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MAP SHOWING OUTCROPS OF TERTIARY BASALTIC ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA

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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 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 prospective regions for further study relative to isolation of high-level nuclear waste (Bedinger, Sargent, and Reed, 1984).

This map on the Tertiary basaltic rocks of northern California was prepared from published geologic maps and reports, utilizing the project guidelines defined in Sargent and Bedinger (1984). The map shows the known occurrences of Tertiary basaltic rocks. Detailed maps and reports, however, are not available for much of the study area, and the included data may contain inconsistencies regarding the composition, age, nomenclature, and stratigraphic relations of the rock units. The Description of Map Units includes the geologic and, if available, radiometric age, the lithology, thickness where available, and sources of data for the basaltic units within numbered areas in counties of the study area. The radiometric ages do not necessarily represent the entire age range of a geologic unit.

DESCRIPTION OF MAP UNITS

[To convert feet (ft) to meters, multiply feet by 0.3048]

County-area number	Map symbol	Geologic unit	Geologic and radiometric age in millions of years (m.y.)	Lithology and comments	References for county area
			LASSEN COUNTY (LA)		
LA-1	Tb		Miocene 5 to 10 m.y.	Cones and flows of jointed, vesicular, very permeable basalt; some flows interbedded with lake deposits. At least several hundred feet thick. Buried flows important source of ground water.	California Department of Water Resources, 1963; Gay and Aune, 1958; Luedke and Smith, 1981; Lydon, and others, 1960
LA-2	Tb		Miocene 5 to 10 m.y.	Basaltic shield volcanoes and cones. Black to gray, jointed, vesicular olivine basalt, andesitic basalt, and pyroxene basalt; permeable to very permeable. Thickness from several hundred feet to more than 2,000 ft. Some flows interbedded with lake deposits.	California Department of Water Resources, 1963; Luedke and Smith, 1981; Lydon and others, 1960
LA-3	Tb		Miocene	Cone or shield composed of black to gray, aphanitic to fine-grained olivine basalt. At least 1,500 ft thick on Bald Mountain.	Lydon, and others, 1960
LA-4	Tb		Miocene 5 to 10 m.y.	Dark, olivine-basalt flows and andesitic rocks which Powers (1932) assigned in part to Cedarville Andesite.	California Department of Water Resources, 1963; Gay and Aune, 1958; T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983; Hazlett, 1984; Powers, 1932
LA-5	Tb	Basalt of Dixie Valley	Pliocene and Miocene	Hard, black, dense, olivine tholeiite; more than 300 ft thick. Transected by northwest-trending normal faults.	Bean, 1980; T.L.T. Grose, Colorado School of Mines, unpublished data, 1983

LA-6	Tba		Pliocene 2.9 and 3.1 m.y.	Dark-gray, massive to vesicular, basaltic andesite flows. At least several hundred feet thick.	Bean, 1980; T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983
LA-7	Tb		Pliocene 4.1 m.y.	Pyroxene-olivine basalt flows. At least 1,000 ft thick.	Bean, 1980; T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983
LA-8	Tb		Pliocene 4.3 m.y.	Uniform, light-gray, diktytaxitic olivine basalt. At least 500 ft thick.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983; Tuppan, 1981
LA-9	Tb		Miocene 7.4 m.y.	Black pyroxene-olivine basalt.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983
LA-10	Tba		Pliocene and Miocene 5 to 10 m.y.	Mainly andesite, basaltic andesite, and dacite.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983; Luedke and Smith, 1981
LA-11	Tba		Pliocene and Miocene 5 to 10 m.y.	Andesite and basaltic andesite.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983; Luedke and Smith, 1981
LA-12	Tb	Basalt of Logan Mountain and unnamed basalts	Pliocene	Dense, black, olivine and pyroxene-olivine basalt. At least 400 ft thick locally.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983

