

Index of Granitic Rock Masses in the State of Nevada

By FLORIAN MALDONADO, RICHARD W. SPENGLER,
W.F. HANNA, and G.L. DIXON

Prepared in cooperation with the
U.S. Department of Energy

A compilation of data on 205 areas of exposed
granitic rock masses in Nevada

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CONTENTS

Abstract	1
Introduction	1
Definitions of selected terms as used in this report	1
Scope of study	2
Clark County	9
Geology	9
Plutons	9
Lincoln County	15
Geology	15
Plutons	15
Southern Nye County	17
Geology	17
Plutons	17
Northern Nye County	20
Geology	20
Plutons	22
Esmeralda County	25
Geology	25
Plutons	27
Mineral County	31
Geology	31
Plutons	31
Lyon County	35
Geology	35
Plutons	35
Churchill County	38
Geology	38
Plutons	40
Lander County	42
Geology	42
Plutons	44
Eureka County	46
Geology	46
Plutons	48
White Pine County	50
Geology	50
Plutons	50
Elko County	55
Geology	55
Plutons	55
Humboldt County	61
Geology	61
Plutons	61
Pershing County	66
Geology	66
Plutons	68
Washoe, Storey, and Douglas Counties and Carson City	72

Geology	72
Plutons	72
Selected references	77

PLATE

[Plate is in pocket]

1. Map showing aeromagnetic data and distribution of plutonic rocks in Nevada

FIGURES

1. Index map of Nevada showing locations of counties and the Nevada Test Site 2
2. Diagram showing variation of amplitude of aeromagnetic anomaly with increasing thickness of prismatic source 11
3. Diagram showing variation of shape and location of aeromagnetic anomaly with change in total magnetization direction of prismatic source 12
- 4-18. Location of plutons in:
 4. Clark County 13
 5. Lincoln County 16
 6. Southern Nye County 18
 7. Northern Nye County 21
 8. Esmeralda County 26
 9. Mineral County 32
 10. Lyon County 36
 11. Churchill County 39
 12. Lander County 43
 13. Eureka County 47
 14. White Pine County 51
 15. Elko County 57
 16. Humboldt County 63
 17. Pershing County 67
 18. Washoe, Storey, and Douglas Counties and Carson City (independent city) 73

TABLES

1. Generalized classification of granitic rocks 2
2. Summary of data related to plutons in the State of Nevada 4
3. Major stratigraphic and geologic time divisions 10

Index of Granitic Rock Masses in the State of Nevada

By Florian Maldonado, Richard W. Spengler, W.F. Hanna, and G.L. Dixon

Abstract

A compilation of 205 areas of exposed granitic rock in Nevada was undertaken for the U.S. Department of Energy. The purpose was to obtain data for evaluating granitic rock masses as potential underground nuclear waste repositories. Information, compiled by county for areas of granitic rock exposure, includes general location, coordinates, land classification, areal extent, accessibility, composition, age, rocks intruded, aeromagnetic expression, mining activity, and selected references.

INTRODUCTION

This index of exposed granitic masses within the State of Nevada summarizes geographic information, geologic and aeromagnetic data, mining activity, and selected references. The information was obtained primarily from published and unpublished reports and maps of the U.S. Geological Survey (USGS) and the Nevada Bureau of Mines and Geology and has been released as an open-file report (Spengler and others, 1979). This report is a summary of that open-file report that included all of the above listed factors in addition to hydrologic setting. Several maps included in the open-file report are omitted in this report because of their large size: (1) topographic map of the State of Nevada, (2) generalized land classification of Nevada, (3) generalized hydrology of Nevada and other parts of the Great Basin, showing ground-water discharge and major sources of recharge and runoff, (4) tectonic map of Nevada and parts of California, (5) preliminary location of earthquake epicenters throughout Nevada and in parts of California, and (6) composite aeromagnetic map of Nevada.

This index involved compilation of data from several earth-science disciplines. Geographic and geologic data for Clark, northern Nye, Mineral, Eureka, Churchill, Elko, Washoe, Storey, and Douglas Counties and Carson City were compiled by Richard W. Spengler. Florian Maldonado compiled geographic and geologic information for Lincoln, Esmeralda, Lyon, White Pine, Lander, Pershing, Humboldt, and southern Nye

Counties. W.F. Hanna contributed sections on aeromagnetic data.

Definitions of Selected Terms as Used in This Report

Aeromagnetic anomalies.—These features are perturbations of the Earth's magnetic field that have been sensed by an aircraft-borne magnetometer and are displayed as contours. Relative maximums and minimums of closed-contour anomalies are referred to, respectively, as highs and lows.

The source of an anomaly refers to the magnetized rocks that cause the anomaly—the total magnetization (magnetic dipole moment per unit volume) of the rocks is attributable to magnetite or a related magnetic mineral species. In general, mafic rocks such as basalt or diorite have stronger magnetizations than felsic rocks such as rhyolite or granite, largely because of greater abundances of magnetic mineral grains but occasionally because of the small size of microscopic domains within the grains.

