DIVISION OF MINES AND GEOLOGY
Ian Campbell, *State Geologist*

STATE OF CALIFORNIA
Ronald Reagan, *Governor*
THE RESOURCES AGENCY
N. B. Livermore, Jr., *Administrator*

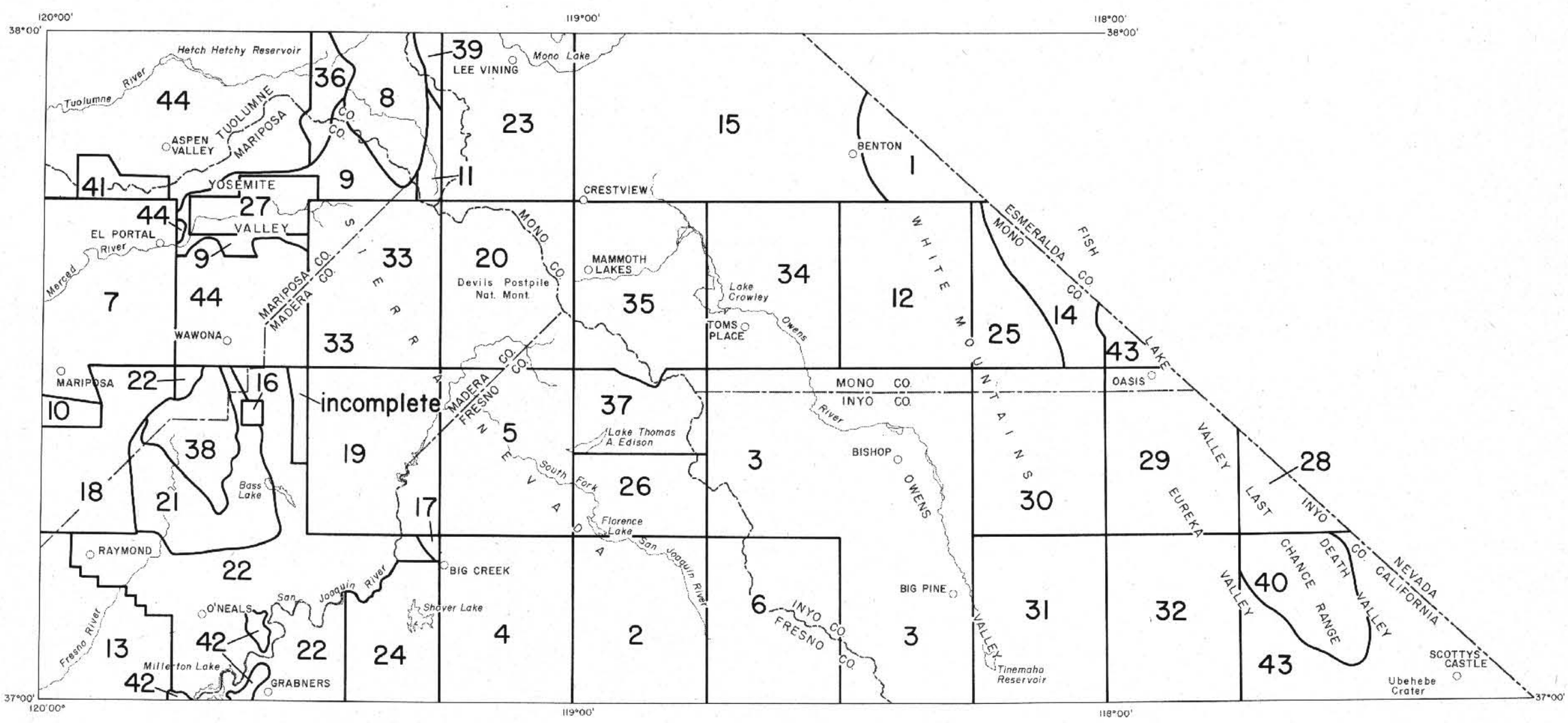
DEPARTMENT OF CONSERVATION
James G. Stearns, *Director*

EXPLANATORY DATA
MARIPOSA SHEET
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION

Compiled by Rudolph G. Strand 1967

Third printing, 1978

INDEX TO GEOLOGIC MAPPING
USED IN THE COMPILATION OF THE MARIPOSA SHEET



1. Anderson, George H., Geology of the north half of the White Mountain quadrangle, scale 1:62,500, California Institute of Technology, PhD thesis, 1933. Map published at smaller scale *in* Anderson, G. H., 1937, Granitization, albitization, and related phenomena in the northern Inyo Range of California-Nevada: Geol. Soc. America Bull., v. 48, no. 1, p. 1–74, Pl. 11, scale 1:348,480.

2. Bateman, Paul C., 1965, Geologic map of the Blackcap Mountain quadrangle, Fresno County, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-428, scale 1:62,500.

3. Bateman, Paul C., 1965, Geology and tungsten mineralization of the Bishop district, California: U. S. Geol. Survey Prof. Paper 470, Plates 2, 3, 4, and 7, scale 1:62,500.

Bateman, P. C., *et al*, 1963, The Sierra Nevada batholith, a synthesis of recent work across the central part: U. S. Geol. Survey Prof. Paper 414-D, Pl. 1, scale 1:250,000.

4. Bateman, Paul C., Geologic map of the Huntington Lake quadrangle, California, scale 1:48,000, U. S. Geol. Survey work in progress 1966.

5. Bateman, Paul C., and Lydon, Philip A., Geologic map of the Kaiser Peak quadrangle, California, scale 1:62,500, U. S. Geol. Survey and California Div. Mines and Geology, work in progress 1964.

6. Bateman, Paul C., and Moore, James G., 1965, Geologic map of the Mount Goddard quadrangle, Fresno and Inyo Counties, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-429, scale 1:62,500.

7. Bowen, Oliver E., Geologic map of the El Portal quadrangle and adjacent parts of the Mariposa quadrangle, scale 1:24,000, California Div. Mines and Geology, work in progress 1966.

Bowen, Oliver E., 1963, Le Grand to El Portal *in* Guidebook to the Annual Field Trip, May 18 and 19, 1963, San Juan Bautista to Yosemite Valley: Geological Society of Sacramento, p. 21–30 and Road Log Map 4 following p. 33, scale approx. 1:125,000.

8. Brodersen, Ray A., Petrology, structure, and age relationships of the Cathedral Peak porphyritic quartz monzonite, central Sierra Nevada, California, scale 1:62,500, University of California, Berkeley, PhD thesis, 1962.

Glacial deposits from Eliot Blackwelder unpublished map of some glacial deposits in the Mt. Lyell quadrangle, scale 1:125,000, 1934.

