DEPARTMENT OF THE INTERIOR
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MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, UTAH

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INTRODUCTION

This map report is one of a series of geologic and hydrologic maps covering 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 the 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 defined in Sargent and Bedinger (1984). For this study argillaceous sedimentary and metasedimentary rocks include shale, claystone, mudstone, siltstone, argillite, slate, and schist. The argillaceous units commonly include non-argillaceous rocks, such as sandstone and limestone, which were deposited with the argillaceous rocks. The project guidelines call for mapping argillaceous rock units more than 500 feet in thickness, but because argillaceous rocks may impede the movement of ground water and commonly have sorptive properties, locally units of lesser thickness were included. In the Description of Map Units the sources of data, age, lithologic character, and thickness are described for the argillaceous units within arbitrarily outlined and numbered areas in counties within the study area.

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

County-area number	Map symbol	Geologic unit	Geologic age	Lithology and comments	References for county area
			BEAVER COUNTY		
B-1	Ok	Kanosh Shale	Middle Ordovician	Shale and thin limestone interbeds, 500 ft thick.	Best, 1976
B-2	Ꞓp	Pioche Shale	Middle and Early Cambrian	Green micaceous shale and a few quartzite beds. Probably in overthrust block. Thickness, 500 ft.	Miller, 1966; Robison, 1960
B-3	₸ m	Moenkopi Formation	Middle(?) and Early Triassic	Mostly shale; some limestone beds and a 318-ft-thick sandstone near top and a 244-ft-limestone in basal part. Formation is 2,212 ft thick.	Baer, 1962; Collinson and Hasenmueller, 1978
B-4	₸ m	Moenkopi Formation	Middle(?) and Early Triassic	Not described.	Hintze, 1963; Collinson and Hasenmueller, 1978
			BOX ELDER COUNTY		
BE-1	Mm	Manning Canyon Shale	Late Mississippian	In thrust plate.	Stokes, 1963
BE-2	Mm	Manning Canyon Shale	Late Mississippian	Black shale and minor interbedded quartzite and limestone. Intensely deformed. More than 1,100 ft thick.	Olson, 1956
BE-3	Zsr	Proterozoic rocks	Late Proterozoic	Proterozoic rocks include more than 1,800 ft ot phyllite, shale, and mafic lava flows.	Olson, 1956
BE-4	Mc	Chainman Shale	Late Mississippian	Mapped as Chainman by Hintze (1980), but Chainman included with Diamond Peak Formation by Blue (1963). Thickness of 450 to 475 ft is for both units.	Blue, 1963; Hintze, 1980
BE-5	Zmc	McCoy Creek Group	Late Proterozoic	Includes: Unit G; 1,350 ft metasilt-stone, argillite, and slate. Unit E; 645 ft slate and quartzite.	Misch and Hazzard, 1962; Woodward, 1967

			IRON COUNTY		
I-1	Ktd	Tropic Formation and Dakota(?) Sandstone	Late Cretaceous	As much as 80 to 85 percent shale; remainder is sandstone in beds generally less than 10 ft thick but locally as much as 70 ft thick. Coal in upper 20 ft. Generally, the Dakota(?) represented by thin sequence of sandstone and conglomerate at base of unit, but in places in Washington County, is as much as 108 ft thick. Combined formations 200 to 1,075 ft thick.	Averitt, 1962, 1967; Averitt and Threet, 1973; Cook, 1960; Gregory, 1950a, 1950b
			JUAB COUNTY		
J-1	€p	Pioche Shale	Early Cambrian	Shale containing sand laminae in lower two-thirds. About 500 ft thick.	Bick, 1966; Hintze, 1973
	Zmc	McCoy Creek Group	Late Proterozoic	McCoy Creek is mainly quartzite. Includes upper 860-ft-thick argillite and 990-ft-thick green-gray argillite about 575 ft below base of upper unit. Thickness, 8,800 ft.	
J-2	MDcp	Chainman and Pilot Shales, undivided	Pilot Shale: Early Mississippian and Late Devonian Chainman Shale: Late and late Early Mississippian	Dark shale and dark bituminous limestone overlying dolomitic siltstone. Combined thickness, 2,100 ft.	Hose, 1974b; Sandberg and others, 1980
J-3	Mgbc	Great Blue Limestone, Chiulos Member	Late Mississippian	Black shale and medium-grained quartzite. Thickness more than 625 ft. In this area, the unit is the upper member of the Great Blue Limestone.	Morris, 1977
			MILLARD COUNTY		
M-1	Mc	Chainman Shale	Late and late Early Mississippian	Dark shale and siltstone interbedded with some limestone. Highly faulted. Underlain by the 10 to 40-ft thick Joana Limestone, which is underlain by 800 ft of shale and siltstone of Pilot Shale (Upper Devonian and Lower Mississippian). Outcrops of Joana and Pilot too small to show.	Hose, 1974a; Hose and Ziony, 1963; Sandberg and others, 1980