The trend, gradient, and wavelength of an anomaly refer, respectively, to the azimuthal orientation of its axis, the amount of change in amplitude per unit of horizontal distance across the entire anomaly (mathematically, this is actually about one-half the full wavelength), and the distance between successive similar points across the crest of the anomaly, assuming that it extends horizontally as a continuous waveform.

Granitic rock.—A holocrystalline, quartz-bearing, plutonic rock ranging in composition from granite to diorite (table 1).

Pluton.—A single exposure or group of exposures of a body of igneous rock that has formed beneath the surface of the Earth by crystallization of magma. The term has been broadly used to conveniently group outcrops rather than to imply any genetic relationship. In certain cases, the terms "stock" and "batholith" have been substituted for pluton. Herein, stock refers to igneous intrusions that have less than 100 km² of surface exposure, and may or may not imply a discordant relationship with the surrounding country rock. Batholith

Table 1. Generalized classification of granitic rocks

Texture	Potassium feldspar >½ total feldspar		Potassium feldspar ¼–¾ total feldspar		Plagioclase feldspar >½ total feldspar		
	Quartz >10 percent	Quartz <10 percent	Quartz >10 percent	Quartz <10 percent	Potassium feldspar >10 percent total feldspar	Potassium feldspar <10 percent total feldspar	
					Quartz >10 percent	Quartz >10 percent	Quartz <10 percent
Equigranular	Granite	Syenite	Quartz monzonite	Monzonite	Granodiorite	Quartz diorite	Diorite
Porphyritic granular	Granite porphyry	Syenite porphyry	Quartz monzonite porphyry	Monzonite porphyry	Granodiorite porphyry	Quartz diorite porphyry	Diorite porphyry

denotes a plutonic mass that has more than 100 km² of surface area.

Scope of Study

Information on the following factors: general location, coordinates, land classification, area, accessibility, composition, age, rocks intruded, aeromagnetic expression, and mining activity for each pluton in Nevada was obtained from the literature. The index was then compiled by county (fig. 1), with two exceptions. Nye County was divided into two sections; Washoe, Storey, and Douglas Counties and Carson City were combined into one section. The information compiled is presented for each county and begins with an introduction that briefly describes the regional geologic setting and is followed by a county map that indicates the location and distribution of plutons within that county. Information on the above factors is then presented for each pluton and summarized in table 2 for all the plutons. The following is an explanation of the factors.

Designation of plutons.—Individual exposures or groups of exposures were assigned a name, prefix, and number to facilitate reference to the State map (pl. 1), county maps, figures, and discussions. Names of plutons were taken from the literature, where available. Granitic rock exposures not previously named were assigned names of local mining districts or topographic features occurring on or near the plutons. The prefix signifies the county in which the pluton occurs and the number represents the order of discussion for each pluton within a particular county. The prefix designations for the counties are as follows:

CL—Clark	EU—Eureka
LI—Lincoln	WP—White Pine
SN—Nye (southern part)	EL—Elko
NN—Nye (northern part)	HI—Humboldt
ES—Esmeralda	P—Pershing
M—Mineral	WS—Washoe
L—Lyon	*—Carson City (independent city)
CH—Churchill	S—Storey
LA—Lander	D—Douglas

*Outcrops occurring in Carson City (independent city) are included in Washoe and Douglas Counties.

General location.—A generalized location of each pluton is given, referenced to a particular topographic, or cultural feature (pl. 1).

Coordinates.—Latitude and longitude of the approximate center of each pluton have been recorded in degrees and minutes. Measurements were made from maps of 1:500,000 or 1:250,000 scale. Where a pluton consists of a cluster of outcrops, the coordinates were measured from a central point within the largest outcrop, or from a point centrally located within the group.

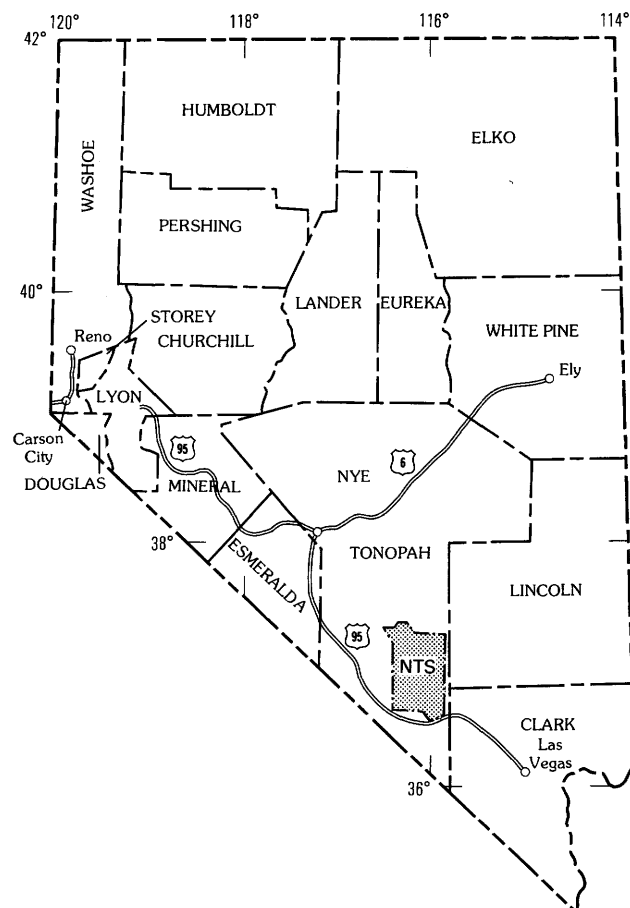


Figure 1. Index map of Nevada showing locations of counties and the Nevada Test Site (NTS).