9. Calkins, Frank C., 1930, The granitic rocks of the Yosemite region, Appendix *in* Geologic history of the Yosemite Valley: U. S. Geol. Survey Prof. Paper 160, p. 120–129, Pl. 51, scale 1:125,000.

10. Cloos, Ernst, 1932, Structural survey of the granodiorite south of Mariposa, California: Am. Jour. Sci. Fifth Series, v. 23, no. 136, p. 289–304, fig. 1, scale approx. 1:72,400.

11. Cloos, Ernst, 1933, Structure of the Sierra Nevada Batholith *in* Guidebook 16, Excursion C-1, Middle California and Western Nevada: International Geological Congress XVI Session, pp. 40–45, Pl. 7, 1:375,000.

Cloos, Ernst, 1936, Der Sierra-Nevada-Pluton in Californien: Neues Jahrbuch fur Mineralogie, Geologie, und Paläontologie, Beil-Bd. 76, Abt. B., p. 355–450, Tafel xv, scale 1 inch = 4 miles.

*12. Crowder, Dwight F., and Sheridan, Michael F., Geologic map of the White Mtn. Peak quadrangle, Mono County, California, scale 1:48,000, U. S. Geol. Survey, work in progress 1966.

Sheridan, Michael F., and Crowder, Dwight F., 1964, Geologic map of the southwest quarter of the White Mtn. Peak quadrangle, Mono County, California: U. S. Geol. Survey Open File Map, scale 1:24,000.

Sheridan, Michael F., and Crowder, Dwight F., 1964, Geologic map of the northwest quarter of the White Mtn. Peak quadrangle, Mono County, California: U. S. Geol. Survey Open File Map, scale 1:24,000.

13. Ehrreich, Albert L., Metamorphism, migmatization, and intrusion in the foothills of the Sierra Nevada, Madera, Mariposa, and Merced Counties, California, scale 1:24,000, Univ. California Los Angeles, PhD thesis, 1964.

14. Emerson, D. O, 1966, Granitic rocks of the Mt. Barcroft quadrangle, Inyo batholith, California-Nevada: Geol. Soc. America Bull., v. 77, pp. 127–152, fig. 2, scale approx. 1 inch = 3¼ miles.

(Mapping of northern extension of Furnace Creek Fault from John Albers, U.S.G.S., personal communication, 1965, and from B. Troxel, California Div. Mines and Geology, ref. no. 43, Glacial deposits from Valmore LaMarche, U.S.G.S., written communication, 1966, and Douglas R. Powell, Physical geography of the White Mountains, California-Nevada, Univ. California Berkeley, MA thesis, 1963.)

*15. Gilbert, Charles M., 1941, Late Tertiary geology southeast of Mono Lake, California: Geol. Soc. America Bull v. 52, no. 6, p. 781–816, fig. 2, scale approx. 1:633,600 and fig. 3, scale approx. 1:400,000.

Additional map details from: Gilbert, C. M., The Cenozoic geology of the region southeast of Mono Lake, California, scale 1:125,000, Univ. California Berkeley, PhD thesis, 1938.

16. Greenwood, Robert, Geology of the Sugar Pine area, Madera County, California, scale approx. 1:13,000, California Institute of Technology, MS thesis, 1943.

17. Hamilton, Warren B., 1956, Geology of the Huntington Lake area, Fresno County, California: California Div. Mines Special Rept. 46, 25 p., Pl. 1, scale 1:63,360.

18. Helley, Edward J., Sediment transportation in the Chowchilla River basin, Mariposa and Madera Counties, California, scale 1:24,000, Univ. California, Berkeley, PhD thesis, 1966.

19. Huber, N. King, Geologic map of the Shuteye Peak quadrangle, California, scale 1:62,500, U. S. Geol. Survey, work in progress 1966.

20. Huber, N. King, and Rinehart, C. Dean, 1965, Geologic map of the Devils Postpile quadrangle, Sierra Nevada, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-437, scale 1:62,500.

Huber, N. K., and Rinehart, C. D., Cenozoic volcanic rocks of the Devils Postpile quadrangle, eastern Sierra Nevada, California: U. S. Geol. Survey Prof. Paper 554-D, in press, 1966.

21. Hunter, J. Fred, A geologic map of a part of the Mariposa 30-minute quadrangle, scale 1:125,000, U. S. Geol. Survey, incompleted project, circa 1916.

22. Jennings, Charles W., Reconnaissance geologic mapping, and photogeologic interpretation of parts of the Millerton Lake, Raymond, Shaver Lake, and Bass Lake quadrangles, scale 1:62,500, California Div. Mines and Geology, reconnaissance mapping for the State Geologic Map, 1965. Faults in Raymond quadrangle from Richard Lownes, written communication, 1966.

23. Kistler, Ronald W., 1966, Geologic map of the Mono Craters quadrangle, Mono and Tuolumne Counties, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-462, scale 1:62,500.

Kistler, R. W., 1966, Structure and metamorphism in the Mono Craters quadrangle, Sierra Nevada, California: U. S. Geol. Survey Bull., 1221-E.

Additional details of lake deposits and pumice deposits from Evans Mayo, unpublished geologic map of part of the Mt. Lyell quadrangle, scale 1:125,000, circa 1933.

24. Krauskopf, Konrad B., 1953, Tungsten deposits of Madera, Fresno, and Tulare Counties, California: California Div. Mines Spec. Rept. 35, 83 p., pl. 1, Reconnaissance geologic map of parts of the Kaiser, Dinuba, Tehipite, and Mount Goddard quadrangles, Fresno County, California, scale 1:125,000.

25. Krauskopf, Konrad B., Geologic map of the Mt. Barcroft quadrangle, scale 1:48,000, U. S. Geol. Survey, work in progress 1966.

26. Lydon, Philip A., 1965, Geology of the south half of the Mt. Abbot quadrangle: California Div. Mines and Geology Open File Report, Map Plate, scale 1:31,680.

27. Matthes, François E., 1930, Geologic history of the Yosemite Valley: U. S. Geol. Survey Prof. Paper 160, p. 1–119, Pl. 29, scale 1:24,000. (Quaternary deposits only; Calkins, ref. no. 9, is the source used for the bedrock geology.)

28. McKee, Edwin H., Geologic map of the Magruder Mountain quadrangle, California, scale 1:62,500, U. S. Geol. Survey, work in progress 1966.

Stewart, John H., and Troxel, B. W. (see ref. no. 40).

29. McKee, Edwin H., and Nelson, Clemens A., Geologic map of the Soldier Pass quadrangle, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, scale 1:62,500, in press, 1966.

Additional information concerning faults from Troxel, ref. no. 43.

30. Nelson, Clemens A., 1966, Geologic map of the Blanco Mountain quadrangle, Inyo and Mono Counties, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-529, scale 1:62,500.

