STATE OF CALIFORNIA
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THE RESOURCES AGENCY
Hugo Fisher, Administrator

DIVISION OF MINES AND GEOLOGY
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DEPARTMENT OF CONSERVATION
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EXPLANATORY DATA

WEED SHEET

GEOLOGIC MAP OF CALIFORNIA

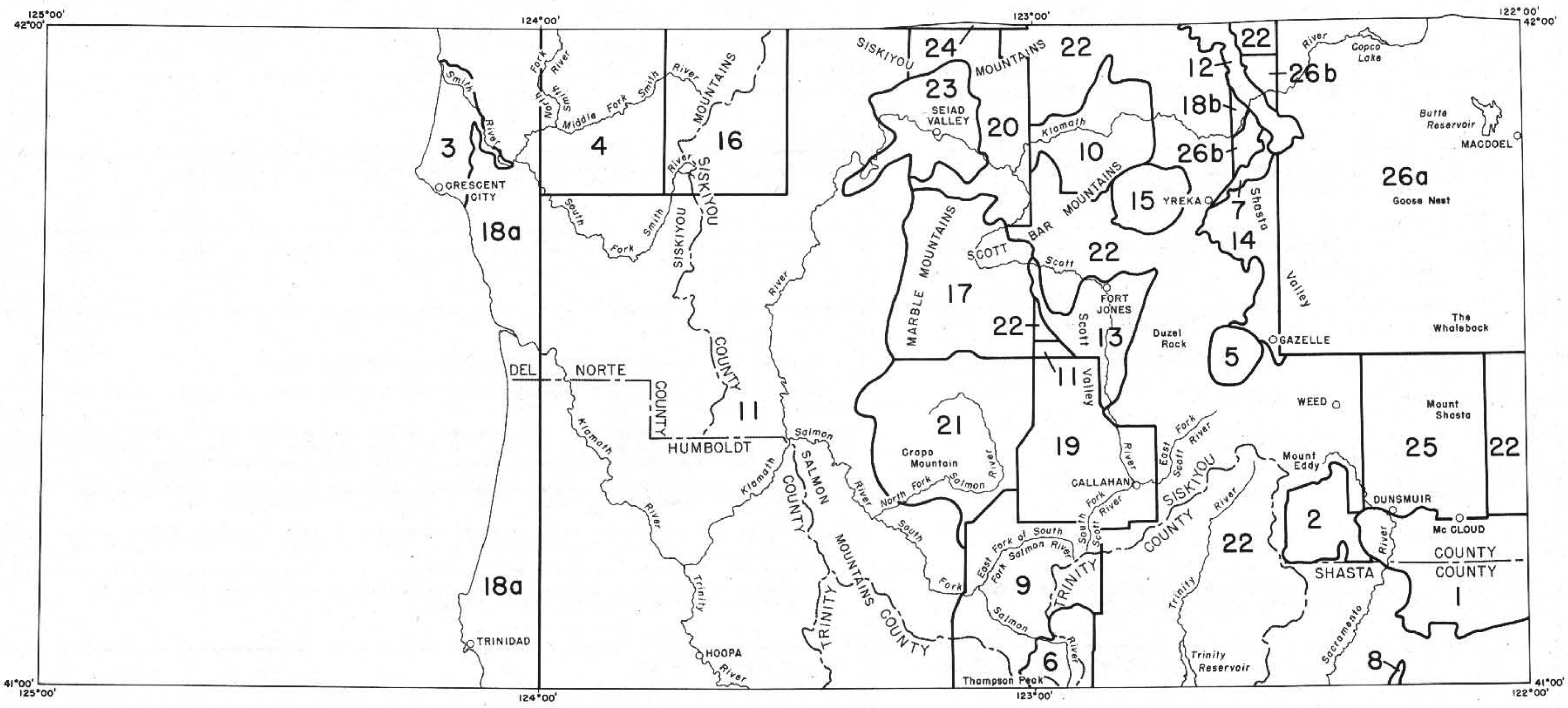
OLAF P. JENKINS EDITION

Compiled by Rudolph G. Strand, 1963

(Third printing, 1977)