M-2	₸R t	Thaynes Formation	Early Triassic	Mostly claystone and siltstone but contains some limestone beds of variable thickness throughout, and some sandstone. Faulted and in thrust sheets. More than 1,900 ft thick.	Hose and Repenning, 1963, 1964
M-3	Mc	Chainman Shale	Late and late Early Mississippian	Shale and siltstone and some limestone especially in upper part. Thickness, 1,550 to 1,850 ft.	Hintze, 1974b; Hose, 1965; Hose and Repenning, 1964; Sandberg and others, 1980
	MDp	Pilot Shale	Early Mississippian and Late Devonian	Siltstone and shale, is 700 to 850 ft thick.	
M-4	Ok	Kanosh Shale	Middle Ordovician	Shale and thin interbeds of calcarenite and in the upper half, siltstone. Thickness, 560 ft.	Hintze, 1974a
M-5	Mc	Chainman Shale	Early and Late Mississippian	Dark shale and carbonate beds and sandstone lenses.	Gutschick and Rodriguez, 1979; Hintze, 1963
	MDp	Pilot Shale	Early Mississippian and Late Devonian	Upper unit of shale and siltstone. Middle unit of limestone, calcareous shale, and sandstone. Lower unit of dark shale.	
M-6	Mc	Chainman Shale	Late and Early Mississippian	Black shale interbedded thin dark limestone. Thickness, more than 2,000 ft.	Gould, 1959; Gutschick and others, 1980; Hintze, 1963
M-7	pЄsr	Sheeprock Group, Inkom Formation	Late Precambrian	On map the outcrop of Sheeprock Group includes the Inkom Formation which is 530 ft of green slate and argillite and minor quartzite.	Crittenden and others, 1971; Woodward, 1968
M-8	₸R m	Moenkopi Formation	Middle(?) and Early Triassic	Upper 850-ft-thick unit of siltstone and shale. Lower unit less than 1,000 ft thick of siltstone, shale, some sandstone, and considerable limestone. Part of formation crops out in thrust sheet.	Callaghan and Parker, 1962; Crosby, 1959; Hintze, 1973
			TOOELE COUNTY		
T-1	Mc	Chainman Shale	Late Mississippian	Upper half; mostly claystone and siltstone and minor quartzite. Lower half; claystone, siltstone, and much quartzite and limestone. Thickness, 1,140 ft. Mapped as undifferentiated Chainman Shale and Diamond Peak Formation (Schaeffer and Anderson, 1960), but classified as only Chainman by Poole and Sandberg (1977).	Poole and Sandberg, 1977; Schaeffer and Anderson, 1960