31. Nelson, Clemens A., 1966, Geologic map of the Waucoba Mountain quadrangle, Inyo County, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-528, scale 1:62,500.

32. Nelson, Clemens A., Geologic map of the Waucoba Spring quadrangle, Inyo County, California, scale 1:48,000, U. S. Geol. Survey, work in progress 1966.

33. Peck, Dallas L., 1964, Preliminary geologic map of the Merced Peak quadrangle, California: U. S. Geol. Survey Mineral Investigations Field Studies Map, MF-281, scale 1:48,000.

*34. Rinehart, C. Dean, and Ross, Donald C., 1957, Geology of the Casa Diablo Mountain quadrangle, California: U. S. Geol. Survey Geologic Quadrangle Maps of the United States, GQ-99, scale 1:62,500.

*35. Rinehart, C. Dean, and Ross, Donald C., 1964, Geology and mineral deposits of the Mount Morrison quadrangle, Sierra Nevada, California: U. S. Geol. Survey Prof. Paper 385, Pl. 1, scale 1:62,500.

Addition of the pyroclastic rock map unit in T.35S., R.28E. from Cleveland, G. B., 1962, Geology of the Little Antelope Valley clay deposits, Mono County, California: California Div. Mines and Geology Spec. Rept. 72, Pl. 1, scale 1:31,680.

36. Rose, Robert L., 1957, Andalusite- and corundum-bearing pegmatites in Yosemite National Park, California: Am. Mineralogist v. 42, p. 635–647, fig. 1, scale 1:187,500.

Additional map details from: Rose, R. L., Geology of the May Lake area, Yosemite National Park, unpublished PhD thesis, University of California, Berkeley, 1957.

37. Sherlock, Donald G., and Hamilton, Warren, 1958, Geology of the north half of the Mt. Abbot quadrangle, Sierra Nevada, California: Geol. Soc. America Bull., v. 69, p. 1245–1268, Pl. 1, scale 1:62,500.

Mapping of Pliocene basalts from P. A. Lydon, California Div. Mines and Geology, written communication, 1955.

Additional mapping of glacial deposits from: Birman, Joseph H., 1964, Glacial geology across the crest of the Sierra Nevada, California: Geol. Soc. America Spec. Paper no. 75, 80 p., Pl. 1, scale 1:62,500.

38. Snetsinger, Kenneth G., Petrology and mineralogy of metamorphic and intrusive rocks, northwest part of the Bass Lake 15′ quadrangle, Madera and Mariposa Counties, California, scale 1:62,500, Stanford University, PhD thesis, 1965.

39. Stanford Geological Survey (under the direction of Robert L. Rose), Geologic map of the Tioga Pass area, Mono and Tuolumne Counties, California, scale 1:20,400, Stanford University, unpublished, 1957.

40. Stewart, John H., and Troxel, Bennie W., Geologic map of the Last Chance Range, scale 1:62,500, U. S. Geol. Survey and California Div. Mines and Geology unpublished mapping compiled for the the State Geologic Map 1963–64. (See also: Stewart, John H., 1965, Precambrian and Lower Cambrian formations in the Last Chance Range area, Inyo County, California: U. S. Geol. Survey Bull. 1224-A, p. A60–A70; and Stewart, John H., 1966, Correlation of Lower Cambrian and some Precambrian strata in the southern Great Basin, California and Nevada: U. S. Geol. Survey Prof. Paper 550-C, p. 666–672.)

41. Tobisch, Othmar T., Geology of the Crane Flat—Pilot Peak area, Yosemite district, California, scale 1:24,000, University of California, Berkeley. MA thesis, 1960.

42. Trauger, Frederick D., Geologic map of a part of the Millerton Lake, Little Table Mountain, and Sulphur Springs quadrangles, scales 1:62,500 and 1:31,680, unpublished 1936–41.

43. Troxel, Bennie W., Geologic map of northern Death Valley, and Eureka Valley area, scale 1:62,500, California Div. Mines and Geology, reconnaissance mapping for State Geologic Map, 1963–64.

44. Turner, Henry W., and Smith, William S. Tangier, A geologic map of the Yosemite 30-minute quadrangle, scale 1:125,000, U.S. Geol. Survey, incompleted project, 1897–1900.

* Location of some major subsurface faults from: Pakiser, L. C., Kane, M. F., and Jackson, W. H., 1964, Structural geology and volcanism of Owens Valley Region, California—a geophysical study: U. S. Geol. Survey Prof. Paper 438, Pl. 1, scale 1:96,000.

For a complete list of published geologic maps of this area see Division of Mines and Geology Special Reports 52 and 52-A.

STRATIGRAPHIC NOMENCLATURE—Continued

AGE	STATE MAP SYMBOL	STATE MAP UNIT State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES Formally named formations grouped in sequence (separated by semicolons) are listed from youngest to oldest.
PALEOZOIC — CAMBRIAN	€	**CAMBRIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	In the White Mountains: Tamarack Canyon Dolomite—*thin-bedded, fine-grained, gray dolomite having black chert nodules in basal part;* Lead Gulch Formation—*limestone, siltstone, shale, and chert;* Emigrant Formation—*thin-bedded gray cherty limestone, gray shale, yellow-buff silty limestone, and massive oolitic limestone;* Bonanza King Formation—*laminated to thick-bedded, gray and buff, fine-grained dolomite and limestone;* Monola Formation—*thin-bedded to massive, fine-grained, gray to blue-gray limestone, gray siltstone, silty gray shale, shaly siltstone, and buff limy siltstone;* Mule Spring Limestone—*thin- to medium-bedded, blue-gray limestone;* Saline Valley Formation—*thin-bedded, brown siltstone, fine-grained quartzite, silty shale, gray to brown shaly siltstone, and thin-bedded gray limestone;* Harkless Formation—*gray-green to brown platy silty shale, thin beds of fine-grained quartzite, thin pisolitic limestone beds at base of unit, and a tongue of fine- to medium-grained brown vitreous quartzite;* Poleta Formation—*gray-green shale, mottled blue-gray limestone, quartzite, gray limestone in upper unit, and massive- to thick-bedded gray-blue limestone in lower unit;* Campito Formation—Montenegro Member—*gray shale and interbedded fine-grained quartzitic siltstone and sandstone,* Andrews Mountain Member—*massively bedded, cross-stratified, gray to black, fine-grained quartzitic sandstone and interbedded gray siltstone and shale.* (The middle of Andrews Mountain Member contains lowest *Olenellid* fauna below which the strata are considered to be Precambrian by C. A. Nelson, 1966.) In the southern part of Last Chance Range: Nopah Formation—*light-gray to creamy-buff dolomite;* Bonanza King Formation (distinctively striped); Carrara Formation—*gray limestone, greenish-gray phyllite; siltstone, and yellowish-brown silty limestone;* Zabriskie Quartzite—*grayish-purple to dark-gray, fine- to medium-grained vitreous quartzite, conspicuously cross-stratified near the base;* Wood Canyon Formation—*very fine-grained quartzite, greenish-gray and gray siltstone, and yellowish-brown and gray limestone.* In the northern part of Last Chance Range: Nopah Formation; Bonanza King Formation; Mule Spring Limestone; Saline Valley Formation; Harkless Formation; Poleta Formation; and Campito Formation.
PRECAMBRIAN	€?	**CAMBRIAN-PRECAMBRIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Deep Spring Formation—*massive blue dolomite, quartzite, and limestone;* Reed Dolomite—*massive white dolomite* (these units are considered to be Precambrian by Stewart, 1965). Gray limestone, olive-gray siltstone and yellowish-gray quartzite in northern Last Chance Range (considered to be equivalent to the Reed Dolomite).
PRECAMBRIAN	Ip€	**LATER PRECAMBRIAN SEDIMENTARY AND METAMORPHIC ROCKS—Algonkian on some maps**	Wyman Formation—*thin-bedded, brown to dark-gray argillite, fine-grained, brown quartzitic sandstone, gray-brown siltstone, and a tongue of lenticular, gray-blue, oolitic limestone.*

