DIVISION OF MINES
Ian Campbell, Chief

STATE OF CALIFORNIA
Edmund G. Brown, Governor

DEPARTMENT OF NATURAL RESOURCES
DeWitt Nelson, Director

EXPLANATORY DATA

ALTURAS SHEET

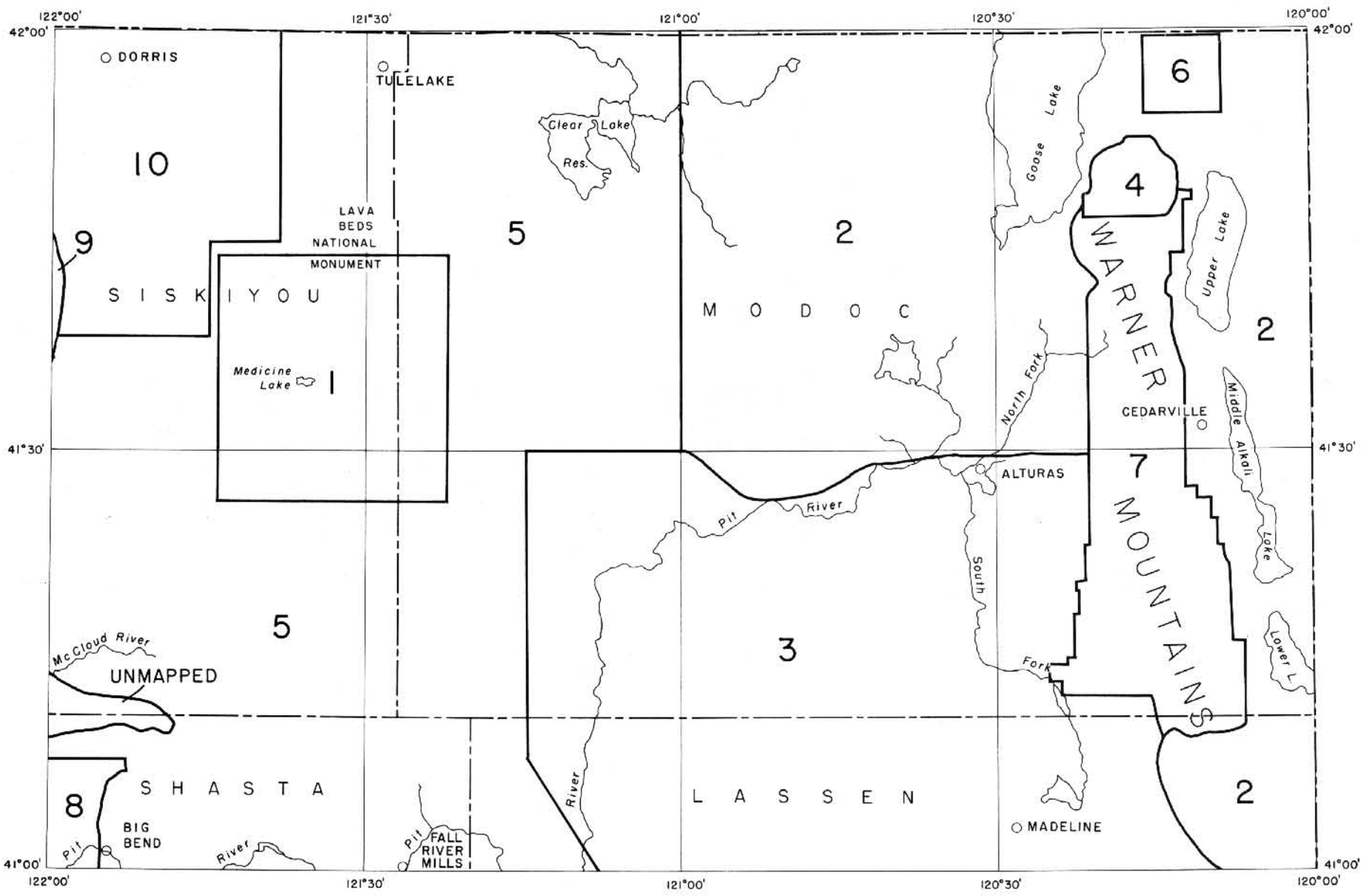
GEOLOGIC MAP OF CALIFORNIA

OLAF P. JENKINS EDITION
Compiled by Thomas E. Gay, Jr. and Quintin A. Aune, 1958

(Second Printing, 1967)

INDEX TO GEOLOGIC MAPPING

USED IN COMPILATION OF THE ALTURAS SHEET



1. Anderson, C. A., 1941, Volcanoes of the Medicine Lake Highland, California: California Univ., Dept. Geol. Sci., vol. 25, no. 7, pp. 347-422. Map to accompany Volcanoes of Medicine Lake Highland, scale 1:125,000. (Modified slightly after Chesterman, C. W., 1956, Pumice, pumicite, and volcanic cinders in California: California Div. Mines Bull. 174, 119 pp., Pl. 2: Geologic map of the Medicine Lake area, Siskiyou County, scale 1:125,000. Minor modifications also by Aune, Q. A. and Gay, T. E. Jr., California Div. Mines, unpublished photogeologic interpretation, 1957-1958).