T-2	PMm	Manning Canyon Shale	Early Pennsylvanian and Late Mississippian	Upper unit; black shale and quartzite. Middle unit; mostly limestone. Lower unit; black shale. Thickness of formation 200 to 1,600 ft.	Rigby, 1958
T-3	PMm	Manning Canyon Shale	Early Pennsylvanian and Late Mississippian	Mostly black shale but includes some thick limestones and few quartzite beds. Thickness, 1,600 ft.	Hintze, 1973; Gilluly, 1932; Poole and Sandberg, 1977
T-4	PMm	Manning Canyon Shale	Early Pennsyvlanian and Late Mississippian	Limestone, 79 ft. Quartzite, arkose, and graywacke, 600 ft. Shale, 1,231 ft.	Tidwell, 1962
T-5	PMm	Manning Canyon Shale	Early Pennsylvanian and Late Mississippian	Upper member, about 500 ft; shale interbedded with argillaceous limestone; two quartzite beds 10 to 25 ft thick at top. Middle member, 30 to 80 ft; fine-grained limestone. Lower member, 500 ft; shale and minor interbedded limestone and quartzite; quartzite prominent near top.	Disbrow, 1957; Poole and Sandberg, 1977
T-6	Mgbc	Great Blue Limestone, Chiulos Member	Late Mississippian	Chiulos, middle member of Great Blue Limestone, consists of shale and minor quartzite prominent near top of member. Thickness, 850 ft.	Disbrow, 1957
T-7	Mgbc	Great Blue Limestone, Chiulos Member	Late Mississippian	Shale interbedded with quartzite; 850 ft thick.	Disbrow, 1961
T-8	Mgbc	Great Blue Limestone, Chiulos Member	Late Mississippian	Chiulos, middle member, of the 1,757-ft-thick limestone formation, is 837 to 1,000 ft of dark shale and crossbedded quartzite.	Morris, 1964; Proctor and others, 1956
T-9	Zsr, Zsrs	Sheeprock Group	Late Proterozoic	Sheeprock Group of Cohenour (1959) in descending order: Quartzite, 0 to 2,000 ft thick. Argillite, tan and light-green, 2,000 to 3,000 ft thick. Tillite, 0 to 4,044 ft thick. Quartzite, conglomerate, and some slate, 1,350 to 1,470 ft thick. Black-banded phyllite, 2,690 ft thick. Upper and basal argillaceous units are shown separately as Zsrs in central part of Sheeprock Mountains. Sheeprock Group is 9,000 to 10,000 ft thick. In recent work Christie-Blick (1982) restricted Sheeprock Group to rocks below the upper quartzite unit, assigned formational names to the various units, and determined somewhat different measured thicknesses.	Christie-Blick, 1982; Cohenour, 1959; Harris, 1958

T-10	Zsr	Sheeprock Group	Late Proterozoic	Not described.	Hintze, 1980
T-11	Mgbc	Great Blue Limestone, Chiulos Member	Late Mississippian	Great Blue Limestone: Upper limestone member, 1,410 ft. Chiulos Member, more than 1,818 ft, black fissile shale and many interbedded ribs of quartzite near middle. Lower limestone member, 911 ft.	Cohenour, 1959
T-12	Mc	Chainman Shale	Late Mississippian	Rocks mapped as Chainman Shale by Hintze (1980) may be shales in the equivalent Ochre Mountain Limestone, (Charles Sandberg, U.S. Geological oral commun., 1982), and may also include some shales of the Manning Canyon Shale (Poole and Sandberg, 1977). Thickness 450 ft.	Hintze, 1973, 1980; Poole and Sandberg, 1977
T-13	Cp	Pioche Shale	Early Cambrian	Shale containing sand laminae in lower two-thirds. About 500 ft thick.	Bick, 1966; Hintze, 1973
	Zmc	McCoy Creek Group	Late Proterozoic	McCoy Creek mainly quartzite but includes an 860-ft-thick uppermost unit of green and black argillite and a 990-ft-thick green-gray argillite about 575 ft below base of upper unit. McCoy Creek is 3,500 ft thick.	
			WASHINGTON COUNTY		
W-1	Ktd	Tropic Formation and Dakota(?) Sandstone	Late Cretaceous	Alternating shales and thin sandstones and some coal beds. Dakota(?) represented by basal conglomerate 0 to 80 ft thick. Combined formations are 800 ft thick.	Cook, 1957, 1960

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