NOTES

[1] These deposits were shown as Tertiary by Nelson (1966), but are now considered to be Pleistocene because of their stratigraphic relationship to a radiometrically dated basalt flow, C. A. Nelson personal communication, 1966. See also: G. B. Cleveland, 1958, Poverty Hills diatomaceous earth deposit, Inyo County, California: California Jour. Mines and Geol. v. 54, no. 3, p. 308.

[2] Blackwelder, Eliot, 1931, Pleistocene glaciation in the Sierra Nevada and Basin Ranges: Geol. Soc. America Bull., v. 42, p. 865–922.

[3] Sharp, Robert P., and Birman, Joseph H., 1963, Additions to classical sequence of Pleistocene glaciations, Sierra Nevada, California: Geol. Soc. America Bull., v. 74, p. 1079–1086.

[4] Chesterman, Charles W., Janda, Richard J., and Wahrhaftig, Clyde, 1965, Geology of the Sierran Foothill in eastern Fresno and Madera Counties, California: Geol. Soc. America Cordilleran Section Annual Meeting, Fresno State College, Fresno, California, April 14–17, 1965.

[5] Putnam, William C., 1962, Late Cenozoic geology of McGee Mountain, Mono County, California: Univ. California Pubs. in Geol. Sci., v. 40, no. 3, p. 205.

[6] Dalrymple, G. Brent, 1964, Cenozoic chronology of the Sierra Nevada, California: Univ. California Pubs. in Geol. Sci., v. 47, p. 1–41.

[7] Curry, Robert R., 1966, Glaciation about 3,000,000 years ago in the Sierra Nevada: Science v. 154, no. 3750, p. 770–771.

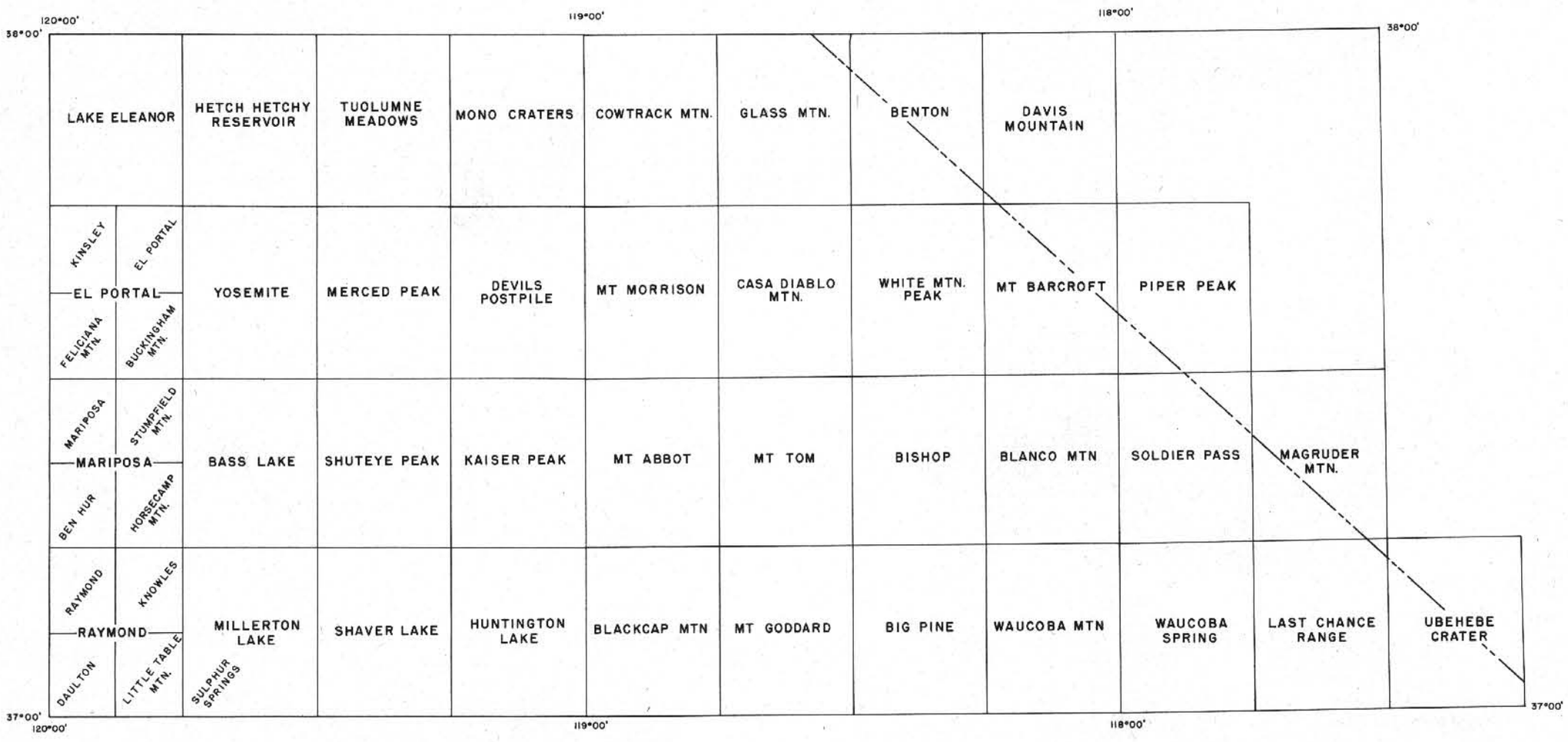
[8] Dalrymple, G. Brent, 1963, Potassium-argon dates of some Cenozoic volcanic rocks of the Sierra Nevada: Geol. Soc. America Bull., v. 74, no. 4, p. 379–390.

