

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS  
SEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, NEW MEXICO

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INTRODUCTION

This map report is one of a series of geologic and hydrologic maps for all or parts of States within the Basin and Range province of the western United States. The map reports contain detailed information on subjects that characterize the geohydrology of the province, including ground-water hydrology, ground-water quality, surface distribution of selected rock types, tectonic conditions, areal geophysics, Pleistocene lakes and marshes, and mineral and energy resources. This work is a part of the U.S. Geological Survey's program for geologic and hydrologic evaluation of the province to identify potentially suitable regions for further study relative to isolation of high-level nuclear waste (Bedinger, Sargent, and Reed, 1984).

This map was prepared from published geologic maps and reports, utilizing the project guidelines as defined in Sargent and Bedinger (1984). In this report, argillaceous sedimentary rocks include shale, claystone, mudstone, and siltstone. The mapped argillaceous units, however, commonly also include non-argillaceous rocks, such as sandstone, limestone, and gypsum, and anhydrite, deposited with the argillaceous beds. The project guidelines include the mapping of argillaceous units greater than 500 feet thick, but because argillaceous rocks may impede the movement of ground-water and commonly have sorptive properties, locally units of lesser thickness were included. In general, the argillaceous units thin and intertongue southward and southeastward across this part of New Mexico into other sedimentary rocks. In the Description of Map Units the age, lithologic character, thickness, and sources of data are described for the geologic units within arbitrarily outlined and numbered areas in counties within the study area.

DESCRIPTION OF MAP UNITS  
[To convert feet (ft) to meters, multiply feet by 0.3048]

County- area number	Map symbol	Geologic unit	Geologic age	Lithology and comments	References for county area
BERNALILLO COUNTY (B)					
B-1	Km	Mancos Shale	Late Cretaceous	Mostly shale and much siltstone and sandstone especially in upper part. Thickness, 1,500 to 2,000 ft.	Kelley and Read, 1961
DONA ANA COUNTY (D)					
D-1	P Pp	Panther Seep Formation	Early Permian and Late Pennsylvanian	Upper one-half mostly thin interbedded shale and lime- stone and two thick gypsum beds. Lower one-half contains more shale but many thin limestone and sandstone beds. Formation, 2,390 ft thick.	Kottlowski and others, 1956
D-2	Pa	Abo Formation	Early Permian	Shale and siltstone, and some thin sandstone. Thickness, 325 ft.	Kottlowski and others, 1956
GRANT COUNTY (G)					
G-1	Kc	Colorado Shale	Late Cretaceous	Shale and sandstone about 800 ft thick.	Elston, 1960
G-2	TKr	Ringbone Formation	Early Tertiary or Late Cretaceous	Upper one-third mainly limestone conglomerate interbedded with shale and arkose. Lower two- thirds mainly shale, thin arkose beds, and a basal limestone conglomerate. Thickness about 7,500 ft.	Zeller, 1970
	Kh	Hell-to- Finish Formation	Early Cretaceous	Arkose and shale common in upper part. Shale, siltstone, and limestone conglomerate in lower part. Thickness is 6,000 ft.	
HIDALGO COUNTY (H)					
H-1	TKr	Ringbone Formation	Early Tertiary or Late Cretaceous	Mostly clay shale but includes conglomeratic lime- stone and arkosic sandstone in upper one-half, and a 500-ft-thick conglomeratic limestone at base. Very deformed. Thickness, 7,500± ft.	Soule, 1972

H-2	Kv	Virden Formation	Late Cretaceous	Formation is nonmarine shale, sandstone, and conglomerate, 1,500 to 4,000 ft thick. Comprised of: upper unit, 365 ft of conglomerate; middle unit, shale that becomes more sandy upwards; and basal 40-ft-thick sandstone. Formation also has been mapped as unnamed shale that is approximate equivalent of Virden Formation.	Elston, 1960; Morrison, 1965
	Kc	Colorado Shale	Late Cretaceous	Mostly shale, but middle 200 ft contains about 50 percent interbedded sandstone. Thickness, 500 to possibly 700 ft.	

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LINCOLN COUNTY (L)

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L-1	Km	Mancos Shale	Late Cretaceous	Fissile shale with sandstone stringers; 600 to 700 ft thick.	Allen and Jones, 1951; Dane and Bachman, 1965; Smith, 1964
L-2	Km	Mancos Shale	Late Cretaceous	Not described.	Dane and Bachman, 1965

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LUNA COUNTY (LU)

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LU-1	Kc	Colorado Shale	Late Cretaceous	Shale and some sandstone layers. More than 300 ft thick.	Darton, 1917
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OTERO COUNTY (O)

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O-1	Pa	Abo Formation	Early Permian	50 percent mudstone, 40 percent coarse arkose and conglomerate and 10 percent limestone in basal part. Thickness, 1,400 ft.	Otte, 1959; Pray, 1961
O-2	Pa	Abo Formation	Early Permian	Mostly mudstone; thickness, 1,200 ft.	Otte, 1959; Pray, 1961
O-3	Pa	Abo Formation	Early Permian	Upper three-fourths is mudstone, and lower one-fourth, conglomerate, arkose, and sandstone. Thickness, 727 ft.	Otte, 1959
O-4	Pa	Abo Formation	Early Permian	Mostly mudstone and some sandstone and 60-ft-thick basal conglomerate; thickness, 421 ft.	Pray, 1961
O-5	Pa	Abo Formation	Early Permian	Southward from this locality the Abo, which is 475± ft thick, is split into two members by a marine tongue of Hueco Formation; so, on the map the Abo outcrop was terminated.	Pray, 1961