Land classification.—Classification of land refers to either private ownership or to the administration of lands under Federal jurisdiction. Information was obtained and, in some cases, generalized from Lutsey and Nichols (1972).

Area.—Exposed areas of granitic rock were measured using a compensating polar planimeter and are expressed in square kilometers. Approximate surface configurations were obtained from the respective county geologic maps and the Nevada State geologic map (1:500,000) by Stewart and Carlson (1974, and 1978). Where a pluton is represented by several isolated exposures, the cumulative area of all exposures is recorded.

Accessibility.—Data given in this section were interpreted principally from U.S. Army Map Service topographic sheets (1:250,000), USGS topographic map series, and USGS State of Nevada map (1965, 1:500,000). Data provide approximate distances to improved roads such as major State, U.S., and Interstate Highways, and railroads. Unimproved roads commonly extend to the plutons, but are mentioned only if major roadways are not nearby.

Composition.—The major composition of the pluton is given. Many of the granitic rock masses have been classified by field inspection only and their composition (or classification) has not been confirmed by geochemical or petrographic analysis.

Age.—Radiometric age data are presented where available; they include the age, method used, material dated, and reference. Where radiometric age determinations are not available, the age is based on field relationships. In cases where age is uncertain, a hyphen has been inserted between the divisions of geologic time to indicate and (or).

Rocks intruded.—Included in this section are formation name(s), age(s), and rock type(s). Where rocks intruded are not exposed, rocks that overlie the pluton are noted.

Aeromagnetic expression.—Two aeromagnetic anomaly maps of Nevada have been used in this report: (1) a mosaic of many individual maps (Zietz and others, 1977), corresponding to aeromagnetic surveys having highly diverse flight specifications; and (2) a map of analytically merged aeromagnetic data (Sweeney and others, 1978), simulating a single aeromagnetic survey made at high elevation. Most surveys represented on the mosaic map correspond to a flight elevation of about 2.7 km; a few were made at elevations ranging from about 0.15 km to 3.8 km. The analytically merged map simulates a flight elevation of 3.8 km.

Aeromagnetic anomalies or parts of anomalies have been correlated with previously mapped igneous or metamorphic rocks. Qualitative, rather than quantitative, inferences have been made about anomaly sources, with

most information provided in brief telegraphic style. Information on anomalies is based on state-wide data published by Spengler and others (1979); quantitative analysis of anomalies in Nevada is currently underway (Blakely, 1986), with emphasis on determining the depths to the bottom of magnetic rock sources, for use in determining Curie-temperature isotherms.

The amplitudes or shapes of anomalies depend largely on the thickness of the source rocks—an expression of the volume of magnetic material—and on the magnitude and direction of total magnetization in the source rocks. The direction of total magnetization may depart significantly from the direction of the Earth's ambient magnetic field because of the presence of anomalously directed remanent magnetization, especially in some volcanic rocks.

As a semiquantitative aid to the infrequent user of aeromagnetic-anomaly data, a few examples of anomalies expected to be caused by terranes of plutonic and other magnetic rocks in Nevada are shown in idealized form in figures 2 and 3. Figure 2 shows variations of anomaly amplitudes with increasing thickness of a typical prismatic source; figure 3 shows variations of anomaly shape and anomaly location with respect to a source with change in direction of total magnetization. The height of the magnetometer above the source rocks is assumed to be 1.5 km. This height is representative of those areas where the high-level data (Sweeney and others, 1978) were acquired over highly elevated sources of about 2.3 km elevation and representative of those areas where the lower-level data (Zietz and others, 1977) were acquired over sources that range from moderately elevated at a 1.7 km elevation to moderately buried at a depth of 1.4 km. The principal inferences to be drawn from figures 2 and 3 are that (1) high-amplitude anomalies must have sources that are thick and have strong total magnetization, and (2) such anomalies will approximately outline the tops of sources if the total magnetization is steeply inclined. Both of these conditions appear to apply widely in Nevada.

Mining activity.—Data provided in this section denote areas near plutons where mining and drilling operations were in progress as late as 1976, and name the major commodities being developed. Comments regarding historical mining activities (1900–1976) have been made for selected plutons. Areas of local mining have been extracted from Payne and Papke (1977).