INDEX TO GEOLOGIC MAPPING

USED IN THE COMPILATION OF THE WEED SHEET



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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— WEED 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 (The formally named formations grouped within an individual State Map Unit are listed in stratigraphic sequence from youngest to oldest.)
CENOZOIC – QUATERNARY – Recent	Qs	**RECENT DUNE SAND**	Dune sand and older eolian sand along the coast.
CENOZOIC – QUATERNARY – Recent	Qal	**RECENT ALLUVIUM**	Recent stream channel, flood plain and alluvial fan deposits. Fluvioglacial deposits (may be Pleistocene in part), and mud flow deposits, notably along Mud Creek on southeast flank of Mt. Shasta.
CENOZOIC – QUATERNARY – Recent		**RECENT VOLCANIC ROCKS:**	
	Qrv	**UNDIFFERENTIATED**	"Shastina" pyroxene andesite—*dark gray or black andesitic basalt rich in bright green granules of pyroxene* (these lavas are "identical" with the early flows of Shasta and hence it is not certain that they originated from the Shastina vent, Williams, 1934, p. 245).
	Qrv^a	**ANDESITIC**	Hypersthene-rich vesicular andesite and basaltic andesite of Goosenest volcano. Dark vesicular, glass-rich pyroxene andesite of Deer Mountain. Pale gray porphyritic pyroxene andesite lava, the latest flow from Shasta. Pale gray andesite lavas (containing long slender prisms of brownish hornblende) of Black Butte dome. Hornblende andesite talus breccia in Diller Canyon on west side of Mt. Shasta.
	Qrv^b	**BASALTIC**	Pluto's Cave Basalt—*black, vesicular olivine-rich augite basalt.* Olivine-augite basalt at Copco Lake. Blocky, scoriaceous, augite-olivine basalt along Alder Creek. Black, vesicular, olivine-augite basalt of Little Deer Mtn. volcano. Dark, vesicular, olivine basalt of The Whaleback. Gray and black, glassy, pyroxene-rich andesitic basalt of Shastina.
	Qrv^p	**PYROCLASTIC**	Dark tuff, lapilli, and bombs of vesicular glass, on Mt. Shasta. Red, brown and black basaltic cinders in the Macdoel 30′ quadrangle.
CENOZOIC – QUATERNARY – Pleistocene	Ql	**QUATERNARY LAKE DEPOSITS**	Recent diatomite at Copco Lake. Semiconsolidated clay, volcanic ash, diatomite, and sand in Butte Valley. Glacial lake sediments near the town of Mt. Shasta.
CENOZOIC – QUATERNARY – Pleistocene	Qg	**QUATERNARY GLACIAL DEPOSITS**	Late (Morris Meadow), middle (Rush Creek), and early (Alpine Lake) Wisconsin (age) moraines in the Trinity Alps area. Undifferentiated glacial deposits on Mt. Shasta and elsewhere. Glacial deposits shown on this map are generalized; in some places the areas are exaggerated in size and may include less than 50% glacial debris.
CENOZOIC – QUATERNARY – Pleistocene	Qt	**QUATERNARY NONMARINE TERRACE DEPOSITS**	Unconsolidated sand, clay, and gravel terrace deposits.