LA-13	Tb		Pliocene	Mostly alumina-enriched olivine basalt. At least 200 ft thick. Minor olivine-basaltic andesite flows.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983; Youngkin, 1980
LA-14	Tba		Pliocene 2.5 m.y.	Olivine-basaltic andesite flows. At least 400 ft thick.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983; Youngkin, 1980
LA-15	Tba		Pliocene 2.3 m.y.	Pyroxene basaltic andesite. At least 200 ft thick.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983
LA-16	Tba		Pliocene and Miocene	Dacite to basaltic andesite flows and pyroclastics. Minimum thickness 2,000 ft.	T.L.T. Grose, Colorado School of Mines, unpublished, field data, 1983
LA-17	Tba		Pliocene and Miocene	Mainly basaltic andesite and minor olivine basalt. Minimum thickness 800 to 1,000 ft.	T.L.T. Grose, Colorado School of Mines, unpublished field data, 1983
LA-18	Tb		Pliocene 4.9 m.y.	Porphyritic, alumina-enriched, olivine-basalt flows interstratified with thin basaltic tuffs; thickness greater than 500 ft. Many northwest-trending normal faults.	T.L.T. Grose, Colorado School of Mines, unpublished field data, data, 1983; Roberts, 1984
LA-19	Tb		Pliocene	Black to gray flows of aphanitic to medium-grained olivine basalt and andesitic basalt. Based on topography, thickness may be 2,000 ft locally.	Lydon, and others, 1960

MODOC COUNTY (MO)

MO-1	Tb	Warner Basalt	Miocene 5.3 to 9.5 m.y.	Olivine-basalt flows included in Warner Basalt of Russell (1928) or "massive lava group" of Powers (1932). No specific description. Thickness, estimated from topography, at least 600 to 700 ft thick.	Gay and Aune, 1958; Jennings, 1977; Luedke and Smith, 1981; McKee and others, 1983; Powers, 1932; Russell, 1928

MO-2	Tb	Turner Creek Formation	Miocene 6.0 m.y.	Olivine-basalt flows and other basaltic rocks. Turner Creek Formation, (as used by the California Department of Water Resources, 1963) about 4,000 ft thick, principally mudflows and tuff but includes basalt of unreported thickness. Basalt jointed and has moderately to minimal permeability. May correlate with upper part of Cedarville series of Russell (1928).	California Department of Water Resources, 1963; Gay and Aune, 1958; Luedke and Smith, 1981; McKee and others, 1983; Rusell, 1928
MO-3	Tb		Miocene 14.1 m.y.	Olivine basalt.	Jennings, 1977; Luedke and Smith, 1981
MO-4	Tb	Warner Basalt of Russell (1928)	Miocene 5 to 10 m.y.	Mostly Warner Basalt of Russell (1928); may include some of upper Cedarville series of Russell (1928). Warner Basalt flows contain labradorite or anorthite phenocrysts, augite, and olivine in glassy groundmass; locally 600 ft thick.	Gay and Aune, 1958; Luedke and Smith, 1981; Russell, 1928
MO-5	Tb	Warner Basalt and upper Cedarville series of Russell (1928)	Miocene 10 to 16+ m.y.	Warner Basalt flows contain labradorite and anorthite phenocrysts, augite, and olivine in glassy groundmass. Upper Cedarville series, andesite and basaltic andesite tuffs, agglomerates, and thin flows. Total thickness of basalt flows and andesitic tephra deposits more than 600 ft and probably more than 1,000 ft. Intruded by rhyolite dated as 7.1 to 8.9 m.y. old.	Gay and Aune, 1958; Luedke and Smith, 1981; Russell, 1928
MO-6	Tb		Miocene 10 to 16+ m.y.	Undifferentiated olivine basalt and andesite flows, tuffs, and agglomerate. Probably correlates with Warner Basalt and Cedarville series of Russell (1928). Thickness, estimated from topography, is more than 1,000 ft.	Gay and Aune, 1958; Luedke and Smith, 1981; Russell, 1928
MO-7	Tb	Warner(?) Basalt	Tertiary	Massive olivine basalt; diktytaxitic and vesicular locally. Probably at least 300 ft thick.	Anderson, 1941; Gay and Aune, 1958