Selected references.—The major sources of geologic information for most counties are listed within the introduction to each county. Published sources of information pertaining to age determination are given

4 Table 2. Summary of data related to plutons in the State of Nevada

Index of Granitic Rock Masses in Nevada

Pluton designation by county	Composition				Age					Radiometric age determination made	¹ Commodity mined	Thrust fault in vicinity	Aeromagnetic Expression					
	Granite	Quartz monzonite	Granodiorite	Diorite	Precambrian	Triassic	Jurassic	Cretaceous	Tertiary				Anomaly			Pluton areal extent		⁵ Other
													High	Low	Weak or none	Approximately equals exposures	Larger than exposures	Mixed or unknown
Clark County CL-1 CL-2 CL-3 CL-4 CL-5 CL-6 CL-7 CL-8	X X X X X X X X	X X X	 X 	 X 	X X X X	 	 	 X X	 X X X X	X X X X Pb, Ag X	Ag, Au 	 X	X X X X X	 X X X	 X	X X X X	 X	
Lincoln County LI-1 LI-2 LI-3 LI-4 LI-5 LI-6	X X X X	 X 	 X 	 X 	 	 	 X X 	X X X X X	 X 	 	W 	X X X X X	X X	 	 	X X	X X X X X	
Southern Nye County SN-1 SN-2 SN-3 SN-4 SN-5 SN-6 SN-7 SN-8	 X X X	 X X X	 X X 	 	 	 	 	 X X X X X	 	 X X 	W 	 X 	 X X X X X X X	 X	 X	 X	 X X X X X	
Northern Nye County NN-1 NN-2 NN-3 NN-4 NN-5 NN-6a NN-6b NN-7 NN-8 NN-9 NN-10a	 X X X	 X X X X X	 X X X X 	 X X	 	 	 	 X X X X X	 	 X X X X X X X	 Au Ag, Au Ag, Au W Au	 X X	X X X X X X X X X X	 X	 X	 X X X	 X X X X X X X	

NN-10b		X				X	X				X			X			X
NN-11				X		X	X						X				X
NN-12a	X							X	X							X	X
NN-12b	X		X	X				X	X							X	X
NN-12c			X	X				X	X							X	X
NN-13		X	X				X	X		W Li		X X X X			X		X
Esmeralda County																	
ES-1		X		X				X		Pb, Ag, Au	X	X					X
ES-2		X				X			X	Au, W	X	X	X		X		
ES-3		X				X	X		X	Au, Ag	X	X	X			X	
ES-4		X				X						X					X
ES-5		X				X			X		X	X					X
ES-6		X				X	X	X	X		X			X			X
ES-7		X				X	X				X	X					X
ES-8		X				X	X				X			X			X
ES-9		X				X			X			X					X
ES-10		X				X	X		X		X	X	X				X
ES-11		X					X				X	X		X			
ES-12		X					X		X		X	X				X	
ES-13		X					X					X					
ES-14		X					X		X		X	X					X
ES-15		X					X		X			X					X
ES-16		X				X			X			X					X
Mineral County																	
M-1	X	X	X			X	X		X	Au, Ag		X	X				X
M-2		X					X	X		W		X				X	
M-3	X						X		X			X					X
M-4	X						X		X	Au, Ag		X					X
M-5		X	X	X			X		X			X				X	
M-6		X	X				X	X	X			X					X
M-7	X	X	X	X			X		X		X	X					X
M-8			X				X		X		X	X				X	
M-9		X	X				X		X	W		X	X	X			X
M-10		X	X				X					X		X			X
M-11	X						X					X					X
Luning County																	
L-1		X	X				X			Au, Ag				X			X
L-2		X	X				X							X			X
L-3		X	X				X		X			X	X				X
L-4		X	X				X					X					X
L-5	X	X	X				X			Cu		X					X
L-6	X	X	X				X					X					X
L-7		X	X				X					X					X
L-8		X	X				X					X				X	
L-9		X	X				X					X				X	
L-10		X	X				X						X				X

Table 2. Summary of data related to plutons in the State of Nevada—Continued

Pluton designation by county	Composition				Age					Radiometric age determination made	¹ Commodity mined	Thrust fault in vicinity	Aeromagnetic Expression					
	Granite	Quartz monzonite	Granodiorite	Diorite	Precambrian	Triassic	Jurassic	Cretaceous	Tertiary				Anomaly			Pluton areal extent		⁵ Other
													High	Low	Weak or none	Approximately equals exposures	Larger than exposures	Mixed or unknown
Churchill County CH-1 CH-2 CH-3 CH-4 CH-5 CH-6 CH-7 CH-8 CH-9 CH-10 CH-11 CH-12	 X X	 X X X X X X X X X	 X X X X X X X X X X	 														