2. Aune, Quintin A., Reconnaissance geology of the northeastern and eastern portions of the Alturas Sheet, California: California Div. Mines, unpublished photogeologic interpretation with field checks, scale 1:62,500, (1957-1958). Quaternary units in Surprise, Goose Lake, and Jess Valleys adapted in part from Carpenter, E. J., and Storie, R. E., 1931 (1936), Soil survey of the Alturas area, California: U. S. Bureau of Chemistry and Soils, Series 1931, no. 23, scale 1:62,500.

3. Aune, Quintin A., and Gay, T. E. Jr., Reconnaissance geology of the southeastern portion of the Alturas Sheet, California: California Div. Mines unpublished photogeologic interpretation with field checks, scale 1:62,500, (1957-1958). Quaternary units in Alturas area adapted in part from Carpenter, E. J., and Storie, R. E., 1931 (1936), Soil survey of the Alturas area, California: U. S. Bureau of Chemistry and Soils, Series 1931, no. 23, scale 1:62,500. Quaternary units in Big Valley adapted in part from Watson, E. B., and Cosby, S. W., 1920 (1924), Soil survey of the Big Valley, California: U. S. Bureau of Soils, pp. 1005-1032, scale 1:62,500.

4. Chesterman, C. W., Geologic map of the Sugar Hill area, scale approx. 1:24,000, California Div. Mines, unpublished (1948).

5. Gay, T. E. Jr., and Aune, Q. A., Reconnaissance geology of portions of the western half of the Alturas Sheet, California: California Div. Mines unpublished photogeologic interpretation with field checks, scale 1:62,500, (1957-1958). Modified in part after Peacock, M. A., 1931, Modoc lava field, northern California: Geog. Rev., vol. 21, pp. 259-275, Fig. 2: Geological reconnaissance map of the Modoc lava field, scale 1:750,000. Modified in part after Powers, H. A., 1932, Lavas of the Modoc Lava Bed quadrangle: Am. Mineralogist, vol. 17, pp. 253-294, Pl. 1: Geological reconnaissance map of Modoc Lava Bed quadrangle, scale 1:500,000; and Powers, unpublished field map of Modoc Lava Bed quadrangle, scale 1:250,000.

6. Hill, J. M., 1915, High Grade district, Modoc County, California, *in* Some mining districts in northeastern California and northwestern Nevada: U. S. Geol. Survey Bull. 594, pp. 38-48, Pl. 5: Sketch map of High Grade mining district, Modoc County, California, scale approx. 1:35,700.

