thoreau / Lower Thoreau	Sandstone Bluff Sandstone	
		MIDDL	Summerville Formation		Summerville Fin.			
			Todilto Limestone		Todilto Limestone		Todilto Limestone	beds Limestone beds
			Entrada Sandston e	Upper Member / Medial Silly Member	Entrada Sandstone	Upper Member / Medial Silty Member	Entrada Sandstone	Upper Member / Medial Silty Member
			Carmel Formation		Carmel Formation		Carmel Formation	
	Y't IT I—	UPPER	Wingate Sandsto ne	Mem. . / Rock Point Mem.	Wingate Sandstone		Wingate Sandstone	
			Chinle Formati on	Owl Rock Mem. / Petrified Forest Mem. / Lower Red Mem. / Shinarump Congl. em.	Chinle Formation	Upper Shale Member / Middle Sandstone Member / Lower Shale Member / Lower Sandstone Member	Chinle Formation	UpMpeer mber Shale ,...,,.....CoMemrreo . Ss. / Middle Sandstone Member / Lower Shale Member / Lower Sandstone Member
		LOWER	Moenkopi Formation					
o N o RI J .< Ci-	4 m c IA IA	LEONARD	De Chelly Sandstone	De Chelly Upper Ss / De Chelly Lower Ss / Ft. Defiance Mem. / Black House Mem. / Oak Springs Mem. (ton gue Su al) / Hunters Po int Mein.	San Andres Limestone / Glorieta Sandstone / Yeso Formation	San Ysidro Mein. / Meseta Blanca Mem.	San Andres Limestone / Glorieta Sandstone / Yeso Formation	
		WOLFCAMP	Supai Formation		Alio Formation		Abo Formation	
	2 Z	UPPER	nt Honaker Trait Fm.	In subsurface only in northwestern New Mexico and northeastern Arizona	Unnamed Limestone / Older Units not shown	In subsurface only	Older Units not shown	In subsurface only
		MIDDLE	Paradox Fm / Pinkerton Trail Fm.					
		LOWER	x Molas Fin.					
	to	MERAMEC OSAGE	Leadville Limestone					
	>R.1 to	UPPER	Ouray Limestone / Elbert Formation / Aneth Formation					
PRECAMBRIAN			Quartzite		Granite. gneiss and schist		? Granite, gneiss, and schist?	

COMPILED FROM PREVIOUSLY PUBLISHED CHARTS, AND SUGGESTIONS FURNISHED BY D. F. KITTEL, R. G. MARVIN. H. W. PEIRCE. C. B. READ. C. T. SMITH. AND L. L. WERTS THE EDITOR ASSUMES FULL RESPONSIBILITY FOR THE ABOVE TREATMENT OF INFORMATION VOLUNTEERED AND WISHES TO POINT OUT THAT NONE OF THE RECOMIVE NDED RELATIONSHIPS SUBMITTED WERE ADOPTED WITHOUT CHANGES. AND THE CHANGES WERE ARBR/TRARILY MADE BY THE EDITOR.

LEXICON OF STRATIGRAPHIC NAMES USED IN NORTHWEST 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 north-western 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. (G.W.), (U.), (O.) and (G.) indicate a significant local aquifer or the production of uranium, oil or gas 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 eighteenth field conference (1967).

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, characterically
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.	fluviatile
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
U	upper

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.; Gerrard, T.A, 1966, Abo is later. equiv. of Fort Apache Memb. and adjac. strata of Supai 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. (widespread) 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. uss. 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.

(O. G.) Akah Zone or Cycle (of Paradox Formation of Hermosa Gp.)—Mid. Pennsylvanian

1) SE. Utah
2) W. J. Malin, 1958, Intermt. Ass. Petr. Geol. 9th Gdbk., p. 135
3) Akah field (North Boundary Butte field), SE Utah
4) Shelf carbons; interb. algal mounds and thin gry. shs. pass later into thick anhyd. and salt; mounds dolo. and anhyd. infill. (175′-400′)
5) Desmoinesian: dep. during max. develop. of evap. cond., Peterson, 1966, A.A.P.G. v. 50, p. 2078

ARROYO PEÑASCO 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 dis-conf. by Log Spring 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 & 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.

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

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., Ganada 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.