WP-6		X						X		Pb, Ag	X	X				X	
WP-7		X						X	X	Au, Ag, Cu	X	X		X		X	X
WP-8		X					X	X	X		X	X				X	
WP-9		X						X	X		X	X				X	
WP-10	X	X						X	X		X	X				X	
WP-11		X						X	X		X	X				X	
WP-12		X						X	X			X		X		X	
WP-13		X						X	X			X				X	
WP-14		X					X		X			X				X	
WP-15		X						X	X					X			X
WP-16	X	X						X	X							X	X
WP-17		X						X	X							X	X
WP-18			X				X		X		X	X				X	X
Elko County																	
EL-1		X	X				X	X	X	Ag	X	X			X	X	
EL-2			X				X	X		Au, Ag, W		X		X			
EL-3				X			X	X				X		X			
EL-4			X				X	X				X			X		
EL-5			X				X	X				X			X		
EL-6		X	X				X	X				X				X	
EL-7		X	X				X	X	X				X			X	X
EL-8			X				X	X					X			X	X
EL-9	X						X	X	X				X			X	X
EL-10		X					X	X	X			X				X	
EL-11		X					X	X	X				X				X
EL-12	² X	X					X	X	X	Cu		X				X	
EL-13	X						X	X	X			X				X	
EL-14		X	X				X	X	X			X				X	
EL-15		X	X				X	X	X					X			X
EL-16	X						X	X	X		X			X			X
EL-17				X			X	X	X					X			X
EL-18		X					X	X	X		X	X			X		
EL-19			X				X	X	X			X			X		
EL-20		X	X	X					X		X	X			X		
EL-21		X							X			X			X		
EL-22			X						X			X			X		
Humboldt County																	
H-1			X					X				X			X		
H-2			X					X				X				X	
H-3		X						X				X				X	
H-4			X	X			X	X		W	X	X				X	
H-5			X				X	X			X	X					X
H-6			X					X			X	X					
H-7			X					X				X					
H-8			X					X				X			X		
H-9			X	X			X			Au		X			X		
H-10			X				X	X				X					X
H-11			X				X		X			X					X

Table 2. Summary of data related to plutons in the State of Nevada—Continued

Pluton designation by county	Composition				Age					Radiometric age determination made	¹ Commodity mined	Thrust fault in vicinity	Aeromagnetic Expression					
	Granite	Quartz monzonite	Granodiorite	Diorite	Precambrian	Triassic	Jurassic	Cretaceous	Tertiary				Anomaly			Pluton areal extent		⁵ Other
													High	Low	Weak or none	Approximately equals exposures	Larger than exposures	Mixed or unknown
H-12 H-13 H-14 H-15 H-16 H-17 H-18 H-19			X X X X X X	 X X X			 X X X	X X X			 X X X	X X X X X X			 X	X X X X	 X	
Pershing County P-1 P-2 P-3 P-4 P-5 P-6 P-7 P-8 P-9 P-10 P-11 P-12 P-13 P-14 P-15 P-16 P-17 P-18			X X X X X X X X X				 X	X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X	 Au, Ag Au W Au	 X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X X X			 X X X X X	X X X X X X X X X X X X X X X X X	 	

Table 3. Major stratigraphic and geologic time divisions . Modified from "Major geochronologic and chronostratigraphic units," Geologic Names Committee, 1983, U.S. Geological Survey

Era or Erathem	System or Period	Series or Epoch	Age estimates commonly used for boundaries (in millions of years)	
CENOZOIC	QUATERNARY	Holocene	0.010	
		Pleistocene		
	TERTIARY	Pliocene	2	(1.7-2.2)
		Miocene	5	(4.9-5.3)
		Oligocene	24	(23-26)
		Eocene	38	(34-38)
		Paleocene	55	(54-56)
MESOZOIC	CRETACEOUS	Upper (Late)	63	(63-66)
		Lower(Early)	96	(95-97)
	JURASSIC	Upper (Late)	138	(135-141)
		Middle (Middle)		
	TRIASSIC	Lower(Early)	205	(200-215)
		Upper (Late)		
PALEOZOIC	PERMIAN	Middle (Middle)	~ 240	
		Lower(Early)		
	PENNSYLVANIAN	Upper (Late)	290	(290-305)
		Middle (Middle)		
	MISSISSIPPIAN	Lower(Early)	~ 330	
		Upper (Late)		
	DEVONIAN	Lower(Early)	360	(360-365)
		Upper (Late)		
PRECAMBRIAN	SILURIAN	Middle (Middle)	410	(405-415)
		Lower(Early)		
	ORDOVICIAN	Upper (Late)	435	(435-440)
		Middle (Middle)		
CAMBRIAN	Lower(Early)	500	(495-510)	
	Upper (Late)			
			~ 570	

Area: 120 km².

Accessibility: Jeep trails extending northward that cross the Colorado River approximately 51 km north of the exposures.

Composition: Granite and quartz monzonite.

Age: 1.06 Ga, 1.09 Ga, Rb-Sr, potassium feldspar (Volborth, 1962) (Precambrian).

Rocks intruded: Precambrian gneiss, migmatite, granite, pyroxenite, and hornblendite.

