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MAP SHOWING OUTCROPS OF PRE-QUATERNARY BASALTIC 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 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 Basin and Range province to identify potentially suitable regions for further study relative to disposal of high-level nuclear waste (Bedinger, Sargent, and Reed, 1984).

This map was prepared from published geologic maps and reports, particularly a geologic map published by the New Mexico Geological Society (1982) and the U.S. Geological Survey (Dane and Bachman, 1965). For this study, basaltic rocks generally include basalt, andesitic basalt, and basaltic andesite, but locally interbedded with the basaltic rocks are flows of andesite, latite, and dacite, and tuffs of andesite and rhyolite. Thin beds of scoria, cinders, breccia, and agglomerate also commonly are associated with the basaltic rocks.

The map shows the known distribution of pre-Quaternary basaltic rocks within the Basin and Range province in New Mexico. Because so few data about the thicknesses of the basaltic flows are available and because the thicknesses may change markedly within short distances, it was not practical to limit the map distribution to just those basaltic units greater than 330 feet thick, as defined in the project guidelines (Sargent and Bedinger, 1984).

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

County-area number	Map symbol	Geologic and radiometric age in million of years (m.y.)	Lithology and comments	References for county area
			BERNALILLO COUNTY (B)	
B-1	Tb	Tertiary 2.78±0.12 m.y.	Three alkali-olivine-basalt flow units with interbedded ash bed.	Kudo and others, 1977
			CATRON COUNTY (C)	
C-1	Tba	Miocene	Largely aphanitic, commonly vesicular basalt and basaltic andesite. In Mangas Mountains includes thin interlayed beds of rhyolite tuff and tuff breccia. Individual flows average 100 ft thick. At least 1,000 ft thick near State Highway 12. Locally, along State Highway 12 and on the eastern flanks of Mangas Mountains is an older series of dark porphyritic, massive to vesicular basaltic andesites. Individual flow units 40 to 75 ft thick, and unit ranges from 50 to more than 400 ft thick.	Elston and others, 1976; Lopez and Bornhorst, 1976; New Mexico Geological Society, 1982; Stearns, 1962; Willard, 1957b; Willard and Givens, 1958; Willard and Stearns, 1971
C-2	Tba	Tertiary	Widespread younger unit (Miocene?) of aphanitic, commonly vesicular basalt and basaltic andesite flows; commonly separated from older basaltic unit by rhyolite and latite flows and rhyolite tuffs, although at places the two basalt units are in contact. Flows are about 30 ft thick and have scoriaceous margins. Unit is generally less than 600 ft thick, but greater than 985 ft thick at 0 Bar 0 Mountain. Older unit (Oligocene?) of vesicular, coarsely porphyritic andesite and basaltic andesite with large feldspar phenocrysts; crops out in northeast part of this area.	Elston and others, 1976; Fodor, 1976; New Mexico Geological Society, 1982; Rhodes and Smith, 1976; Stearns, 1962; Willard, 1957a; Willard and Stearns, 1971

C-3	Tba	Miocene, and Oligocene 15.2±0.4, 19.2±2.5, 23.2±0.6, and 25.0±0.6 m.y.	Widespread unit of basalt and basaltic andesite (Miocene and Oligocene?) which locally contains interlayers of volcaniclastic rocks, cinder layers, and basaltic breccias. In southern part of area upper part of unit is olivine basalt, containing large labradorite and pyroxene phenocrysts, which overlies basaltic andesite. In southernmost part of area, near Mogollon and east of Reserve, limited outcrops of an older unit (Oligocene) of andesite and basaltic andesite flows as much as 1,000 ft thick. Flows are thin and interlayered with volcaniclastic sandstone as much as 100 ft thick. Rhyolite flows and tuffs separate the two basaltic units.	Coney, 1976; Elston and others, 1976; New Mexico Geological Society, 1982; Ratte 1980; 1981; Rhodes and Smith, 1976; Smith, 1976; Stearns, 1962; Weber and Willard, 1959a, 1959b; Willard and Stearns, 1971
C-4	Tba	Miocene 20 to 25 m.y.	Widespread unit of basalt and basaltic andesite, dark andesite, and dark latite in fine-grained to porphyritic flows and lesser quantities of red scoria, agglomerate, and interbedded clastics. Includes flow breccias and locally thin beds of rhyolite tuff. Generally 100 to 500 ft thick but locally as much as 2,000 ft thick. Flows generally thin but range from 3 to 50 ft in thickness.	Coney, 1976; Elston and others, 1976; Ericksen and others, 1970; New Mexico Geological Society, 1982; Ratte and Gaskill, 1975; Ratte and others, 1979; Richter, 1978; Weber and Willard, 1959b; Willard and others, 1961