[9] Listed in alphabetical order, not in intrusive sequence. For details concerning the distribution of the plutons see: Bateman, Paul C., *et al*, 1965, The Sierra Nevada batholith, a synthesis of recent work across the central part: U. S. Geol. Survey Prof. Paper 414-D, p. D1–D46.

[10] Albers, John P., and Stewart, John H., 1965. Preliminary geologic map of Esmeralda County, Nevada: U. S. Geol. Survey Mineral Investigations Field Studies Map MF-298.

TOPOGRAPHIC QUADRANGLES
WITHIN THE MARIPOSA SHEET

AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY
FEDERAL CENTER, DENVER, COLORADO 80225
1967



STRATIGRAPHIC NOMENCLATURE—Continued

AGE	STATE MAP SYMBOL	STATE MAP UNIT State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES Formally named formations grouped in sequence (separated by semicolons) are listed from youngest to oldest.
MESOZOIC – CRETACEOUS	gr	**MESOZOIC GRANITIC ROCKS**	In the Sierra Nevada: Bridalveil Granite[9], Cathedral Peak Granite, El Capitan Granite, Half Dome Quartz Monzonite, Inconsolable Granodiorite, Johnson Granite Porphyry, Lamarck Granodiorite, Leaning Tower Quartz Monzonite, Mount Clark Granite, Mount Givens Granodiorite, Pohono Granodiorite, Round Valley Peak Granodiorite, Sentinel Granodiorite, Taft Granite, Tinemaha Granodiorite, Tungsten Hills Quartz Monzonite, and Wheeler Crest Quartz Monzonite. In the White Mountains: Barcroft Granodiorite, Boundary Peak Granite, Cabin Granodiorite, Cottonwood Adamellite, Leidy Adamellite, McAfee Adamellite, Pellisier Granite, and Sage Hen Adamellite. Other unnamed plutons ranging in composition from alaskite to diorite.
	bi	**MESOZOIC BASIC INTRUSIVE ROCKS**	Undifferentiated quartz diorite, diorite, and gabbro in the Sierra Nevada. Metamorphosed basic igneous rocks in the Raymond quadrangle (includes some metabasalt as well as metagabbro). Hornblende norite, olivine-hornblende norite, and hornblende gabbro in the area west of Yosemite National Park.
	ub	**MESOZOIC ULTRABASIC INTRUSIVE ROCKS**	Pyroxenite in the Raymond quadrangle. Soapstone and talc rock in Kinsley quadrangle. Serpentine elsewhere.
JURASSIC	Ju	**UPPER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Mariposa Formation—*black slate and phyllite, dark-gray or gray-green sheared sandstone, tuffaceous sandstone, and basal conglomerate.*
	Jml	**MIDDLE AND/OR LOWER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	In Mono Craters quadrangle: Jurassic marble, calc-silicate hornfels, and metaconglomerate. In Mt. Morrison quadrangle: metatuffaceous sandstone and siltstone, calc-hornfels, marble, thin beds of slate, and metavolcanic rocks (may be as old as Triassic). In Devils Postpile quadrangle: Lower Jurassic thin-bedded tuffaceous sandstone and siltstone, commonly calcareous.
	JTRv	**JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS**	In Mariposa and El Portal quadrangles: aphanitic rhyolite member of Mariposa Formation; Penon Blanco Volcanics—*massive green metamorphosed metatuff breccia, local andesitic and basaltic lava, and interbedded black slate and phyllite.* In the Tioga Pass area: unnamed Triassic meta-andesite flow and metarhyodacite pyroclastic rocks, Jurassic metarhyolite, metadacite, meta-andesite, metatuff and metarhyodacite, and Carboniferous(?) metadacite and meta-andesite. In the Raymond quadrangle: metamorphosed sodic dacite, sodic rhyolite, potassic rhyolite, andesite, basalt, and diabase. In Devils Postpile quadrangle: Early Jurassic and possibly Triassic or Permian crystal lithic metatuff, meta-andesite, metabasalt, metadacite, and some Jurassic metasedimentary rocks. In the Merced Peak quadrangle: Jurassic(?) amphibolite hornfels, schist and gneiss derived from tuff, bedded tuff and flows (in part this unit has been intruded by dikes which now constitute 25–50 percent of the rock). In the Mt. Morrison quadrangle: metamorphosed tuffs, flows, and hypabyssal intrusive rocks which range in composition from andesite to rhyolite. In the Blackcap Mtn. and Mt. Goddard quadrangles: flow-banded metarhyolite, metarhyolite to metadacite tuff, meta-andesite, metabasalt, and some lenses of metasedimentary rocks. In the Mt. Tom quadrangle: metarhyolite tuff, quartz latite sills, dikes, and flows(?), meta-andesite, and some metasedimentary rocks. Mafic metavolcanic rocks south of Bishop. Andesitic, dacitic, and rhyolitic metatuffs in Kaiser Peak quadrangle. Jurassic metamorphosed tuffs, flows, lapilli-tuff, graywacke, and shale, and calc-silicate hornfels in Mono Craters quadrangle.
UNDIVIDED	m	**PRE-CRETACEOUS METAMORPHIC ROCKS UNDIFFERENTIATED**	Triassic(?) and Jurassic gneiss and felsic gneiss in the Mt. Goddard quadrangle. Predominantly metavolcanic rocks in the Mt. Abbot quadrangle. Quartz-mica schists, slate, and greenstone in the Bass Lake area. Metamorphic rocks including some migmatite in the Millerton Lake area. Quartzite, interbeds of pelitic and calc-silicate hornfels, marble, brucite marble, quartzofeldspathic hornfels, meta-andesite, metadacite, metarhyolite, and metabasalt in the May Lake area of Yosemite National Park. Dolomitic limestone, argillite, schist, sandstone, quartzite, conglomerate, and metavolcanic rocks in the northern White Mtns. (adjoining units to the east in Esmeralda County, Nevada, range in age from Precambrian to Ordovician, Albers and Stewart, 1965[10]).
	ls	**LIMESTONE AND/OR DOLOMITE**	Marble and calc-silicate rocks in the Sierra Nevada west of Bishop. Metamorphosed calcareous rocks, marble, tactite, and various calc-silicate hornfelses in the Shaver Lake quadrangle.
	ms	**PRE-CRETACEOUS METASEDIMENTARY ROCKS**	Quartzite, quartz-mica schist, calc-silicate hornfels and tactite in Shuteye Peak quadrangle, and in Merced Peak quadrangle where these units are believed to be Permian or Triassic. Quartzite, schist, and hornfels in Sugar Pine area. Carboniferous marble, calc-silicate rock, metachert, phyllite, slate, and quartz hornfels, Triassic calc-silicate hornfels, metaconglomerate, and metasandstone, Jurassic metasandstone, calc-silicate hornfels, phyllite, slate, quartz hornfels, and quartz-mica schist in the Tioga Pass area. Metagraywacke, metagrit, metaconglomerate, and marble in White Mtn. Peak quadrangle (probably Permian, Triassic or Jurassic). Elsewhere small outcrops of quartzite, hornfels, and silicated marble.
	mv	**PRE-CRETACEOUS METAVOLCANIC ROCKS**	Permian or Triassic biotite schist and amphibolite probably derived from volcanic rocks, in the Merced Peak quadrangle. Meta-andesite in southeastern part of Yosemite 30-minute quadrangle. Metatuff and metavolcanic breccia in White Mtn. Peak quadrangle (probably Permian, Triassic or Jurassic). Diabase and volcanic breccia in the northwestern part of the Last Chance Range.
	gr-m	**PRE-CENOZOIC GRANITIC AND METAMORPHIC ROCKS**	Plutonic and metamorphic rocks partly concealed under float of porphyritic dikes and sills in Casa Diablo quadrangle. Granitic dike swarms in metamorphic host rock in Millerton Lake quadrangle. Marginal intrusive breccia consisting of fragments of adjacent metamorphic rock in alaskite in Mt. Goddard quadrangle. Schistose to gneissose aluminous and quartzofeldspathic migmatites, basic quartzofeldspathic and aluminous granulose to schistose migmatite, and gneissose quartzofeldspathic migmatite in Raymond quadrangle.