Black Creek Member (of DeChelly Sandstone)—Permian
1) NE Arizona
2) H.W. Peirce, 1964, Mus. N. Ariz. B. v. 40, p. 28
3) Black Creek, S. end Defiance Plat., NE Ariz.
4) Pale buff, gry, pink qtz sss., cliff-form., qtzose cement; 65% eolian X-bed. units; 35% horiz.-strat., water-dep. 5′-12′ units (0′-225′)
5) Conf. and grad. with White House Memb.; overlain unconf. by Shinarump Cgl. or conf. by Ft. Defiance Memb.; equiv. of Glorieta Ss.

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

(U.) BRUSHY BASIN 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. West of Blanding, Utah
4) Variegated sandy shs., few thin ls., ss., and chert cgl. lenses (450′)
5) Conf. and gradat. with Westwater Canyon 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 Thoreau, N. Mex.; fluv. origin

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′)

5) 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 near N. Mex-Ariz. state line.

Casamero Member (of Morrison Formation)—U. Jurassic

1) NW New Mexico
2) C. T. Smith, 1967, this Gdbk.
3) SW¼, NW¼, Sec. 4, T 14 N, R 12 W
4) Pred. qtz ss., med-fine gr., thin varig. grn. gry. and red. sltst. and mudst. interbedd., cgl. lens, intri. X-bedsintercal. with horiz. beds. (80′)
5) Disconf. or conf. and gradat. with Prewitt Memb., Disconf. overlain by Dakota(?) Fm., equiv. of Brushy Basin Memb., thins southward by truncation by Dakota(?), indistinguishable from other sand facies to west and south.

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 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. cgls., 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

CHUSKA SANDSTONE—Tertiary

1) NW New Mexico and NE Ariz.
2) H. E. Gregory, 1916, U.S.G.S. W.S.P. 380
3) Chuska Peak, McKinley Co., NW New Mex.
4) Mass. wh.-gry. X-bed., silic.-cem. sss., interb. with friab. poro. sss., thin bas. cong. of qtz., chert, petrif. wood pebbs.; arkosic ss. in up. memb., cem. sporad. (700′-1,000′)
5) Pliocene?; unconf. on Summerville to Tohatchi Fms. "Zuni erosion surface" of McCann, after Cret.-Eocene uplift; Sed. betw. Gallup and Zuni correl. with White Cone seds. near Jedito, Ariz. where Frick coll. late Plio. camel bones; overlain and penetr. by basaltic lava flows; low. 250′ of fluv. orig., named Deza Fm. (Wright, 1954), up. beds of eolian orig. (max. thick. 1,800′) (see J. Blagbrough, this Gdbk.)

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 ¼ 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 Lookout 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) Conconino 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.

CORREO SANDSTONE MEMBER (of Chinle Formation)—U. Triassic

1) W.-cent. New Mexico
2) V. C. Kelley and G. H. Wood, 1946, U.S.G.S. O. G. Inv. Prel. Map 47
3) Expos. 1 mi. N. of Correo, Valencia Co., New Mex.
4) Drk. brn. to buff, med. mass., X-bedd ss. interb. cgl.; X-bedd. uneven and irreg. (90′-120′)
5) Conf. overlies an unnamed red sh. memb.; disconf. underlies Wingate Ss.; Silver, 1948, pinches out to W.

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 sandy. ls. common; Harshbarger, Repenning, and Irwin, 1957, consid. lower Summerville the S later. 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, cgls, 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

(G.W.U.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.; in trip area a mass. qtz. ss., silic cem-; locally fract.- yield abund. artesian water

DALTON SANDSTONE MEMBER (of Crevasse Canyon Formation)—U. Cretaceous

1) NW New Mexico
2) J. D. Sears, 1934, U.S.G.E. B. 860-A
3) Dalton Pass, Gallup region, McKinley Co., New Mex.
4) Two mass. sss.; low. pt. orang.-pk., coarse to fine-gr., well-sort. qtz. grs. in clay matrix; up. pt. gry.-wh. to gry.-orang., coarse to med.-gr., well-sort. qtz. and feldsp. grs. in clay matrix; X-laminat., non-marine (180′)
5) Coloradan; gradat. conf. or intertong. with Mulatto Tong. or Dilco Memb.; intertong. and conf. overlain by Low. Gibson Memb.; to E. both sss. replac. by Mancos Sh.; local equiv. of Bartlett Barren Memb.

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 a 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.