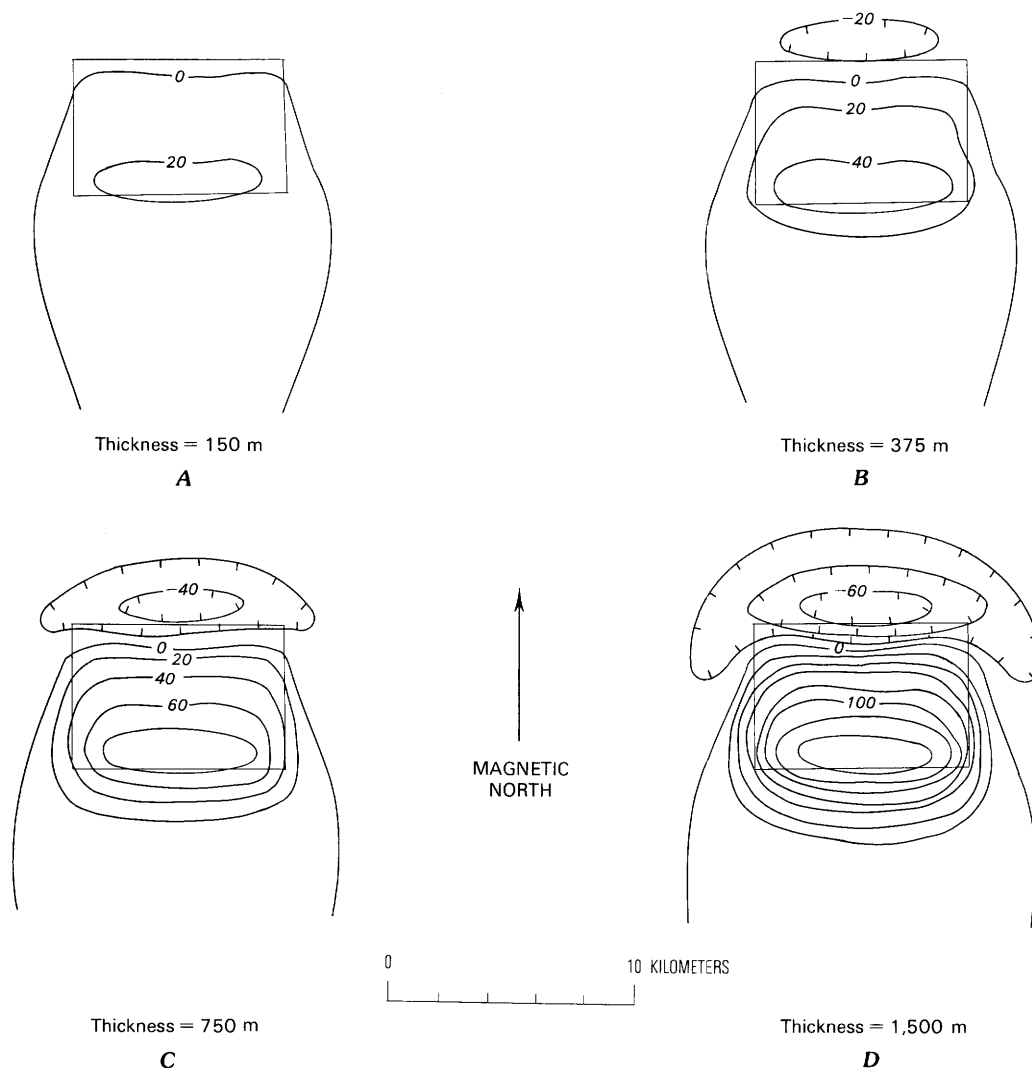


Figure 2. Variation of amplitude of aeromagnetic anomaly with increasing thickness of prismatic source as indicated, A-D. Height of aircraft magnetometer above source is 1.5 km; total magnetization of source is 1 A m^{-1} , of same direction and polarity as Earth's ambient magnetic field; contour interval is 20 gammas (nT); areal extent of source is slightly greater than 50 km^2 . Note that anomalies, regardless of thickness, occur almost directly over tops of sources.

Aeromagnetic expression:

Anomaly: High (long-wavelength, high-amplitude).

Inferred source: Same areal extent as exposed plutonic rocks.

Remark: Northward displacement of anomaly is associated with topography.

Mining activity: Gold and silver have been mined at two localities within the district.

Selected reference: Volborth, 1962.

CL-2. Wilson Ridge

General location: Hamblin Mountains.

Coordinates: lat $36^{\circ}10' \text{ N.}$, long $114^{\circ}35' \text{ W.}$

Land classification: Recreation area.

Area: 33 km^2 .

Accessibility: A secondary, all-weather road extends east of Las Vegas and flanks the northern edge of Lake Mead, approximately 2 km north of the exposure.

Composition: Granite and diorite.

Age: Tertiary.

Rocks intruded: Precambrian gneiss, schist and pegmatite, and Gale Hills Formation (Cretaceous(?)) and Tertiary—conglomerate, sandstone, and limestone).

Aeromagnetic expression:

Anomaly: High (northeast-trending).

Inferred source: Basalt and related extrusive rocks.

Mining activity: None.

Selected reference: Anderson, 1973.