DONA ANA COUNTY (D)

D-1	Tb	Miocene 9.8±0.4 m.y.	Rincon Valley Formation, Selden Basalt Member: One and locally two olivine basalt flows interbedded in lower part of formation.	Clemons, 1976a; 1976b, 1977; Clemons and Seager, 1973; New Mexico Geological Society, 1982; Seager, 1975; Seager, and Clemons, 1975; Seager and Hawley, 1973; Seager and others, 1971, 1975, 1982, 1984
	Tba	Tertiary 25.9±1.5, 26.1±1.4, and 27.4±1.2 m.y.	Thin vesicular to amygdaloidal basaltic andesite and nonvesicular hypersthene-andesite flows; includes basaltic cinder beds and cone fragments, tongues of conglomeratic sandstone, and hornblende andesite and latite as much as 800 ft thick. Part of Sierra de las Uvas volcanic field.	
D-2	Tba	Tertiary	Dacite, latite, and basaltic andesite.	Hoffer, 1976

GRANT COUNTY (G)

G-1	Tba	Miocene and Oligocene	A younger (Miocene) unit predominantly of basalt, olivine basalt, and basaltic andesite in which plagioclase crystals are common; locally interbedded with sediments of Gila Conglomerate. Maximum thickness, 500 ft. An older (Oligocene) unit of finely porphyritic, andesitic basalt and basaltic andesite, but composition ranges from basalt to quartz latite. Andesite basalt flows generally are amygdaloidal. North of Virden, unit is about 1,000 to as much as 2,600 ft thick.	Elston, 1960; Elston and others, 1976; Griggs and Wagner, 1966; New Mexico Geological Society, 1982; Ratté and Hedlund, 1981; Rhodes and Smith, 1972; Weber and Willard, 1959b
G-2	Tb	Miocene 6.3±0.4 and 9.3, 9.8±0.3 m.y.	Vesicular flows of alkali-olivine-basalt as much as 200 ft thick; interbedded with sediments of upper Gila Conglomerate.	Aldrich, 1976; Elston, 1957; Elston and others, 1976; Ericksen and others, 1970; Finnell, 1976; Hedlund, 1977; Hernon and others, 1964; Jones, and others, 1970; Kuellmer, 1954, 1956; Ratté and Gaskill, 1975; Ratté and others, 1979; Rhodes, 1976; Seager and others, 1982; Willard and others, 1961
	Tba	Miocene and Oligocene 29.6±1.0 and 29.3±1.0 m.y.	A younger (Miocene) sequence dominantly of vesicular and scoriaceous basalt and basaltic andesite flows 10 to 60 ft thick; includes latitic flows and in places rhyolite tuff; unit has maximum thickness of 540 ft. Sequence of older (Oligocene) latite and basaltic andesite flows comprises majority of basaltic rocks in this area; at places individual flows are 50 to 75 ft thick. Along Mimbres River, unit is composed of vesicular to amygdaloidal basaltic andesite flows (Bear Springs Basalt) as much as 1,000 ft thick, underlain by nonporphyritic andesite flows (Razorback Formation) having maximum thickness of about 800 ft. At places flows are intercalated with sandstone, andesite and rhyolite tuffs, and gravel. Older sequence separated from younger basaltic rocks mainly by rhyolite flows and tuffs.	
G-3	Tba	Tertiary	Outcrop northeast of Mangas Springs includes upper unit (Miocene?) 0 to 100 ft of basalt and basaltic andesite flows 10 to 60 ft thick, separated by rhyolite and tuff from a lower unit (Oligocene) of platy, flow-banded, fine-grained basaltic andesite 0 to 1,960 ft thick. Present, but not shown on map, is unit (Pleistocene and Pliocene) of vesicular basalt flows as much as 150 ft thick, interbedded with Gila Conglomerate. Unit is basalt and basaltic andesite in Little Burro Mountains.	Finnell, 1982; Gillerman, 1964; New Mexico Geological Society, 1982