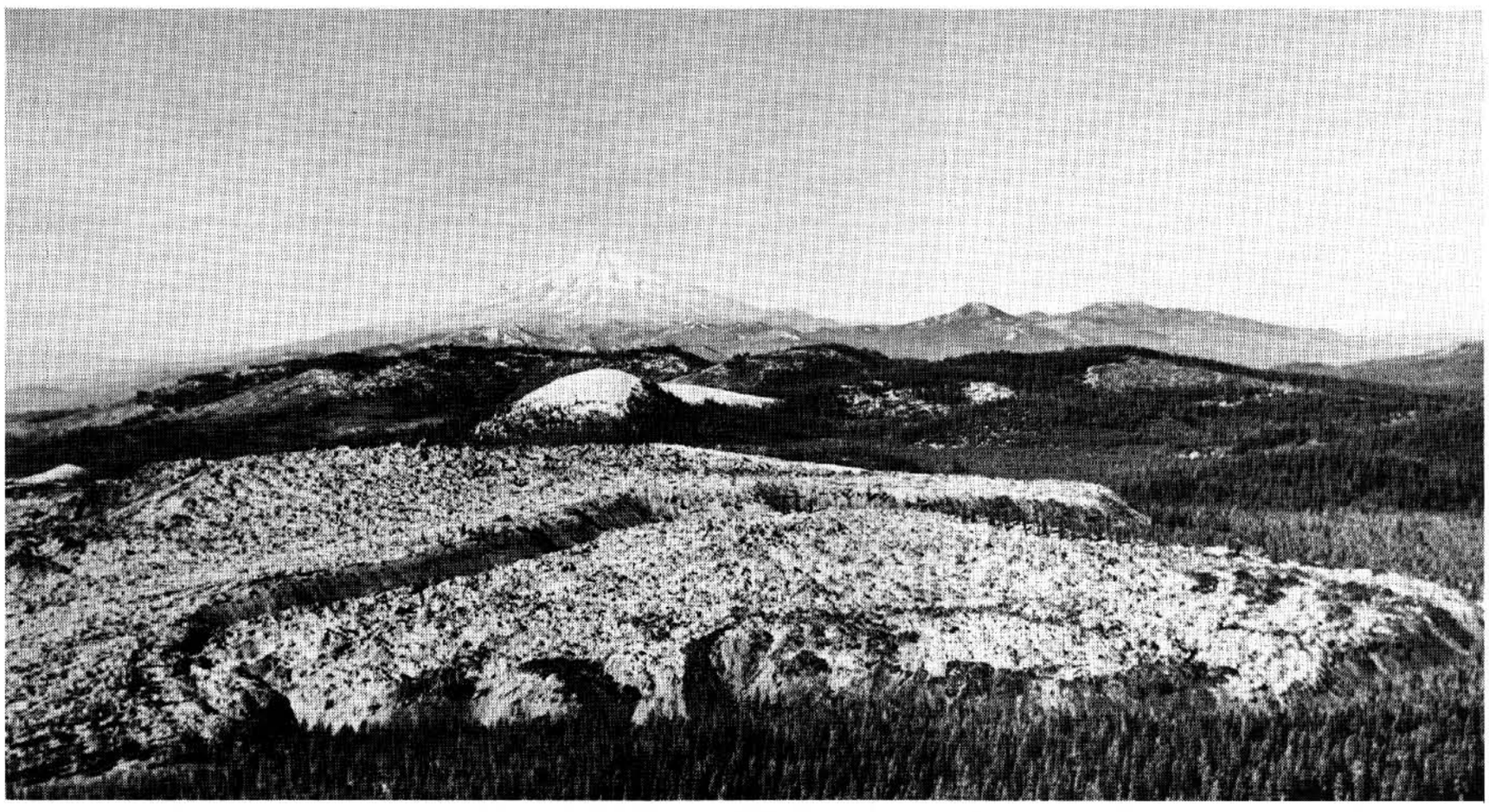
7. Russell, R. J., 1928, Basin range structure and stratigraphy of the Warner Range, northeastern California: California Univ., Dept. Geol. Sci. Bull., vol. 17, no. 11, pp. 387-496, Map: Geologic map of Warner Mountains, scale 1:125,000. (Modified in part by Aune, Q. A., and Gay, T. E. Jr., California Div. Mines, unpublished photogeological interpretation, 1957-1958).

8. Sanborn, A. F., Geology and paleontology of a part of the Big Bend quadrangle, Shasta County, California, scale 1:62,500, Stanford University, unpublished Ph.D. thesis. (Modified slightly by Gay, T. E. Jr., California Div. Mines, unpublished photogeologic interpretation, 1957).

9. Williams, Howel, 1949, Geology of the Macdoel quadrangle, California: California Div. Mines Bull. 151, pp. 1-60, Pl. 1: Geologic map of Macdoel quadrangle, scale 1:125,000.

10. Wood, P. R., Map of Butte Valley region, California, showing geology and locations of wells, scale 1:62,500, U. S. Geological Survey ground water study, unpublished 1954; released to open file, 1958. (Upper Pliocene nonmarine unit after Hanna, G. D., and Gester, G. C., California Acad. Sciences, personal correspondence, 1958, and Chesterman, C. W., California Div. Mines, unpublished map, 1958).

For a complete list of published geologic maps of this area see Division of Mines Special Report 52.