CENOZOIC – QUATERNARY – Pleistocene	Qm	**PLEISTOCENE MARINE DEPOSITS AND MARINE TERRACE DEPOSITS**	Battery Formation—*buff and blue sand units interbedded with white, bluish-gray, brown, and blue clay units.*
CENOZOIC – QUATERNARY – Pleistocene	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	"Older" alluvium, fan and terrace deposits. "Older" surficial agate-bearing deposits northwest of Copco Dam. "Older" dune sand in the Trinidad quadrangle.
CENOZOIC – QUATERNARY – Pleistocene		**PLEISTOCENE VOLCANIC ROCKS:**	
	Qpv	**UNDIFFERENTIATED**	Andesitic basalt and dense gray pyroxene andesite (early flows forming the base of Mt. Shasta).
	Qpv^r	**RHYOLITIC**	Pale gray rhyolitic dacite characterized by large phenocrysts of plagioclase. White pumiceous lava (probably a glassy dacite) forming the domes south of Gray Butte on Mt. Shasta.
	Qpv^a	**ANDESITIC**	Porphyritic pale-gray and brown, pyroxene andesites having distinctive platy or slabby habit and abundant basic inclusions, present on Mt. Shasta. Fine-grained andesite or andesitic basalt of the Bear Butte and Spring Hill lava cones. Pale gray andesite and dacite of Gray Butte plug dome. Colorless glass-rich andesite of the twin domes on the north side of Mt. Shasta.
	Qpv^b	**BASALTIC**	Butte Valley Basalt—*smooth crusted, black to gray, vesicular olivine basalt* (in part Recent). Pale gray to black, dense, massive to vesicular basalts that emanated from the Everitt Hill volcano and flowed down the Sacramento River Valley.
	Qpv^p	**PYROCLASTIC**	Well consolidated lapilli tuff and tuff-breccia in the Macdoel 30′ quadrangle, (Pleistocene to Recent). Volcanic mud flow deposits and tuff-breccias exposed in walls of Mud Creek Canyon (perhaps oldest exposed rocks of Mt. Shasta). Black tuff, lapilli, and volcanic bombs on Mt. Shasta.
CENOZOIC – TERTIARY – Pliocene	QP	**PLIOCENE-PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Probable Plio-Pleistocene deposits in the Orick quadrangle. Pleistocene or Late Tertiary terrace deposits that have been slightly deformed and contain deeply weathered boulders (Hoopa quadrangle).
CENOZOIC – TERTIARY – Pliocene	✳	**QUATERNARY AND/OR PLIOCENE CINDER CONES**	Pliocene(?) to Recent cinder cones.
CENOZOIC – TERTIARY – Pliocene	Pu	**UPPER PLIOCENE MARINE SEDIMENTARY ROCKS**	Small areas of highly fossiliferous marine, near-shore sands and gravels deposited on very irregular surface along the present day coast.
CENOZOIC – TERTIARY – Pliocene		**PLIOCENE VOLCANIC ROCKS:**	
	Pv^a	**ANDESITIC**	Pyroxene andesite and hornblende andesite in the Macdoel 30′ quadrangle (possibly Plio-Pleistocene).
	Pv^b	**BASALTIC**	Olivine basalt and basaltic andesite in the Macdoel 30′ quadrangle (possibly Plio-Pleistocene to late Pleistocene).
	Pv^p	**PYROCLASTIC**	Low mounds of red cinders, remnants of cinder cones in Macdoel quadrangle.