PALEOZOIC – PERMIAN	IP	**PALEOZOIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Briceburg Formation—*black phyllite and slate with minor chert, sheared metasandstone, and lenses of metavolcanic rocks and limestone* (shown as IP or Ju, considered to be late Paleozoic by some geologists and Upper Jurassic by others); Hite Cove Formation—*thin-bedded gray metachert, dark-colored phyllite and quartz-mica schist, minor sandstone and metaconglomerate, and shear zones of mylonite* (probably Permian and Carboniferous, possibly Triassic in part, includes rocks previously mapped as Calaveras Formation in Yosemite 30-minute quadrangle). Dolomite and quartzite in the northwestern extension of Grapevine Mountains. Tactite, calc-hornfels, quartz-sericite hornfels, graphite-andalusite hornfels, siliceous hornfels, quartz-mica phyllite, and biotite-quartz hornfels in Casa Diablo quadrangle (may be Precambrian, Rinehart and Ross, 1957). Quartzofeldspathic hornfels, calc-silicate hornfels, and carbonaceous marble in Mono Craters quadrangle. Micaceous quartzite, pelitic hornfels, siliceous calc-hornfels, metachert, marble, and schist in Bishop Creek area.
	Is	**LIMESTONE AND/OR DOLOMITE**	Fine-grained, gray, calcite marble and minor lenses of calc-hornfels and tactite in Casa Diablo quadrangle. Mississippian or Pennsylvanian limestone in northern Last Chance Range. Limestone of Hite Cove Formation in El Portal quadrangle.
	IPv	**PALEOZOIC METAVOLCANIC ROCKS**	Metavolcanic rocks of Hite Cove Formation in the El Portal quadrangle.
	Pm	**PERMIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Bloody Mountain Formation—*medium- to dark-gray, massive, siliceous calc-hornfels, siliceous hornfels, and some limestone* (Permian age based upon fossil fauna reported by R. R. Curry, written communication, 1966). Quartzofeldspathic hornfels, calc-silicate hornfels, and metavolcanic rocks in Mono Craters quadrangle.
	Pmv	**PALEOZOIC METAVOLCANIC ROCKS**	Meta-andesite flows and breccia, felsic tuff and flows, and local graywacke and metasandstone lenses (Permian radiometric age date by Kistler, 1966).
CARBONIFEROUS	C	**UNDIVIDED CARBONIFEROUS MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Mississippian and Pennsylvanian rocks undifferentiated in Last Chance Range.
	CP	**PENNSYLVANIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Keeler Canyon Formation—*thin-bedded, gray limestone, cherty limestone, and interbedded purple siltstone* in Waucoba Mtn. quadrangle (Permian in part); Rest Spring Shale—*dark-gray siltstone, shale and mudstone* (considered to be Mississippian to Pennsylvanian? in type area to south and in Last Chance Range, but considered to be Mississippian in Waucoba Mtn. quadrangle). In the Mt. Morrison area: Lake Dorothy Hornfels—*color-banded, thin-bedded, microgranular, siliceous calc-hornfels* (Pennsylvanian and/or Permian?); Mildred Lake Hornfels—*light- to dark-gray siliceous hornfels that weathers reddish-brown, some white to greenish-gray siliceous calc-hornfels layers* (Pennsylvania and/or Permian?); Mount Baldwin Marble—*medium-dark and bluish-gray fine-grained marble,* locally contains chert nodules; Bright Dot Formation—*gray to dark-gray siliceous hornfels and metachert* (Pennsylvanian age uncertain). Micaceous quartzite, pelitic hornfels, and marble in the Mt. Tom quadrangle. CP? in the Mono Craters quadrangle represents quartzofeldspathic hornfels, calc-silicate hornfels, marble, and quartzite.
	CM	**MISSISSIPPIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Perdido Formation—*upper unit of thin-bedded gray shale, brown quartzite, and chert pebble conglomerate, lower unit of medium-bedded, dark-gray, fine-grained dolomite, thin- to medium-bedded black to brown chert, brown quartzite and basal limestone conglomerate* in Waucoba Mtn. quadrangle. Mississippian strata in Last Chance Range.
DEVONIAN	D	**DEVONIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Lost Burro Formation—*light-gray dolomite prominently striped with nearly black limestone and dolomite.*
SILURIAN	S	**SILURIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Hidden Valley Dolomite—*gray dolomite, nodular cherty zone near base, silty and sandy zones near top* (in part Devonian; present in Waucoba Spring quadrangle). Sunday Canyon Formation—*platy, gray to buff, limy shale, minor gray limestone interbeds in basal portion, grading upward to thin-bedded blue-gray shaly limestone* (perhaps Devonian in part; present in Waucoba Mtn. quadrangle).
ORDOVICIAN	O	**ORDOVICIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	In the Waucoba Spring quadrangle and in the Last Chance Range: Ely Springs Dolomite—*dolomite containing dark-brown and black nodular chert;* Eureka Quartzite—*vitreous quartzite, upper part massive and nearly white; lower part thinly-bedded, hematitic and limonitic;* Pogonip Limestone—*medium-gray limestone and dolomite which weathers to brownish or yellowish color.* In the Waucoba Mtn. quadrangle: Johnson Spring Formation—*medium-bedded, fine- to medium-grained, light-gray, vitreous quartzite beds, and buff, crystalline dolomite beds;* Barrel Spring Formation—*siltstone and shale which weather reddish-brown, and thin beds of gray-buff limestone and quartzite;* Badger Flat Limestone—*gray silty limestone and calcarenite and interbedded buff siltstone, black chert abundant near base;* Al Rose Formation—*brown-weathering siltstone, shale, and mudstone.* In the Convict Lake Block: Convict Lake Formation—*gray, siliceous hornfels and grayish-black to pale-orange thinly-laminated calc-hornfels, some slate, metachert, metasandstone, and marble;* Mount Aggie Formation—*interbedded, thin- to thick-bedded, dark-gray slate and bluish-gray marble* (questionable Ordovician); Buzztail Spring Formation—*interlayered, dark-colored, pelitic hornfels and slate, siliceous hornfels, metachert, calcareous quartz sandstone and marble* (questionable Ordovician). In the McGee Mtn. Block: Hilton Creek Marble—*light- to dark-bluish-gray, fine-grained marble containing silicated zones throughout* (questionable Ordovician); gray coarse-grained calcareous metasandstone, dark-gray, thinly laminated pelitic hornfels and slate, siliceous hornfels, metachert, marble, and siliceous calc-hornfels. O-S = Ordovician or Silurian(?) units: Mount Morrison Sandstone—*metamorphosed fine- to medium-grained calcareous quartz sandstone, some siliceous calc-hornfels* in Mt. Morrison quadrangle. Interbedded thick strata of dark-gray siliceous hornfels and quartzite, gray metamorphosed calcareous quartz sandstone, muscovite siliceous hornfels, and dark-gray metachert in Mt. Morrison quadrangle. Marble, calc-silicate hornfels, quartzite, andalusite hornfels, and quartzofeldspathic hornfels in Mono Craters quadrangle.