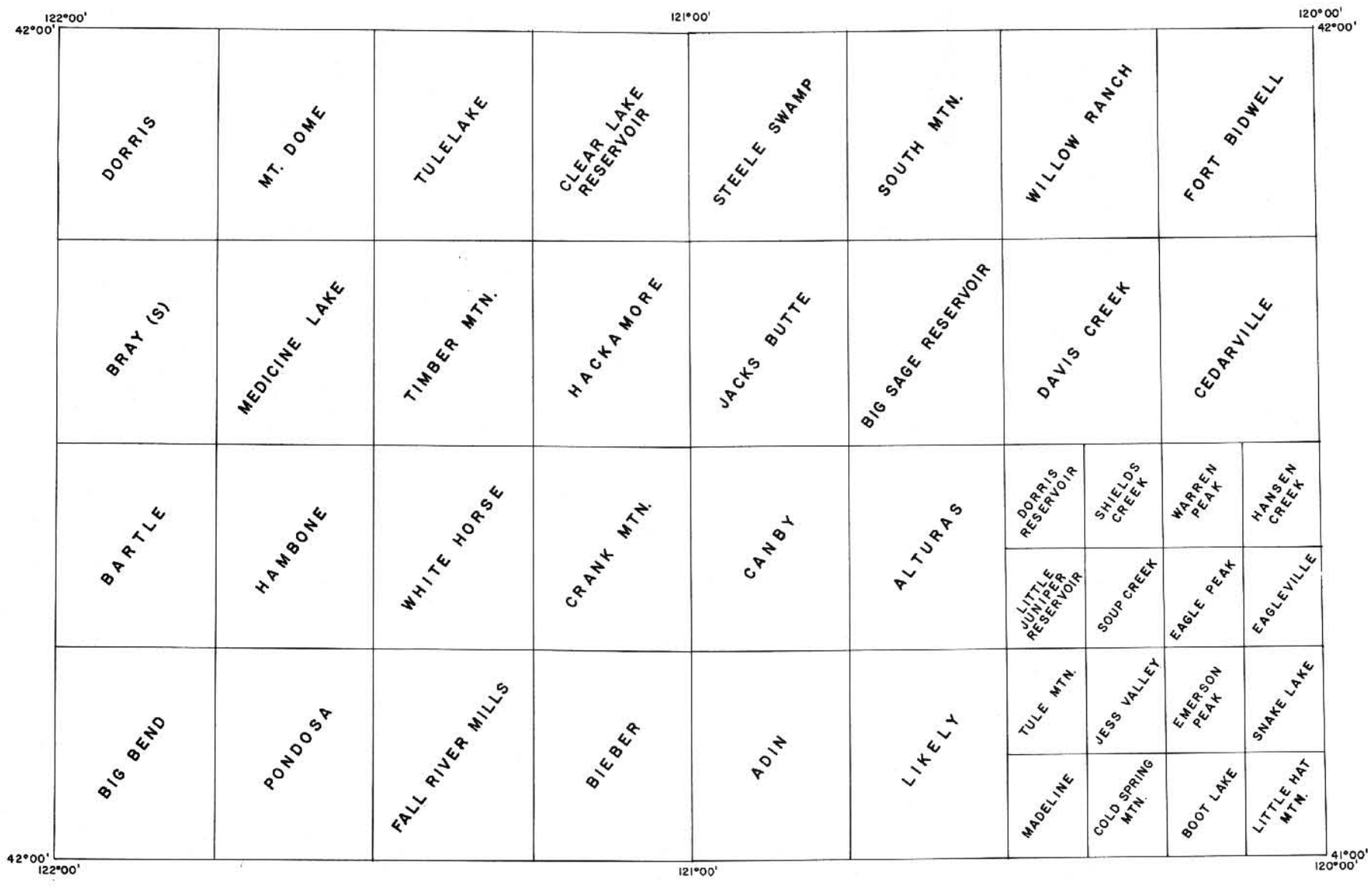
View west from the Medicine Lake Highland toward Mt. Shasta. Little Glass Mountain, in middle foreground, consists of two Recent obsidian flows having pumiceous surfaces. Rounded white dome in middle distance is Pumice Stone Mountain, a pumice-covered basaltic cinder cone. *Photo by C. W. Chesterman.*