CENOZOIC – TERTIARY – Pliocene	Tm	**TERTIARY MARINE SEDIMENTARY ROCKS**	St. George Formation—*dull gray-blue, massive fossiliferous siltstone and shale containing irregular lenses of sand* (Pliocene).
CENOZOIC – TERTIARY – Miocene	Mu	**UPPER MIOCENE MARINE SEDIMENTARY ROCKS**	Wimer Formation—*friable yellow shale and siltstone that weather brown.*
CENOZOIC – TERTIARY – Undivided	Tc	**TERTIARY NONMARINE SEDIMENTARY ROCKS**	Late Tertiary auriferous gravel deposits in the Gasquet and Klamath quadrangles.
CENOZOIC – TERTIARY – Undivided		**TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:**	
	Ti	**UNDIFFERENTIATED**	Intrusive rocks exposed in Hornbrook and Dunsmuir areas.
	Ti^r	**RHYOLITIC**	Massive gray and olive-green propylitized pyroxene dacite at Cedar Lake. Albite rhyolite porphyry dikes in the Gasquet quadrangle.
	Ti^a	**ANDESITIC**	Andesitic volcanic necks.
	Ti^b	**BASALTIC**	Basaltic volcanic neck in vicinity of Copco Dam.
CENOZOIC – TERTIARY – Undivided		**TERTIARY VOLCANIC ROCKS:**	
	Tv	**UNDIFFERENTIATED**	Wasson Formation, Roxy Formation, Colestine Formation[1]—*hypersthene augite andesite, basalt, some dacite flows, volcanic conglomerate and sandstone* (considered to be upper Eocene to upper Miocene by H. Williams).
	Tv^r	**RHYOLITIC**	Basaltic flows in the Gazelle area and in the southeast corner of the map area (age uncertain; may prove to be Quaternary).
	Tv^b	**BASALTIC**	White to pale cream very fine-grained rhyolite plug domes in the Macdoel 30′ quadrangle.
	Tv^p	**PYROCLASTIC**	White to cream, and pale blue-green rhyolite tuff, glassy pumiceous dacite tuff, and andesitic tuff-breccia.
MESOZOIC – CRETACEOUS	Ku	**UPPER CRETACEOUS MARINE SEDIMENTARY ROCKS**	Hornbrook Formation—*greenish-gray massive arkosic sandstone, conglomerate, and bluish-gray shale, buff and white massive sandstone* (nonmarine in part), *cross-bedded sandstone, and coal.* Coarse- to medium-grained sandstone, angular boulder conglomerate, and light-gray shale in the Gunsight Peak area.
MESOZOIC – CRETACEOUS	KJf	**FRANCISCAN FORMATION**	Franciscan Formation—*graywacke, interbedded shale, minor conglomerate, thin-bedded chert, some undifferentiated basaltic or spilitic rocks that have been altered to greenstone, and small masses of glaucophane schist.* KJf? = Dothan Formation— *dark gray hard metagraywacke, metasandstone, thin-bedded metashale, and intercalated green metavolcanic rocks* (probably Late Jurassic, but believed by F. Wells and G. Walker (USGS Map GQ25, 1953) to be older than the Galice Formation shown as Ju on this map; the Franciscan Formation and the lithologically similar Dothan Formation have been extended from their type areas from the south and from the north to the Oregon-California line where the rocks are known by either name).
MESOZOIC – CRETACEOUS	KJfv	**FRANCISCAN VOLCANIC AND METAVOLCANIC ROCKS**	Metamorphosed basic igneous rocks within the Franciscan Formation.