STRATIGRAPHIC NOMENCLATURE—MARIPOSA SHEET

AGE	STATE MAP SYMBOL	STATE MAP UNIT State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES Formally named formations grouped in sequence (separated by semicolons) are listed from youngest to oldest.
CENOZOIC – QUATERNARY – Recent	Qs	**RECENT DUNE SAND**	Large sand dune in southern Eureka Valley and eolian sand deposits along the southwest margin of Eureka Valley; stabilized dune sand in area four miles west of Bishop.
	Qal	**RECENT ALLUVIUM**	Alluvium and Recent alluvial fan deposits. Locally includes some pumice tuff-breccia in Mono Craters area, Recent moraines in Mt. Goddard area, lake beds in Merced Peak area, eolian sand veneer along southwest margin of Eureka Valley, residual decomposed granite in valleys within Millerton Lake quadrangle, and spring tufa deposits northeast of Ubehebe Crater. Also includes some of the glacial outwash, ground moraine, and talus deposits present over much of the area.
	Qf	**RECENT ALLUVIAL FAN DEPOSITS IN THE GREAT VALLEY**	Sediments deposited by the Fresno River.
		RECENT VOLCANIC ROCKS:	
	Qrv	**UNDIFFERENTIATED**	Pleistocene or Recent, dark-gray, glassy, olivine-bearing, quartz latite.
	Qrv^{r}	**RHYOLITIC**	Rhyolite domes in Devils Postpile quadrangle; rhyolite domes and obsidian flows of Mono Craters.
	Qrv^{b}	**BASALTIC**	Scoriaceous basalt flows of the Red Cones, Devils Postpile quadrangle.
	Qrv^{p}	**PYROCLASTIC**	Mantle of light-gray rhyolitic pumice tuff-breccia in the southeastern Mono Basin area (mapped only where known to be several tens of feet thick; possibly includes Pleistocene and Tertiary deposits). A veneer of cinder deposits which extends northward from the Ubehebe Crater area.
QUATERNARY – Pleistocene	Ql	**QUATERNARY LAKE DEPOSITS**	Deposits of ancestral Long Valley Lake—gray sandstone and conglomerate, light-gray clay beds, calcareous tufa, and yellowish to greenish-white diatomaceous earth. Diatomaceous earth interbedded in lacustrine silt, sand and pebble conglomerate (southwest corner Tinemaha Reservoir[1]). Lake beds of ancient Waucobi Lake—well-bedded light-gray to buff shaly siltstone, fine- to coarse-grained sandstone, in part tuffaceous. Recent playa silt and clay in Eureka and Deep Spring Valleys, lake beds along Mono Lake and in northern part of Death Valley. Glacial lake deposits in Yosemite Park.
	Qg	**QUATERNARY GLACIAL DEPOSITS**	The more prominent moraine and till deposits of Pleistocene Sierran glaciations (i.e. Tioga, Tenaya, Tahoe, Mono Basin, Sherwin, and McGee Glaciations of Blackwelder, 1931[2], Sharp and Birman, 1963[3], and Birman, 1964 ref. no. 37; till of pre-Sherwin (McGee?) glaciation recognized by Bateman and Moore, 1965.
	Qt	**QUATERNARY NONMARINE TERRACE DEPOSITS**	Gravels terraced to the level of ancestral Long Valley Lake; river terrace gravels west of Bishop.
	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Friant Formation—*gravel, sand, clay, volcanic ash, pumice fragments, and interbedded continental stream and lake sediments* (may correlate with Modesto, Riverbank, and Turlock Lake Formations of Chesterman, Janda, and Wahrhaftig, 1965[4]). Older alluvium and megabreccia in Eureka Valley; some lake deposits of ancient Waucobi Lake (Bishop quadrangle); and older alluvium containing layers of reworked pumice (NW¼ White Mtn. Peak quadrangle).
		PLEISTOCENE VOLCANIC ROCKS:	
	Qpv^{r}	**RHYOLITIC**	Light-brownish-gray porphyritic quartz-latite of Mammoth Mountain; light- to medium-gray, structureless "younger" rhyolite in Mt. Morrison quadrangle; gray perlitic glass, pitchstone, obsidian, and pale-reddish-brown to light-brownish-gray flow-banded rhyolite in Glass Mtn. area (Pleistocene age per W. C. Putnam, 1962[5], and Pliocene(?) age by Rinehart and Ross, 1964); rhyodacite in southern Mt. Goddard quadrangle (may be late Tertiary in age); and light-gray rhyolite, pumiceous perlite, perlite, black brecciated obsidian, and gray perlitic vitrophyre, south of Big Pine.
	Qpv^{a}	**ANDESITIC**	Porphyritic plagioclase and olivine andesite (Devils Postpile quadrangle); scoriaceous andesite of Pumice Butte; and light- to dark-gray andesite of the Devils Postpile; andesite of Mono Craters; and andesite at northern end of Long Valley.
	Qpv^{b}	**BASALTIC**	Basalt flow rocks in eastern half of map area; in Bishop and Waucoba Spring quadrangles these flows may be late Tertiary.
	Qpv^{p}	**PYROCLASTIC**	Bishop Tuff—*gray, salmon, pink, brown, and purple, agglutinated, rhyolitic tuff, contains a basal pumice layer, welded in part.* Pumice, perlitic glass, and obsidian northeast of Lake Crowley, probably derived from Glass Mountain, (shown as Pliocene(?) by Rinehart and Ross, 1964); rhyolitic tuff, tuffaceous sandstone, and conglomerate southeast of Mono Lake; cinder cones south of Big Pine, composed of grayish-red cinders, bombs, and angular blocks of olivine basalt; basaltic ash and cinders in Waucoba Mtn. quadrangle; lapilli tuff breccia to vitric tuff of rhyolite composition in Mt. Morrison quadrangle; pumice lapilli tuff in White Mtns.