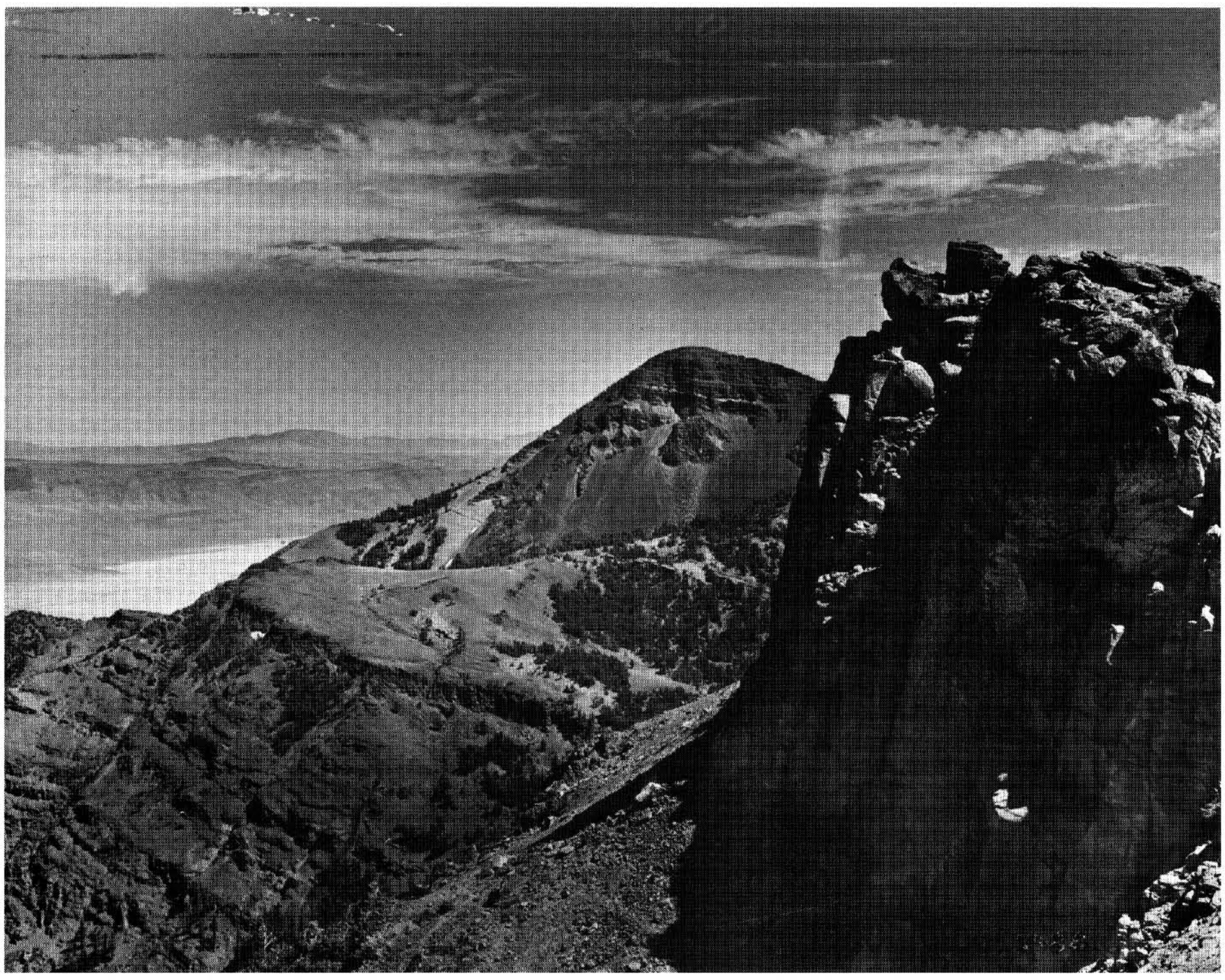
TOPOGRAPHIC QUADRANGLES

WITHIN THE ALTURAS SHEET

AVAILABLE FROM THE U. S. GEOLOGICAL SURVEY

Revised 1967





View along the east face of the Warner Range toward Lower Alkali Lake in Surprise Valley and Hays Canyon Range, Nevada. Bold outcrop in right foreground is Miocene columnar basalt which caps west-tilted Tertiary andesitic and rhyolitic pyroclastic rocks shown in middleground. *Photo by Eastman Studios, courtesy Shasta-Cascade Wonderland Association.*

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STRATIGRAPHIC NOMENCLATURE — Continued