STRATIGRAPHIC NOMENCLATURE—Continued

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MESOZOIC		**MESOZOIC GRANITIC ROCKS**	
	gr	**UNDIFFERENTIATED**	Quartz diorite, diorite, gabbro, granite and granodiorite that have not yet been differentiated in the mapping. Locally includes some ultramafic rocks.
	gr^a	**GRANITE AND ADAMELLITE (QUARTZ MONZONITE)**	Adamellite at Yellow Butte. Granite and adamellite in the Seiad Valley quadrangle.
	gr^g	**GRANODIORITE**	Hornblende-biotite grandiorite, and leucocratic granodiorite in the Etna and Coffee Creek quadrangles. Granodiorite in the Seiad Valley quadrangle.
	gr^t	**TONALITE (QUARTZ DIORITE) AND DIORITE**	Trondhjemite in Caribou Mtn. area (Coffee Creek quadrangle), tonalite, hornblende diorite, biotite diorite, and pyroxene diorite in the Etna and Coffee Creek quadrangles. Tonalite in the Seiad Valley quadrangle.
	bi	**MESOZOIC BASIC INTRUSIVE ROCKS**	Hornblende gabbro and related dark diorite, augite-hornblende gabbro, hornblende gabbro and hornfels complex in the Coffee Creek quadrangle. Hornblende gabbro, and undifferentiated gabbro and related dark diorite in the Etna quadrangle. Gabbro, undifferentiated gabbro and diorite, and minor granodiorite elsewhere.
	ub	**MESOZOIC ULTRABASIC INTRUSIVE ROCKS**	Predominantly serpentinized peridotite. Includes some unaltered peridotite, dunite, and pyroxenite, also landslide deposits of ultramafic rocks in the Coffee Creek quadrangle. Most of the ultramafic rock in the eastern part of the map area may be part of a once-continuous sheet that intruded a low-angle fault along which Paleozoic strata to the east were thrust westward over the Abrams and Salmon Formations (Irwin and Lipman USGS Prof. Paper 450-C Article 67, 1962).
JURASSIC	Ju	**UPPER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Galice Formation—*dark gray to black slate, phyllite, and interbedded thin to massive, light gray, tuffaceous sandstones; includes some interbedded andesitic metavolcanic rocks.*
	Jml	**MIDDLE AND/OR LOWER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Potem Formation—*argillite, tuffaceous sandstone and shale, and limestone;* Arvison Formation—(pyroclastic rocks deposited in a marine environment) *volcanic breccia and agglomerate containing interbedded tuff, tuffaceous sandstone and conglomerate; some limestone.*
	JT̶Rv	**JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS**	Metavolcanic rocks in the northwestern part of the Weed sheet (may be in part correlative with the Rogue Formation in Oregon and are in part interbedded within the Galice Formation). Bagley Andesite—*flow rocks, volcanic breccia and pyroclastic deposits* (Middle Jurassic). Pit Formation, (volcanic part of)—*Keratophyre, light to dark colored flow rocks, mafic flows and some pyroclastic rocks* (Triassic).
TRIASSIC	T̶R	**TRIASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Modin Formation—*shale, sandstone, tuff, agglomerate, andesite flow rocks, limestone, and conglomerate;* Brock Shale(?)—*thin dark shale, in part calcareous;* Hosselkus Limestone—*gray, lenticular, fossiliferous limestone;* Pit Formation—*slate, siltstone and sandstone and some undifferentiated volcanic rocks.*
	m	**PRE-CRETACEOUS METAMORPHIC ROCKS, UNDIFFERENTIATED**	Chiefly undivided phyllite, chert, and metavolcanic rocks of the Western Paleozoic and Triassic Belt of Irwin (1960), (in part correlative with the Applegate Group of southwestern Oregon); includes rocks of the so-called Southwestern Devonian and Southwestern Carboniferous Belts of Diller[2] the Blue Chert and part of the Lower Slate series of Hershey,[2] and the Grayback Formation of Maxson (1933). In Scott Bar and Condrey Mtn. quadrangles, includes amphibolite, quartzite, and marble. Stuart Fork Formation—*phyllitic quartzites, graphitic quartz-mica phyllites, greenstone and related tuff, minor marble* (formerly included within the Abrams Mica Schist, Davis and Lipman, G.S.A. Bull., Dec., 1962. This formation is present in the Coffee Creek quadrangle and is probably correlative with similar rocks elsewhere in the central metamorphic belt.)
	ls	**ls = LIMESTONE AND/OR DOLOMITE**	White, coarsely crystalline limestone (marble) in the Seiad quadrangle and the Marble Mountains.