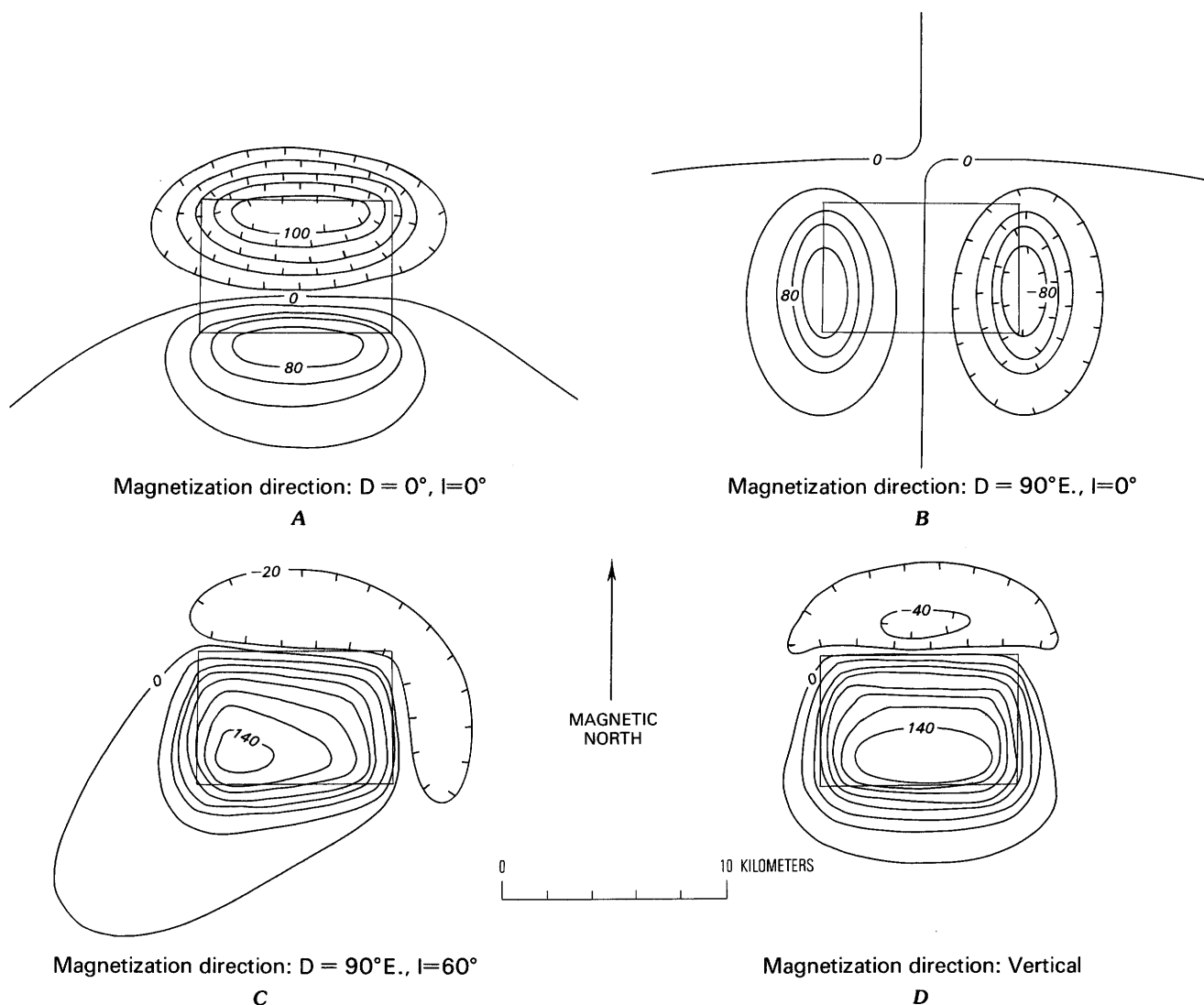


Figure 3. Variation of shape and location of aeromagnetic anomaly with change in total magnetization direction of prismatic source. (D = declination, I = inclination). Height of aircraft magnetometer above source is 1.5 km; total magnetization of source is 1 A m^{-1} ; thickness of source is 1.5 km; contour interval is 20 gammas (nT); areal extent of source is slightly greater than 50 km^2 . Note that anomalies associated with sources having shallow magnetization inclinations (A and B) occur over opposite edges of source. Anomalies associated with sources having steep magnetization inclinations (C and D) occur almost directly over tops of sources.

CL-3. Boulder City

General location: Underlies Boulder City.

Coordinates: lat $35^\circ 59' \text{ N.}$, long $114^\circ 49' \text{ W.}$

Land classification: Private land within the city limits of Boulder City.

Area: 34 km^2 .

Accessibility: U.S. Highway 93 crosses the exposure.

Composition: Granite and granodiorite.

Age: $53 \pm 10 \text{ Ma}$, lead-alpha, zircon (Schilling, 1965) (Tertiary).

Rocks intruded: Patsy Mine Volcanics (Tertiary).