DE CHELLY SANDSTONE—Permian

1) NW New Mexico and NE Ariz.
2) H. E. Gregory, 1915, 1916, A.J.S. (4) 40; U.S.G.S. W.S.P. 380
3) Along Canyon de Chelly, Apache Co., Ariz.
4) Pale br.-red, tan, orange, even-gr., coarse X-bed. sss., feldsp. and qtz. grs. well-rnd.; a few shs., little or no calc. or iron cem.; no fossils, (300′-800′)
5) Leonardian; conf. on top of high. sh. in up. Cutler Ss.; (Baker & Reeside, 1929) a memb of Cutler

Fm.; (McKee, 1934) Coconino Ss. later. equiv. of up. DeChelly; (Read. 1951) De Chelly a shift. beach and bar dep.; prob. equiv. of Glorieta Ss. in Zuni area; (Peirce, 1958) DeChelly pinch out N. near San Juan Riv. is non-dep.; thins to S., low. memb. passes into supai lith.; up. memb. thins SW to Pine Springs, Ariz. Peirce (1964) recog. five membs.

(O.G.) Desert Creek Zone or Cycle (of Paradox Formation of Hermosa Gp.)—Mid. Pennsylvanian

1) SE Utah and SW Colo.
2) G. Herman and C. A. Barkell, 1957, A.A.P.G. v. 41, p. 872
3) Desert Creek field, SE Utah
4) Part. evap. cycle, shelf carbons.; low. cal. pt. algal mound ls. and anhyd.; up. pt. interb. ool. ls. and dolo.; top and bott. bounded by bl. shs. (200′)
5) Desmoinesian; conf. on Akah cycle, conf. underly. Ismay cycle; import. product. zone; Peterson, 1966, A.A.P.G. v. 50, p. 2073, cycle recog, along sw basin shelf from Comb Ridge to NW New Mex.

Deza Formation—Tertiary

1) NW New Mex. and NE Ariz.
2) H. E. Wright, Jr., 1954, A.A.P.G. B. 38, p. 1831
3) Deza Bluff, up to E. foot slope of Chuska Mt., 3 mi. N of Tohatchi, N. Mex.
4) Thin-bed. wh.-buff-grn. sss. interb. with choco.-red sh., sdy. cgl. with qtz. pebbs. 2′-10′ at base; fluv. orig.
5) Miocene?; unconf. on Tohatchi Fm.; conf. and grad. with Chuska Ss.; reject. by Repenning, Lance and Irwin, 1958—see J. Blagbrough, this Gdbk.

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.

(U.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 ss. (265′-844′)
5) Conf. on Carmel or unconf. on Wingate, conf. and gradat. with Todilto 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.

Fort Defiance Member (of DeChelly Sandstone)—Permian

1) NE Arizona
2) H. W. Peirce, 1964, Mus. N. Ariz. B. v. 40, p. 29
3) Bonito Canyon, NE Ariz.
4) Slope-form, horiz-strat., water-dep. siltst. and sss. interb.; drk. red-brw. to pale red-brw., small to med. X-bed., ripple marks (0′-105′)
5) Conf. overlies Black Creek Memb. at type loc.; unconf. overlain by Shinarump Cgl.; ls. rept. from well at St. Michaels; prob. equiv. of San Andres Fm.

FRUITLAND FORMATION—U. Cretaceous

1) NW New Mexico and SW Colorado
2) C. M. Bauer, U.S.G.S. Prof. Pap. 98-P
3) Expos. at village on San Juan Riv., San Juan Co., New Mex.
4) Later. and vert. intercal. sss., shs. sdy. shs., clay sss., coal; horiz. iron-carbon. concrets.; brackish and fluvial (194′-292′)
5) Montanan; conf. and gradat. underlies Kirtland Sh.; conf. overly. and intertong. with Pictured Cliffs Ss.; 530′ thick at New Mex-Colo. border

(G.W.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. 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.

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. McKnight, 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 Gp.; James Gilluly and J. B. Reeside, Jr., 1928, recog. three fms.—ascend.—Wingate Ss., Todilto(?) Fm., Navajo Ss. all con. (eolian or fluv.) origin; Baker, Dane and Reeside, 1936, renamed Todilto(?) Fm.—the Kayenta Fm.; SW Colo., NW N. Mex.

(G.W.) GLORIETA SANDSTONE—Permian

1) Cent. N. 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.; in trip area up. pt—well-cem.; low. pt. friable local. fract. gives high permeab.

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.