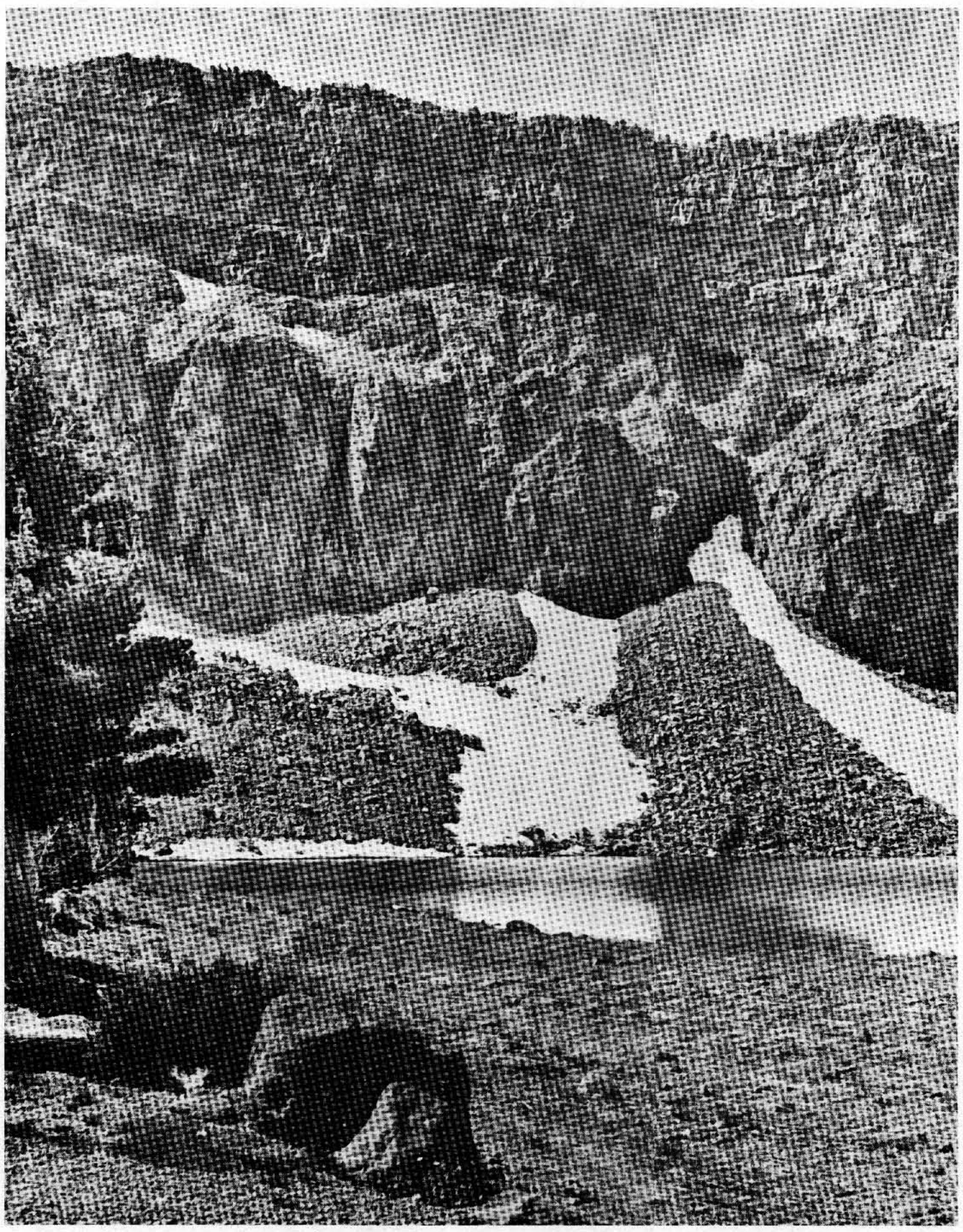
AGE	STATE MAP SYMBOL	STATE MAP UNIT	Anderson 1	Peacock 5	Powers 5	Russell 7	Unpublished reconnaissance mapping by Division of Mines		
							Aune 2	Aune and Gay 3	Gay and Aune 5
CENOZOIC — UNDIVIDED TERTIARY	Ti	**TERTIARY INTRUSIVE ROCKS** (Rhyolite sills, dikes, plugs; minor intrusive basalt)				Rhyolite	Rhyolite sills, dikes, plugs; minor intrusive basalt	Intrusive rhyolite	
CENOZOIC — UNDIVIDED TERTIARY	Tv Tv^a Tv^b Tv^p	**TERTIARY VOLCANIC ROCKS: UNDIFFERENTIATED—Tv; ANDESITIC—Tv^a; BASALTIC—Tv^b; PYROCLASTIC—Tv^p** (Undifferentiated flows—Tv; andesite flows and pyroclastic rocks—Tv^a; olivine basalt flows and basaltic pyroclastic rocks—Tv^b; Tuff and Trap formation, Cedarville andesite, Upper Cedarville, Middle Lava Layer, andesitic mudflows, tuff-breccia—Tv^p)		Tuff and Trap fm. (Miocene or older Cenozoic)	Cedarville andesite (Tv^p) (Miocene)	Upper Cedarville (in part); Middle Lava layer; Lower Cedarville (in part)—Tv$^{p\,2}$	Andesitic mudflows, tuff-breccias (in part equivalent to Russell's Upper Cedarville[2])—Tv^p	Undifferentiated flows; olivine basalt flows; pyroclastic rocks—Tv^p	Andesite flows and pyroclastic rocks—Tv^a; olivine basalt flows; tuffs, tuff-breccias
MESOZOIC — JURASSIC	Jml	**MIDDLE AND LOWER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS** (Potem formation and a marine pyroclastic formation near Arvison Flat)							Potem formation; and a marine pyroclastic formation near Arvison Flat
MESOZOIC — JURASSIC	JTRv.	**JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS** (Bagley andesite)							Bagley andesite (Jurassic)
MESOZOIC — TRIASSIC	TR	**TRIASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS** (Brock shale, Hosselkus limestone, Modin formation, Pit formation)							Modin formation,[3] Brock shale, Hosselkus limestone, Pit formation

NOTES

[1] "Warner basalt" of Russell (1928) includes lithologically similar basalts ranging in age from post middle Miocene through Pleistocene; subdivided on Alturas sheet into Pleistocene, Pliocene, and Miocene units.