	ms	**PRE-CRETACEOUS METASEDIMENTARY ROCKS**	Quartzites, metachert, and mica schist on Yellow Butte (Macdoel 30′ quadrangle). Phyllite, blue-gray thin-bedded chert, some volcanic rocks, and minor limestone have been considered as correlative with the Triassic Applegate Group). Rocks considered to be more highly metamorphosed equivalents of the Galice Formation, includes Weitchpec Schist of Oscar Hershey[2] (1906).
	mv	**PRE-CRETACEOUS METAVOLCANIC ROCKS**	Greenstone and greenstone schist having metasedimentary interbeds of chert, argillite and limestone (these rocks may be correlative with the Applegate Group). Metadiabase intrusive rock south of Gunsight Peak northeastward to Paradise Craggy in the Hornbrook quadrangle. The "mv" unit north of Seiad Valley depicts coarse-grained, foliate and/or lineate black amphibolite of metamorphic grade similar to that of the adjacent "pS" unit. However, F. Wells (personal communication to W. Dickinson) believes that the black amphibolite resembles metamorphic phases of undoubted Applegate Group, whereas the hornblende schist ("pS" unit) is unlike anything known to be Applegate Group or its equivalents.
PALEOZOIC PERMIAN	P̶v	**PERMIAN METAVOLCANIC ROCKS**	Dekkas and Nosoni Formations undifferentiated (Bollibokka Group)—*indurated tuff-breccia, conglomerate, and green and maroon mudstones.*
	P̶	**PERMIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	McCloud Limestone—*light gray, coarsely crystalline limestone, some dark gray massive or thin-bedded limestone.*
	C	**UNDIVIDED CARBONIFEROUS MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Baird Formation—*Metamorphosed maroon and green mudstone, multicolored conglomerate, sandstone, tuff, and dark gray limestone* (probably Mississippian).
MISSISSIPPIAN	CM	**MISSISSIPPIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Bragdon Formation—*Metamorphosed shale, siltstone, mudstone, sandstone and coarse conglomerate.*
DEVONIAN	D	**DEVONIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Kennett Formation—*Metamorphosed black shale and mudstone, and dark gray dense coral reef metamorphosed limestone.*
	Dv?	**DEVONIAN AND PRE-DEVONIAN ? METAVOLCANIC ROCKS**	Copley Greenstone—*Green meta-andesite that weathers buff, irregularly interbedded flows, tuffs, and tuff-breccia.*
SILURIAN	S	**SILURIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Gazelle Formation—*Essentially unmetamorphosed volcanic graywacke, dark gray to black siltstone and mudstone, siliceous and feldspathic grit, chert conglomerate, limestone and limestone conglomerate.*
ORDOVICIAN	O	**ORDOVICIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Duzel Formation[3]—*Pale gray-green schistose graywacke, phyllite, limestone, chert, and greenstone.*
	pS	**PRE-SILURIAN ? METAMORPHIC ROCKS, UNDIFFERENTIATED**	Lineated hornblende schist and medium to dark green plagioclase-chlorite schist in the Seiad Valley quadrangle. Chlorite-quartz-muscovite schist in the Condrey Mtn. and Seiad Valley quadrangles. Hornblende schist in the Preston Peak quadrangle. Hornblende and chlorite schists in the Scott Bar quadrangle. These units have been considered as equivalents of the Salmon Hornblende Schist and Abrams Mica Schist, however they may be nothing more than more highly metamorhposed equivalents of Triassic or Paleozoic rocks to the south. Dickinson (1963 written communication) believes that the amphibolites shown as "mv" north of Seiad Valley are of approximately equivalent metamorphic grade to the adjacent "pS" schists.
	pSs	**PRE-SILURIAN ? METASEDIMENTARY ROCKS**	Quartz-mica schists that have been considered as Abrams Mica Schist. Grouse Ridge Formation (Davis and Lipman, G.S.A. Bull., Dec. 1962)—*micaceous and feldspathic quartz schists, almandine-hornblende rocks, hornblende schists, hornblende gneisses, and calc-schists.* Rocks shown as pSs? (gneissic amphibolite) are considered by Lipman (1962) as part of the Salmon Hornblende Schist.
	pSv	**PRE-SILURIAN ? METAVOLCANIC ROCKS**	Salmon Hornblende Schist—*lineated hornblende schist probably formed by the metamorphism of basaltic rocks.* Included in pSv is a "transitional" Stuart Fork-Salmon unit of Lipman and Davis; the mapped northward extension of this unit is however, a greenstone that has a similar metamorphic history to that of the Stuart Fork Formation. Davis and Lipman (G.S.A. Bull., Dec., 1962) have postulated that the Stuart Fork-Salmon contact is a major low angle thrust fault.