(O.G.) HERMOSA FORMATION or GROUP—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 cgls., 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 cgls., 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. sndy. 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 litoral ss. split by Satan Tongue of Mancos; Pike, 1947, upper Hosta Ss. is lateral equiv. of Point Lookout Ss.

Hunters Point Member (of DeChelly Sandstone)—Permian

1) NE Arizona
2) H. W. Peirce, 1964, Mus. N. Ariz. B. v. 40, p. 20
3) Canyon DeChelly, NE Ariz.

4) Cliff-form., pale red-brw to org.-pink X-bed sss.; water-dep., channels and ripple-marks, horiz.-strat. subark. ss. (0′-238′)
5) Conf. on Supai Fm.; conf. and grad. with Oak Springs Cliffs memb.; part. equiv. of San Ysidro Memb. of Yeso Fm.

(O.G.) Ismay Zone or Cycle (of Paradox Formation of Hermosa Gp.)—Mid. Pennsylvanian
1) SE Utah and SW. Colo.
2) W. J. Malin, 1958, Intermt. Ass. Pet. Geol. 9th Gdbk., p. 135
3) Ismay field, SE boundary of Utah with Colo.
4) Shelf carbons.; interb. nar. lens. algal mounds, fossil. calcilut. and ool. calcaren., bl. and drk. gry. shs. becom. gry-grn. to red shs. to SE (120′-200′)
5) Desmoinesian; orig. Bluff zone, Herman and Barkell, 1957; Peterson, 1966, A.A.P.G. v. 50, p. 2075.

(U.) Jackpile Ore Bearing Bed (Brushy Basin Member of Morrison Formation)—U. Jurassic
1) Confined to Grants Uranium region
2) V. L. Freeman and L. S. Hilpert, 1956, U.S.G.S. B. 1030-J, p. 317
3) Near Laguna, Sec. 28, T. 10 N., R. 5 W.
4) Vry. pale orang.-wh. ss., fine-med. gr., scour and fill X-bed.; few clay parts. (0′-175′—max. at Jackpile Mine)
5) Disconf. overlain by Dakota Ss.; conf. and grad. with low. Brushy Basin sss.; an eros. remnant in Pre-Dakota depress.; is up. most ss. of Brushy Basin Memb.

Jackpile Sandstone (Brushy Basin Member of Morrison Formation)—U. Jurassic
(See Jackpile Ore Bearing Bed)

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., 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.

KIRTLAND SHALE—U. Cretaceous
1) NW New Mexico and SW Colorado
2) C. M. Bauer, 1916, U.S.G.S. Pro. Pap. 98-P
3) Expos. at Kirtland P.O., San Juan Co., New Mex.
4) Pred. gry. shs., some blu., ywl. grn., friab. wh. sss., in up. pt. brn. resist. ss. (Farmington Memb.); fluvial (836′-1,180′)
5) Montanan; conf. or unconf. overlain by McDermott Fm., Animas Fm., or Ojo Alamos Ss.; conf. and gradat. on Fruitland Fm.; Reeside, 1924, recog. three membs., descend.—up. sh. 12′-475′, mid. Farmington Ss. memb., 20′-480′, low. sh. 271′-1,031′; Barnes, et al., 1954, up. sh. memb. includ. 95′ of peb. ss. and sdy sh. of McDermott Fm.

LEWIS SHALE—U. Cretaceous
1) W. Colorado, NW New Mexico, and S and cent. Mont.
2) W. Cross and A. C. Spencer, 1899, U.S.G.S. La Plata Folio # 60
3) Expos. at Fort Lewis in La Plata valley
4) Drk.-gry.—drab gry. sdy. shs, clays, sss. with thin calc. lens and concret. of lss.; well-bedd. calc. shs. (marine), thin bedd. wh.-gry. sss.; max. (2,000′)
5) Montanan; conf. undrly. and intertong. with Pictured Cliffs Ss. or Williams Fork Fm.; gradat. and conf. overlain by Fox Hills Ss. fluvial beds; Reeside, 1924, marine fauna, is comtemp. with up. pt. of Mesaverde Gp. in San Juan Bas.; Rich, 1958, is marine stat. equiv. of Meeteetse Fm. (non-marine)

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., New Mex.

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, recommend. abandonment; Kelley and Wood, 1946, in Lucera Uplift recog. three membs., ascend.—Gray Mesa, Atrasado, Red Tanks: Wilpolt, et al., 1946, in E. Socorro Co., recog. two unnamed membs. (widespread in New Mex.)