	QP	**PLIOCENE-PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	"Old" alluvial deposits in Death Valley and on west flank of Last Chance Range; quartzite boulder fanglomerate in Soldier Pass quadrangle.
	✳	**QUATERNARY AND/OR PLIOCENE CINDER CONES**	Basaltic and andesitic cinder cones.
TERTIARY – Pliocene	Pc	**UNDIVIDED PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Esmeralda Formation—*buff, friable, arkosic sandstone, green siltstone, white tuff, and gray to green sandstone* (late Miocene to Pliocene); tuffaceous sandstone, sandstone and conglomerate in Soldier Pass quadrangle; Pliocene(?) alluvium on upland surfaces of Sierra Nevada (Mt. Morrison quadrangle); and Pliocene(?) boulders, cobbles, and coarse sand in Blanco Mtn. quadrangle.
		PLIOCENE VOLCANIC ROCKS:	
	Pv^{r}	**RHYOLITIC**	Light-gray to purplish-gray, glassy to aphanitic, quartz latite of Two Teats dated at 3.0 ± 0.1 m.y. (Plio-Pleistocene) by Dalrymple, 1964[6], similar rocks nearby reported as 2.72 ± 0.2 m.y. by R. R. Curry, 1966[7], quartz-latite flow remnant northwest of Convict Lake.
	Pv^{a}	**ANDESITIC**	Dark-gray, hornblende andesite of Bald Mtn.; Pliocene or Pleistocene medium-gray, aphanitic andesite at northeast corner of Devils Postpile quadrangle; andesite of Deadman Pass in Devils Postpile quadrangle; latite and biotite-augite latite in the northern part of the Yosemite 30-minute quadrangle.
	Pv^{b}	**BASALTIC**	Gray to black olivine basalt in Casa Diablo quadrangle dated at 3.2 ± 0.1 m.y. (Plio-Pleistocene) by Dalrymple, 1963[8]; gray olivine basalt and some andesite in Merced Peak quadrangle (Pliocene and Pleistocene); olivine basalt in Mt. Abbot quadrangle dated at 3.6 ± 0.1 m.y. (Pliocene) by Dalyrmple, 1963[8]; trachybasalt, some trachyandesite and olivine latite in Kaiser Peak quadrangle; olivine basalt in Deep Spring Valley dated at 10.8 ± 1.0 m.y. (early Pliocene) by Dalrymple, 1963[8]; basalt of Esmeralda Formation in Sylvania Mountains; Pliocene(?) basalt and andesite in Shuteye Peak quadrangle; trachybasalt in the Huntington Lake quadrangle, and basalt in the Millerton Lake area dated at 9.5 ± 0.3 m.y. by Dalrymple, 1963[8]; basalt in Saline and Last Chance Ranges, and in northwestern extension of Grapevine Mtns., possibly Pleistocene.
	Pv^{p}	**PYROCLASTIC**	Andesitic tuffs and breccia in Yosemite 30-minute quadrangle; buff, pink and gray vitric rhyolitic tuff in the Blanco Mtn. quadrangle; buff and gray rhyolitic tuff in Soldier Pass and Mt. Barcroft quadrangles.
TERTIARY – Oligocene	ϕc	**OLIGOCENE NONMARINE SEDIMENTARY ROCKS**	Titus Canyon Formation(?)—*boulder conglomerate in red silty clay matrix* (in northern Last Chance Range; identification is tentative).
TERTIARY – Eocene	Ec	**EOCENE NONMARINE SEDIMENTARY ROCKS**	Ione Formation—*conglomerate, sandstone, and mudstone* (in western foothills of Sierra Nevada).
TERTIARY – Undivided	Tc	**TERTIARY NONMARINE SEDIMENTARY ROCKS**	Indurated conglomerate in Mono Craters quadrangle. "Old" gravel deposits in Last Chance Range. Sedimentary deposits exposed in walls of Ubehebe Crater. Poorly consolidated conglomerate, sandstone, and tuff in Millerton Lake area (considered to correlate with Mehrten Formation upper Miocene to lower Pliocene by Trauger, unpublished ref. no. 42). Auriferous gravels at western edge of Yosemite 30-minute quadrangle.
		TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:	
	Ti	**UNDIFFERENTIATED**	Undifferentiated hypabyssal rocks of west-central Mono Craters quadrangle.
	Ti^{r}	**RHYOLITIC**	Rhyolitic plugs in vicinity of Scottys Castle.
	Ti^{a}	**ANDESITIC**	Intrusive andesite in White Mountains.
		TERTIARY VOLCANIC ROCKS:	
	Tv^{r}	**RHYOLITIC**	Rhyolite in Waucoba Spring quadrangle. Rhyolite in vicinity of Scottys Castle (may be correlative with Miocene(?) rhyolite mapped to southeast in Grapevine Mtns.). Post-Jurassic rhyodacite in Tioga Pass area.
	Tv^{a}	**ANDESITIC**	Andesitic flow remnants in the northern part of Bass Lake quadrangle. Post-Jurassic andesite in Tioga Pass area.
	Tv^{p}	**PYROCLASTIC**	Gray rhyolitic vitric crystal tuff in Benton Range. Andesitic crystal lithic tuff in southeastern Mono Craters quadrangle. Tuff and tuffaceous sediments in Saline and Last Chance Ranges and in northwestern extension of Grapevine Mountains (may correlate with Miocene(?) deposits to southeast, or with rhyolitic tuff in Deep Spring Valley which has been dated as 10.9 ± 0.2 m.y. (early Pliocene) by Dalrymple, 1963[8]).