G-4	Tba	Miocene	Black, scoriaceous, basaltic andesite flow; some is aphanitic, surgary textured, and contains sparse andesine phenocrysts Maximum thickness about 100 ft.	Ballmann, 1960; Hedlund, 1978
G-5	Tb	Tertiary 11.8±0.3 m.y.	Olivine-basalt flows as much as 75 ft thick, capping mesa. Overlies undeformed fanglomerate.	Bromfield and Wrucke, 1961; New Mexico Geological Society, 1982; Seager and others, 1984
		HIDALGO COUNTY (H)		
H-1	Tba	Tertiary	Augite and olivine-augite, generally vesicular basalt; maximum thickness 150 to 200 ft.	Flege, 1959; New Mexico Geological Society, 1982
		LUNA COUNTY (L)		
L-1	Tb	Tertiary 3.0±0.07, 3.9±0.2, and 5.2±0.1 m.y.	Olivine-basalt flows, scoria, and pumice; less than 100 ft thick; most flows are aphanitic but a few are porphyritic.	Balk, 1961; New Mexico Geological Society, 1982; Seager and others, 1984
L-2	Tba	Tertiary	Basaltic andesite and andesite.	New Mexico Geological Society, 1982
L-3	Tba	Tertiary	Thin, vesicular basaltic andesite and nonvesicular hypersthene-andesite flows; includes basaltic cinder beds and cone fragments, and tongues of conglomeratic sandstones. In Cooke Range also includes basalt and some latite and minor interbedded rhyolitic tuffs.	Clemons, 1976a; 1979, 1982; New Mexico Geological Society, 1982; Seager and others, 1982
		SANDOVAL COUNTY (SA)		
SA-1	Tb	Tertiary	Two basalt flows cap mesa at head of Borrego Canyon on southern flanks of Jemez Mountains, which are north of map area. Upper flow is olivine basalt, 15 to 40 ft thick, less banded than the lower flow, and only slightly vesicular. Lower and less extensive flow is banded because of alternating scoriaceous and dense flows; lower flow is 30 to 70 ft thick and separated from upper flow by tuff, breccia, and gravel.	Kelley and Kudo, 1978

SA-2	Tb	Tertiary 2.5±0.3 m.y.	Basalt and cinder cones of San Felipe volcanic field have modal affinities to alkali olivine basalt, but chemically are classified as olivine tholeiites. Lava may be as much as 800 ft thick. Field extensively broken by faults.	Bachman and Mehnert, 1978; Kelley and Kudo, 1978
SA-3	Tb	Tertiary 2.61±0.09 m.y.	Tuff, breccia, and basalt diatreme comprising Canjilon Hill, a small hill south of the Jemez River north of Bernalillo. The rock is hypersthene-normative alkali olivine basalt.	Kelley and Kudo, 1978

SANTA FE COUNTY (SF)

SF-1	Tb	Tertiary	Basalt in the Santa Fe Group. Dated rocks north of map area have age of 2.5±0.2 m.y.	Bachman and Mehnert, 1978; New Mexico Geological Society, 1982

SIERRA COUNTY (SI)

SI-1	Tba	Tertiary	Porphyritic, slightly scoriaceous, fine-grained basalt (Bear Spring Basalt).	Jicha, 1954; Kuellmer, 1956; New Mexico Geological Society, 1982; Seager and others, 1982
SI-2	Tb	Tertiary 3.1±0.07 to 4.52±1.0 m.y.	Vesicular to amygdaloidal, alkali-olivine-basalt flows as much as 100 ft thick, and some dikes and plugs; locally interbedded with fanglomerate, conglomeratic sandstone, gravel, and sand.	Harley, 1934; Hedlund, 1977; Kuellmer, 1956; New Mexico Geological Society, 1982; Seager and others, 1982
	Tba	Tertiary 28.1±0.6 m.y.	Intensely faulted composite unit mainly of vesicular basaltic andesite but includes latite porphyry flows and breccia that locally grades into andesitic to latitic flows. Also includes some interfingering deposits of conglomerate, sandstone, shale, and rhyolitic tuffs. Unit as much as 1,000 ft thick on west side of area.	