(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 Ss.; 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

MENEFEE 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) Menefee 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 cgltic 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.

MESAVERDE GROUP—Upper Cretaceous

1) W. Colorado and NW New Mexico
2) W. H. Holmes, 1877, 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′ thick sh.
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. 2E., 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

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 Fm.; Wengerd 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, subsurface 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

(U.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 N. Mex. (Mt. Taylor area)
2) C. B. Hunt, 1936, U.S. Geol. Survey Bull. 860-B, p. 44 (J. D. Scars, 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.

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 Gp.; Harshbarger, Repenning, and Irwin, 1957, max. thick. 1,400′ in NW Navajo country, thins S and SE to zero, lent. beds of freshwater cherty. ls.; S Utah, W Colo., extreme NW N. Mex.; eolian origin

Oak Springs Cliffs Member (of DeChelly Sandstone)—Permian

1) NE Arizona
2) H. W. Peirce, 1964, Mus. Ariz. B. v. 40, p. 23
3) Oak Springs Cliffs, Canyon DeChelly, NE Ariz.
4) Slop.-form.; pale red-brw. ss. and silt., micace. sss., horiz.-strat., water-dep. (0′-128′)
5) Conf. on Hunters Point Memb.; conf. overlain by White House Memb.; later. equiv. of San Ysidro Memb. of Yeso Fm.

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. design.
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 arg. ls., up to 4,500′, (3) blk., slty. calc. sh., br. fine-xtall, argil. fine-gr. ls., 200′-500′; W Colo., NW N. Mex (subsurface)

PESCADA 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, petri-

fied logs, Middle Sonsela Ss. bed, upper pt., variegated mudst., red sndy. sltst., and lent. sss., 800'-1,000'; NW N. Mex.

PICTURED CLIFFS SANDSTONE—U. Cretaceous

1) NW New Mexico and SW Colorado
2) W. H. Holmes, 1877, U.S. Geol. & Geog. Sur. Terr. 9th Ann. Rpt. for 1857
3) Pictured Cliffs on San Juan River, New Mex.
4) Up. wh. mass. ss. (130') underlain by ywl.-brn. to wh. sss. (100'); max. (281')
5) Montanan; gradat. and conf. on Lewis Sh.; conf. and gradat. into ovrly. Fruitland Fm.; correl. with up. most Pierre Sh.; carries littoral marine fauna; not recog. outside San Juan Basin; Beaumont, et al., 1956, to S. where Lewis Sh. ends, P.C. Ss. not separable from Cliff. House Ss.

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 Mnefee Fm.

Poison Canyon Sandstone Lens (of Brushy Basin or Westwater Canyon Members of the Morrison (Formation)—U. Jurassic

1) Confined to Grants Uranium region
2) Zitting, et al., 1957. Mines Mag.; Hilpert, L. S. & Corey, A. S. 1957
3) Near Poison Canyon Mine in sec. 19, T. 13 N., R. 9 W.
4) Fine-med. gr. arkosic ss. poor. cem.; up. pt. clay and slty., abund. carbon. or silic. wood; low. pt. better sort., clay string., galls comm., local cgl. no wood frags. 90% of U. ore in low. pt. (0'-100')
5) Is up. major ss. unit of Morrison; above and below thick, cont. mudst.; traced thruout Poison Canyon mineral trend; merges to W., N., S. into Westwater Canyon Memb. of same lithol. Conf. to local use—Poison Canyon Fm., 1888, Paleocene, SE. Colo. has priority.

(U) 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 cgltic. ss., sltst. lenses (185'-190')
5) Disconf. on Chavez Memb., conf. and gradat. with Brushy Basin Memb., equiv. of Westwater Canyon Memb.

(U) RECAPTURE MEMBER (of Morrison Formation)—U. Jurassic

1) SE Utah
2) H. E. Gregory, 1938, U. S. Geol. Survey Prof. Paper 188, p. 59-59
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 Gp., 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.

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

(G.W.) 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.; in trip area up. third gry.—buff ss. or sdy. ls.—remnant patches, Karst topo. 0'-15' thick.