[2] "Upper Cedarville" (Russell 1928) subdivided on Alturas sheet into Tv^p, Mc, and Mv^a; "Middle Lava Layer" included in Tv^p; "Lower Cedarville" subdivided into Φc and Tv^p.

[3] Triassic age determined by Sanborn (unpublished Ph.D. thesis),



Patterson Lake, occupying a glacial basin, or cirque, on the east face of the Warner Range southwest of Cedarville. Here a thick series of gently west-dipping Miocene basalt flows unconformably overlies massive Tertiary andesitic pyroclastic and flow rocks. *Photo by Eastman Studios, courtesy of Shasta-Cascade Wonderland Association.*

STRATIGRAPHIC NOMENCLATURE—ALTURAS SHEET

LEGEND ALTURAS SHEET			DATA FROM SELECTED PUBLISHED SOURCES USED TO COMPILE THE ALTURAS SHEET Numbers Refer to Index on Reverse Side of Sheet						
							Unpublished reconnaissance mapping by Division of Mines		
AGE	STATE MAP SYMBOL	STATE MAP UNIT	Anderson 1	Peacock 5	Powers 5	Russell 7	Aune 2	Aune and Gay 3	Gay and Aune 5
CENOZOIC / QUATERNARY / Recent	Qs	**RECENT SAND DUNES** (Dune and shoreline sands)					Dune and shoreline sands		
CENOZOIC / QUATERNARY / Recent	Qal	**RECENT ALLUVIUM** (Alluvium, Quaternary sediments, fans, local lake deposits)	Alluvium	Alluvium		Quaternary sediments (in part also lake deposits)	Alluvial fans, local fluvial and lacustrine deposits	Alluvium	Alluvium
CENOZOIC / QUATERNARY / Recent	Qrv Qrv^{r} Qrv^{b} Qrv^{p}	**RECENT VOLCANIC ROCKS: UNDIFFERENTIATED—Qrv; RHYOLITIC—Qrv^{r}; BASALTIC—Qrv^{b}; PYROCLASTIC—Qrv^{p}** (Cinders—Qrv; rhyolite obsidian, rhyolite-dacite, dacite—Qrv^{r}; Modoc basalt—Qrv^{b}; rhyolite pumice—Qrv^{p})	Cinders—Qrv; rhyolite obsidian, rhyolitie-dacite, dacite—Qrv^{r}; Modoc basalt, very Recent rhyolite; rhyolite pumice—Qrv^{p}	Acidic lavas and pumice, dacite and rhyolite flows with pumice cones—Qrv^{r}; basalt—later localized flows and earlier extended flows—Qrv^{b}	Obsidian group—Qrv^{r}; Modoc basalt—Qrv^{b}			Modoc basalt flows	Recent extrusive rocks—Qrv; Recent rhyolite; Modoc basalt
CENOZOIC / QUATERNARY	Qg	**QUATERNARY GLACIAL DEPOSITS** (Glacial moraine)	Glacial moraine				Glacial moraine		
CENOZOIC / QUATERNARY	Ql	**QUATERNARY LAKE DEPOSITS** (Lake deposits, peat and muck)		Lacustrine fm. (Recent); gravel, sand, and diatomaceous earth in lakebeds and terraces	Lacustrine group (in part Pliocene)	Quaternary sediments (in part also alluvium)	Saline lake deposits in Surprise Valley; calcareous lake deposits in Goose Lake Valley	Pleistocene lacustrine sediments; peat in Jess Valley, peat and muck in Big Valley	Pleistocene to Recent lake deposits
CENOZOIC / QUATERNARY	Qt	**RIVER AND STREAM TERRACE DEPOSITS** (Pleistocene lake terrace)					Pleistocene lake terrace	Pleistocene lake terrace	
CENOZOIC / QUATERNARY	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS** (Fluvial and lacustrine siltstone, sandstone, and conglomerate)					Fluvial conglomerate, fluvial and lacustrine sandstone and siltstone	Lacustrine, sandstone and conglomerate	Fluvial and lacustrine sandstone and siltstone