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SANDOVAL COUNTY (SA)

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SA-1	Km	Mancos Shale	Late Cretaceous	Includes in descending order: Niobrara Formation - Generally sandy shale with thin sandstone lenses, 800 to 1,000 ft thick. Sandy shale and paper-thin sandstone, 250 to 300 ft thick. Argillaceous shale, 500 ft thick. Carlile Shale - Juana Lopez Member, 6 ft of interbedded sandy shale and thick-bedded sandy limestone. Shale, 300 to 475 ft thick. Graneros Shale - Dark shale and subordinate sandstone, 200 to 250 ft thick.	Stearns, 1953
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SANTA FE COUNTY (SF)

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SF-1	Km	Mancos Shale	Late Cretaceous	Mostly shale, containing 170-ft-thick unit of thin sandstone near middle, and several thin sandstones in basal 130 ft. Mancos is 2,355 ft thick.	Disbrow and Stoll, 1957
SF-2	Km	Mancos Shale, Niobrara Shale Member	Late Cretaceous	Niobrara Shale Member, 2,105 to 2,240 ft thick, composed of: sandy marine shale, 1,550 ft thick; sandstone lentil (not mapped) 205 to 340 ft thick; and gray shale, 350 ft thick.	Bachman, 1975
SF-3	Km	Mancos Shale, undifferentiated	Late Cretaceous	Highly intruded by Tertiary monzonite and latite porphyry.	Bachman, 1975
SF-4	Km	Mancos Shale Rocks equivalent to: Niobrara Formation, Greenhorn Limestone, Graneros Shale	Late Cretaceous	Niobrara Formation: 75+ ft of calcareous shale and argillaceous limestone. Carlile Shale: 200+ ft of gray shale. Greenhorn Limestone: 30 to 40 ft of limestone and calcareous shale. Graneros Shale: 200 to 250 ft of dark-gray shale.	Johnson, 1975 Stearns, 1953

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SIERRA COUNTY (SI)

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SI-1	P Pp	Panther Seep Formation	Early Permian and Late Pennsylvanian	Upper 800 ft has equal proportions of shale, limestone, and sandstone. Lower 600 ft, mostly shale but includes thick limestone and thinner sandstone units.	Kottlowski and others, 1956
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SI-2	Pa	Abo Formation	Early Permian	Calcareous siltstone and shale and few sandstone beds. Thickness is 835 ft.	Kottlowski and others, 1956
SI-3	P Tpp	Panther Seep Formation	Early Permian and Late Pennsylvanian	Upper 1,100 ft, interbedded shale and limestone; lower 725 ft, mostly shale with several thick limestone and sandstone units.	Kottlowski and others, 1956
SI-4	Pa	Abo Formation	Early Permian	Calcareous siltstone and shale and many arkosic siltstone and sandstone beds. Abo is 613 ft thick, but thins to south.	Kottlowski and others, 1956
SI-5	Kmv	Mesaverde Formation	Late Cretaceous	Mostly shale and siltstone, but considerable lenticular sandstone and conglomerate and some coal. Thickness, 2,500± ft.	Dane and Bachman, 1965; Kelley and Silver, 1952
	Km	Mancos Shale	Late Cretaceous	Mancos Shale 350 to 450 ft. Upper 300 to 400± ft, shale and some siltstone. Lower 40 ft, shale and very thin limestone beds.	

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SOCORRO COUNTY (S)

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S-1	Km	Mancos Shale	Late Cretaceous	Shale interbedded with sandstone units as much as 80 ft thick. Intertongues with Mesaverde Formation. Mancos is more than 900 ft thick.	Tonking, 1957
S-2	Km	Mancos Shale	Late Cretaceous	Mancos Shale is 760 to 870 to 870 ft thick. Upper shale member, 225 to 290 ft thick. Middle sandstone member, 240 ft thick. Lower shale member, 295 to 340 ft thick. The overlying Mesaverde Formation (not shown) is mostly sandstone containing interbedded shale and coal.	Wilpolt and Wanek, 1951
S-3	Pa	Abo Formation	Early Permian	Abo is 914 ft thick; upper 414 ft mostly sandstone; lower 500 ft mainly shale and few arkosic sandstone beds, especially in the basal 50 ft.	Needham and Bates, 1943
S-4	Pa	Abo Formation	Early Permian	Shale, sandstone, arkose, and conglomerate. Because the Abo thins southwestward from type locality in Abo Canyon (area S-3) and becomes much more sandy, the outcrop pattern was terminated in area where thickness is about 300 ft.	Read and others, 1945; Wilpolt and others, 1946

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TORRANCE COUNTY (T)

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T-1	Pa	Abo Formation	Early Permian	Shale and thin arkose sandstone.	Read and others, 1945
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