NOTES

[1] These units are equivalent to a part of the Western Cascade Volcanic Series of H. Williams.
[2] Diller, J. S., 1903, Klamath Mountain section, California: Am. Jour. Sci. 4th ser., vol. 15, pp. 342-362.
Hershey, O. H., 1901, Metamorphic formations of northwestern California: Am. Geologist, vol. 27, pp. 225-245.
Hershey, O. H., 1906, Some western Klamath stratigraphy: Am. Jour. Sci. 4th ser., vol. 21, pp. 58-66.
[3] The Duzel Formation was first described by F. Wells, G. Walker, and C. Merriam (G.S.A. Bull., May 1959) as Upper Ordovician (?) based upon a fossil fauna at Horseshoe Gulch. This age was determined by Helen Duncan (of the U.S.G.S.) who recognizes the less likely possibility that this fauna may be Early Silurian (written communication from Miss Duncan, 1963). C. W. Merriam (written communication, 1963) believes that a different faunal assemblage which he collected at a later date at Horseshoe Gulch is Silurian; however, he recognizes the possibility that both Ordovician and Silurian strata may be present.

TOPOGRAPHIC QUADRANGLES
WITHIN THE WEED SHEET
AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY
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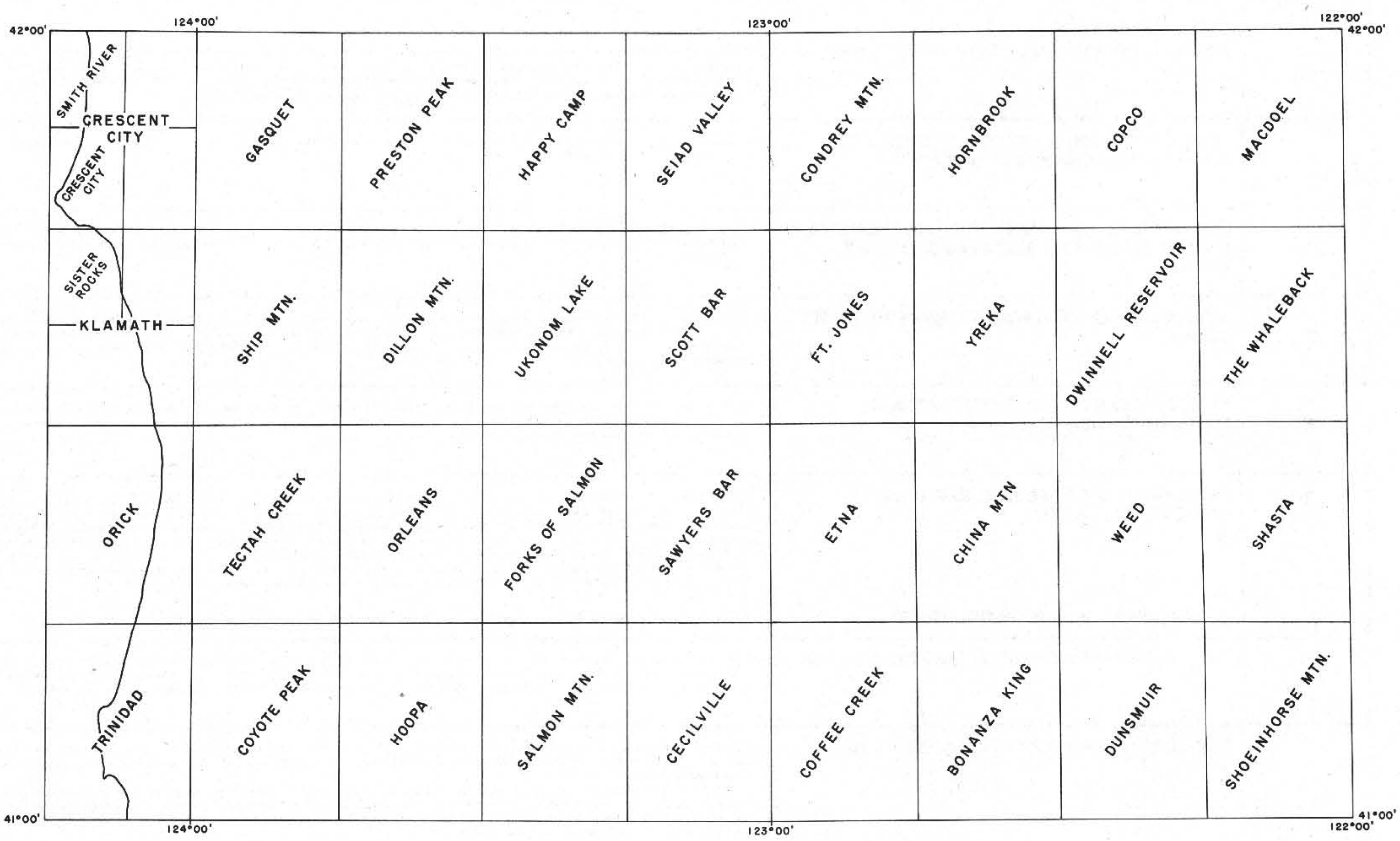
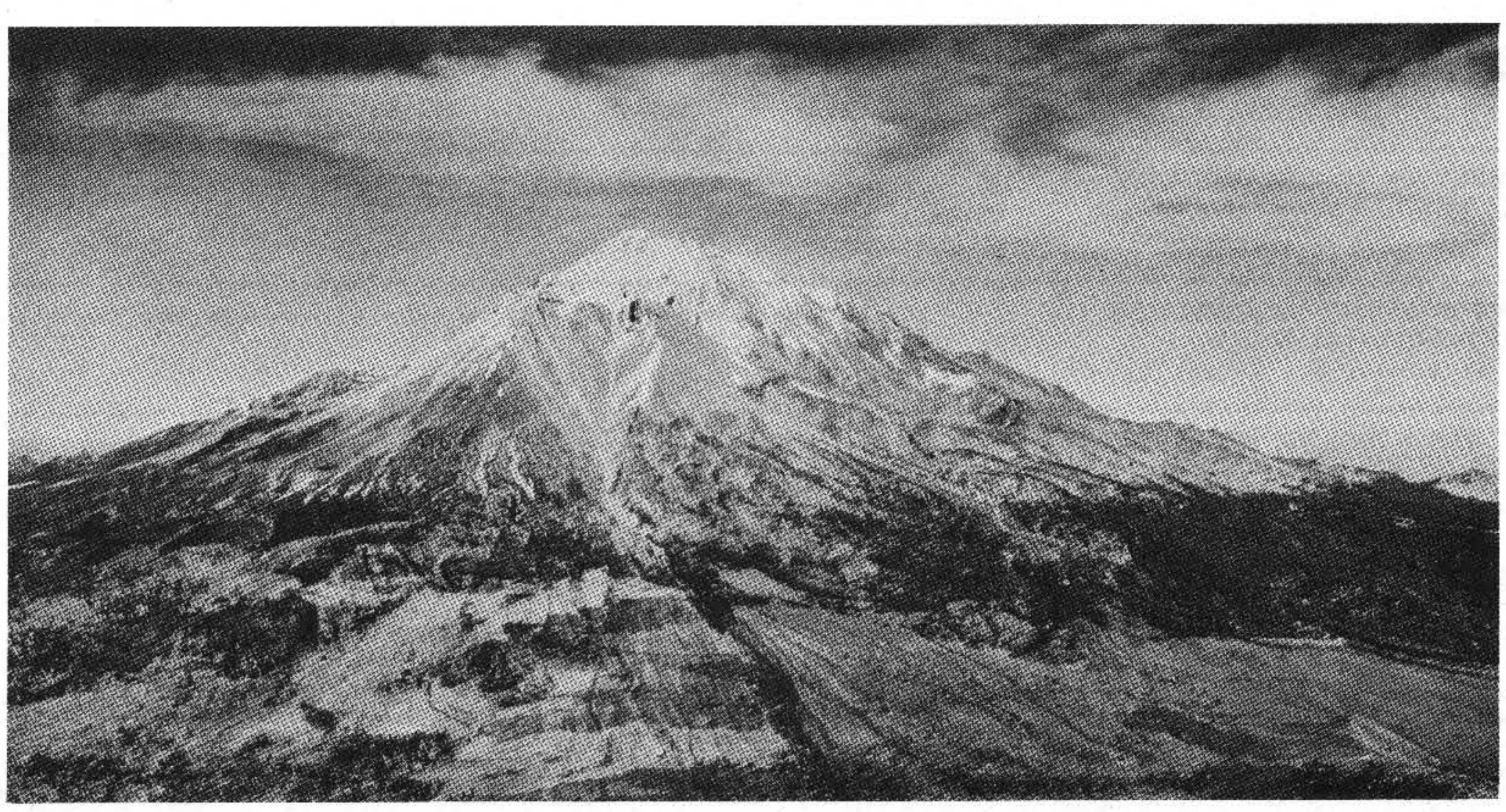
1963





Mt. Shasta as seen from the west, extends upward to 14,162 feet and forms a classic example of a Quaternary composite volcanic cone. Shastina is the large parasitic composite cone that appears on the near flank of the mountain. The wedge-shaped gash on Shastina is Diller Canyon, a feature which Howel Williams suggests may be due to violent downward explosions.

Photo by Fairchild Aerial Surveys, Inc.
Oct. 5, 1930

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