CENOZOIC / QUATERNARY / Pleistocene	Qpv^{r} Qpv^{a} Qpv^{b} Qpv^{p}	**PLEISTOCENE VOLCANIC ROCKS: RHYOLITIC—Qvp^{r}; ANDESITIC—Qpv^{a}; BASALTIC—Qpv^{b}; PYROCLASTIC—Qpv^{p}** (Perlitic rhyolite—Qpv^{r}; platy andesite, pyroxene andesite—Qpv^{a}; Lake basalt, olivine basalt, Warner basalt [in part] [1]—Qpv^{b}; cinders—Qpv^{p})	Perlitic rhyolite, Recent perlitic rhyolite; later platy olivine andesite, platy andesite; Lake basalt; cinders	Platy andesite (late Pleistocene or Recent); basalt (Pleistocene)—extensive floods of pahoehoe basalt forming Modoc plateau	Platy andesite group; Warner basalt (in part Pliocene [1])	Warner basalt [1]	Olivine basalt flows ("Warner basalt" [1])	Olivine basalt flows ("Warner basalt" [1])	Plio-Pleistocene olivine basalt flows [1]; pyroxene andesite
CENOZOIC / QUATERNARY / Pleistocene	✳	**QUATERNARY AND PLIOCENE CINDER CONES** (Cinders, Modoc cinder cones, basaltic cinder cones, volcanic vents)	Cinders (Pleistocene and Recent)	Volcanic vents	Modoc cinder cones		Cinder cones	Cinder cones, mostly Pliocene	Quaternary (and several Pliocene) basaltic cinder cones
CENOZOIC / TERTIARY / Pliocene	Puc	**UPPER PLIOCENE NONMARINE SEDIMENTARY ROCKS** (Fossiliferous sandstone and conglomerate)							Fossiliferous sandstone and conglomerate
CENOZOIC / TERTIARY / Pliocene	Pc	**UNDIVIDED PLIOCENE NONMARINE SEDIMENTARY ROCKS** (Diatomaceous sandstone, shale, and tuff of Alturas formation, pumiceous sandstone, shale, siltstone)			Lacustrine group (in part Pleistocene)		Diatomaceous sandstone, shale, and tuff of Alturas fm.	Diatomaceous sandstone, shale, and tuff of Alturas fm., fluvial and lacustrine sandstone and siltstone	Diatomite
CENOZOIC / TERTIARY / Pliocene	Pv^{r} Pv^{a} Pv^{b} Pv^{p}	**PLIOCENE VOLCANIC ROCKS: RHYOLITIC—Pv^{r}; ANDESITIC—Pv^{a}; BASALTIC—Pv^{b}; PYROCLASTIC—Pv^{p}** (Rhyolite, obsidian—Pv^{r}; platy olivine andesite, Massive Lava group, and Shasta Lavas, in part—Pv^{a}; Warner basalt [1] basaltic shield volcanoes, olivine basalt flows, Massive Lava group, and Shasta Lavas, in part—Pv^{b}; andesite tuff, tuffs, welded tuffs of Alturas formation—Pv^{p})	Older rhyolite; older platy olivine andesite; massive basalt, Warner basalt; andesite tuff—Pv^{p}	Obsidian (rhyolitic glass associated with Shasta Lavas)—Pv^{r}; Shasta Lavas (basalt and andesite flows)	Massive Lava group (in part), Warner basalt (in part early Pleistocene) [1]	Warner basalt [1]	Basaltic shield volcanoes ("Warner basalt" [1])	Flow basalt, shield volcanoes Pv^{b}; tuffs and welded tuffs of Alturas fm.	Platy andesite; olivine basalt; andesitic tuffaceous rocks
CENOZOIC / TERTIARY / Miocene	Mc	**UNDIVIDED MIOCENE NONMARINE SEDIMENTARY ROCKS** (Diatomite and tuff)				Upper Cedarville (in part) [2]	Diatomite and tuff		
CENOZOIC / TERTIARY / Miocene	Mv Mv^{r} Mv^{a} Mv^{b} Mv^{p}	**MIOCENE VOLCANIC ROCKS: UNDIFFERENTIATED—Mv; RHYOLITIC—Mv^{r}; ANDESITIC—Mv^{a}; BASALTIC—Mv^{b}; PYROCLASTIC—Mv^{p}** (Undifferentiated volcanic rocks—Mv; rhyo-dacite domes—Mv^{r}; andesite flows—Mv^{a}; Warner basalt flows [1]—Mv^{b}; rhyolitic and andesitic tuff and tuff-breccia—Mv^{p})			Massive Lava group (in part)	Warner basalt [1]; Upper Cedarville (in part)—Mv^{a}, Tv^{p} [2]	Undifferentiated volcanic rocks; rhyo-dacite domes—Mv^{r}; andesite flows; olivine basalt flows ("Warner basalt" [1]); rhyolitic tuff-breccia—Mv^{p}	Andesite flows; olivine basalt flows; rhyolitic and andesitic tuffs and tuff-breccias—Mv^{p}	Olivine basalt flows ("Massive Lava group" in part)
CENOZOIC / TERTIARY / Oligocene	ϕc	**OLIGOCENE NONMARINE SEDIMENTARY ROCKS** (Lower Cedarville [2])				Lower Cedarville (in part) [2]			
CENOZOIC / TERTIARY / Eocene	Ec	**EOCENE NONMARINE SEDIMENTARY ROCKS** (Montgomery Creek formation)							Montgomery Creek formation