SI-3	Tba	Miocene and Oligocene	Complex assemblege (Miocene and Oligocene?) of basaltic andesite, basalt, andesite, and latite flows. Basaltic andesite is vecicular, scoriaceous, and fine grained. Unit commonly interbedded with conglomerate and sandstone of Gila Conglomerate. Correlates with Bearwallow Mountain Formation. As much as 2,000 ft thick. Rests unconformably on older rocks and separated from older basaltic andesite unit by rhyolite flows and tuffs. Older unit (Oligocene), mostly andesite and lesser quantities of basaltic andesite flows and some dacite flows, all about 600 ft thick. Flows thin and very fine grained.	Coney, 1976; Elston and others, 1976; Ericksen and others, 1970; New Mexico Geological Society, 1982; Willard, 1957b
SI-4	Tba	Tertiary	Vesicular to amygdaloidal basaltic andesite.	Harley, 1934; New Mexico Geological Society, 1982; Seager and others, 1982
SI-5	QTb	Quaternary and Tertiary 2.1±0.4 and 2.9±0.3 m.y.	Olivine-basalt flows. Oldest dated flow (2.9 m.y.), at Mitchell Point, small unmapped outcrop on west side of Rio Grande at the head of Elephant Butte reservoir, is interbedded with alluvial sand apparently equivalent to the Camp Rice Formation. Basalts in the Caballo, and possibly also the Fra Cristobal Mountains, rest on prominent erosional surface of late Pliocene or early Pleistocene age.	Bachman and Mehnert, 1978; Kelley and Silver, 1952
SI-6	Tb	Tertiary 4.8±0.10 m.y.	Basalt capping Table Top Mountain northeast of Winston; flow overlies tilted beds of Santa Fe Group and overlies boundary fault of Sierra Cuchillo uplift without offset.	Seager and others, 1984
	Tba	Miocene 18.3±0.4 m.y.	Basaltic andesite along creek just east of Winston. Unconformably underlies fanglomerate of Santa Fe Group.	

SOCORRO COUNTY (S)

S-1	Tba	Tertiary 4.5±0.1 m.y.	Basaltic andesite to andesite lava flows. Includes the radiometrically dated basalt at San Acacia (Machete, 1978), aphanitic to slightly porphyritic basaltic andesite in flows as much as 138 ft thick which form bench as much as 230 ft above Rio Grande.	Machette, 1978; New Mexico Geological Society, 1982

S-2	Tba	Tertiary 23.8±1.2 m.y.	Basalt and porphyritic basaltic andesite. Probably equivalent to La Jara Peak Member of Datil Formation which is as much as 2,500 ft thick.	Chapin, 1971; New Mexico Geological Society, 1982; Tonking, 1957
S-3	Tb	Tertiary 4.0±3 to 16.3±1.1 m.y.	Basalts interbedded with sediments of Gila Conglomerate and Santa Fe Group. The youngest radiometrically dated basalt flow overlies alluvium of ancestral Rio Grande west of Socorro. The oldest basalt flow caps lower Miocene gravel west of Magdalena. Rhyolites associated with the basalts and sediments dated at 10.7 and 14.3±1.0 m.y.	Bachman and Mehnert, 1978; Luedke and Smith, 1978; New Mexico Geological Society, 1982
	Tba	Tertiary	Basaltic andesite and andesite lava flows.	
S-4	Tb	Late Pliocene 2.2±0.10 m.y.	Basalt flow at Black Butte, just south of San Marcial, overlies alluvial sand and gravel of ancestral Rio Grande.	Bachman and Mehnert, 1978
S-5	Tb	Tertiary 3.5±0.2 and 24.3±1.5 m.y.	Basalt flows.	Bachman and Mehnert, 1978

VALENCIA COUNTY (V)

V-1	Tb	Tertiary 3.4±0.4 m.y.	Basalt plug.	Bachman and Mehnert, 1978

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