MO-8	Tb	Big Valley Mountains volcanic series and other basaltic rocks	Miocene 10 to 16+ m.y.	Thick sequence of basalt flows interlayered with minor beds of sand, tuff, and diatomite; jointed, slight dip, and minimal permeability. At least 4,000 ft thick. Overlain unconformably by Pliocene andesite and basalt.	California Department of Water Resources, 1963; Luedke and Smith, 1981
MO-9	Tb		Miocene 7.8 m.y.	Gray-black basalt containing scoriaceous zones along tops of flow units.	California Department of Water Resources, 1963; Gay and Aune, 1958; Luedke and Smith, 1981
MO-10	Tb		Miocene 8.2 m.y.	Very densely jointed, flat-lying olivine-basalt flows 50 to 250 ft thick.	California Department of Water Resources, 1963; Gay, and Aune, 1958; Jennings, 1977; Luedke and Smith, 1981
MO-11	Tb		Miocene 5 to 10 m.y.	Gray-black, vesicular, jointed, basalt flows.	California Department of Water Resources, 1963; Gay and Aune, 1958; Luedke and Smith, 1981
MO-12	Tb		Miocene 12.6 m.y.	Olivine basalt.	Luedke and Smith, 1981
MO-13	Tb		Pliocene and Miocene 2.0, 2.8, 6.4, 7.2, and 7.8 m.y.	Basalt flows.	Gay and Aune, 1958; Jennings, 1977; Luedke and Smith, 1981

MO-14	Tb	Upper Cedarville series of Russell (1928), Warner Basalt of Russell (1928), unnamed rocks	Miocene 11.9 to 15.5 m.y.	Underlain by Warner Basalt and upper Cedarville series (see descriptions in area MO-5) and by units Tvm, Tvt, and Tvb of Duffield and Weldin (1976). From top to bottom, their units are: Tvm--Interlayered basalt and andesite flows. Olivine basalt containing phenocrysts of labradorite or anorthite, augite, and olivine in glassy matrix, commonly diktytaxitic; zeolites locally. Andesite flows, porphyritic, massive to jointed, and brecciated. About 1,600 ft thick. Tvt--Well-bedded andesitic to rhyolitic air-fall tuffs locally interbedded with basalt flows, 100 to 400 ft thick. Tvb--Forty to seventy olivine-basalt flows: average 20 ft thick, and contain phenocrysts of labradorite or anorthite, augite, and olivine in a glassy matrix. Flows have massive centers and vesicular tops and bottoms. Vesicles contain zeolites. Unit ranges from about 900 to 1,300 ft thick. Individual flows as much as 150 ft thick and show columnar jointing. The three basaltic to andesitic units overlie rhyolitic welded ash-flow and andesite flows, and locally are overlain by and intruded by rhyolite flows and plugs. Parts of the section in this area were assigned to the Warner Basalt and the Cedarville series by Russell (1928).	California Department of Water Resources, 1963; Duffield and Weldin, 1976; Gay and Aune, 1958; Luedke and Smith, 1981; Russell, 1928

			SHASTA COUNTY (SH)		
SH-1	Tb	Massive lava group of Powers (1932) and Warner Basalt of Russell (1928)	Miocene 5 to 10 m.y.	Undifferentiated basaltic flows. Uniform basalt, consisting of clear-yellow olivine grains in matrix of colorless plagioclase. Estimated thickness from topography at least 1,000 ft.	Gay and Aune, 1958; Jennings, 1977; Luedke and Smith, 1981; Powers, 1932; Russell, 1928
			SISKYOU COUNTY (SI)		
SI-1	Tb		Pliocene	Olivine-basalt flows possibly interbedded with andesite. No specific description. Correlated with Cedarville Andesite by Powers (1932). Estimated thickness from topography at least 300 ft.	Gay and Aune, 1958; Jennings, 1977; Powers, 1932

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