San Jose Formation—Eocene
1) N New Mexico and S. Colo.
2) G. G. Simpson, 1948, Am. J. Sc. v. 246
3) Expos. along E edge of San Juan Bas. from Yegua Cañ. S. 25 mi. to NW of Cuba, and 10-15 mi. to Lindrith
4) Three lithofac. interton. later. and vert. in lenti. units; band. wh.-gry., grn.-ywl., pur. clays; wh. sdy. clays and wh.-ywl. sltsts; wh.-ywl., fine-gr., narrow channel sss. with clay lens.; contin. dep. petrif. wood near base (1,200′-1,300′)
5) Low. Eocene; Unconf. on Mid. Paleoc. Nacimiento Fm. in San Juan Bas.; Conf. on Late Paleoc. in S. Colo.; former. called "Wasatch type" rks.

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., silst., and cgls., 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. overlain 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, litoral, 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; in Zuni Mtns.—225′-300′ thick.

SALT WASH 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 Gp., 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.

(U) 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; cont. origin

(G.W.) 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.; peb. cgl. with petrif. wood local at base (120′-200′)
5) Absent W of Chinle valley; in trip area a persistent aquifer

(U.) 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.

(U.) 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 ss., 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. predom. 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

TOHACHI FORMATION (of Mesaverde Gp.)—U. Cretaceous

1) NW New Mexico and NE Ariz.
2) H. E. Gregory, 1916, U.S.G.S.W.S.P. 380; redefin. Allen and Balk, 1954, N. Mex. Bur. Min. B. 36, p. 96-97
3) 2 mi. N and 3 mi. W. of Tohatchi Indian School, McKinley Co., N. Mex.
4) Low. memb. cliff-form. 400′-850′ thin-med. bedd. sss. with 50% sh. interbeds. with carbon. mater., X-bedd; up. memb. 850′ oliv.-gry.-ywl.-gry. uniform, vry. benton. clays, few sss. (max. thick 1,300′)
5) Up.most U. Cret.; conf. on top mass. channel ss. of Menefee Fm., unconf. under Chuska Ss.; Low memb. ?equiv. of Cliff House and Pictured Cliff Sss.; up. memb. ?equiv. of Fruitland and/or Kirtland Fms.

Tohatchi Formation (of Mesaverde Gp.)—U. Cretaceous

(see Tohachi Formation)

TRES HERMANOS SANDSTONE MEMBER (of Mancos Shale)—

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. (see Marvin, this Gdbk.)

Twowells Sandstone Member (of Dakota Sandstone)—U. Cretaceous

1) W-cent. New Mexico
2) W. S. Pike, 1947, Geol. Soc. America Mem. 24, p. 35-36
3) Two Wells 1.5 mi. W of NE ¼, Sec. 17, T. 12 N., R. 19 W., McKinley Co., N. M.
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.; Dane (1960), Owen (1963) Twowells Ss. merges N into top of Dakota Ss.; "Graneros" ss. (Burton, 1955) is subsurf. extens. of Twowells and Tres. Hermanos sss. These two sss. may be same

(G.W.U.) WESTWATER CANYON 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

White House Member (of DeChelly Sandstone)—Permian

1) NE Arizona
2) H. W. Peirce, 1964, Mus. N. Ariz. B. v. 40, p. 25
3) Canyon DeChelly, NE Ariz.
4) Cliff-form. X-bed. gry.-org.-pink sss.; 95% eolian, subark., X-bed. units, 21′ thick; 5% horiz-strat., water-dep. 3′ thick units, siltst. and sdy. siltst. (0′-570′)
5) Unconf. overlain by Shinarump Cgl. or conf. and grad. overlain by Black Creek Memb.; overlies Oak Springs Cliffs and Hunters Point Membs.; equiv. to Glorieta and San Andres in Zuni Mtns.

Whitewater Arroyo Shale Member (of Dakota Sandstone)—U. Cretaceous

1) W.-cent. New Mexico
2) D. E. Owen, 1966, A.A.P.G. B. v. 50, p. 1026
3) 1.5 mi. W. of Two Wells, cuesta on N. side of Whitewater Arroyo, NE ¼, Sec. 17, T. 12 N., R. 19 W., McKinley Co.
4) Gry. to ol. gry., slty sh., oysters com., thin coal at base rare (0′ near Toadlena—80′) av. 60′
5) Prob. Greenhorn; Conf. on ss. of Dakota, usual. sharp, some interton. Gallup area; conf. and grad. under Twowells Ss. Memb.

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 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 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 Ss., conf. overlain by Moqui Memb.; basal memb. of Moenkopi, thins to zero to E and S

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 Gp. from Cow Springs thru Todilto