Aeromagnetic expression:

Anomaly: Low (long-wavelength, low-amplitude).

Inferred source: Not highly magnetic.

Remark: Exposed rocks occur near south flank of anomaly.

Mining activity: None.

Selected references: Anderson, 1969; Schilling, 1965.

CL-4. Alunite

General location: Northeastern extremity of the McCullough Range at Alunite.

Coordinates: lat $35^\circ 58' \text{ N.}$, long $114^\circ 56' \text{ W.}$

Land classification: Public domain.

Area: 13 km^2 .

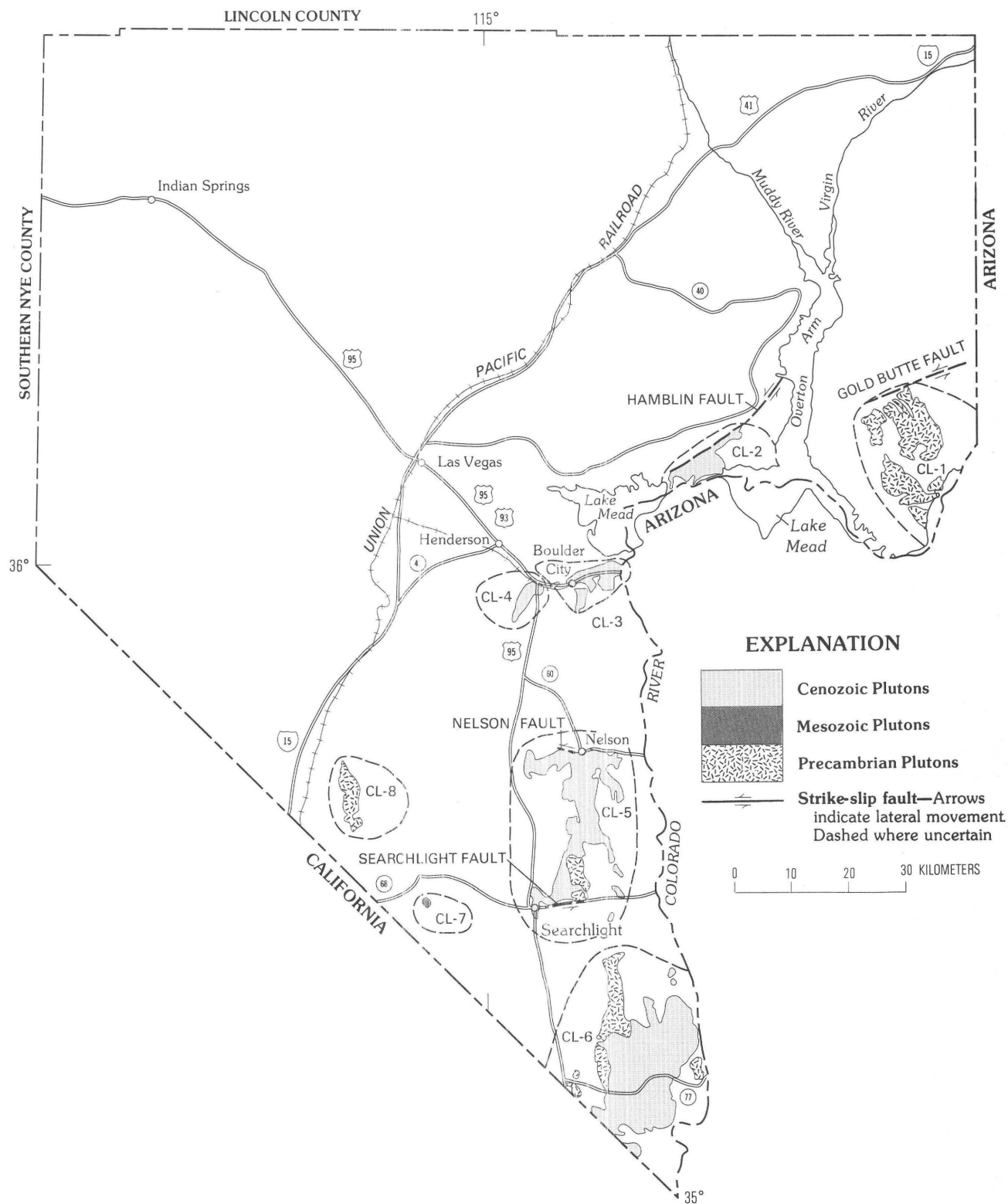


Figure 4. Locations of plutons in Clark County.

Accessibility: U.S. Highways 95 and 93 pass about 0.5 km north of the exposure. A branch of the Union Pacific Railroad parallels the highways.

Composition: Granite.

Age: Tertiary.

Rocks intruded: Overlain by Tertiary volcanics and alluvium.

Aeromagnetic expression:

Anomaly: Common flank of high and low.

Inferred source: Not highly magnetic.

Mining activity: The area lies within the Alunite district, where gold and alunite were mined in the early 1900's; mining operations ceased in the late 1930's.

Selected reference: Longwell and others, 1965.

CL-5. Knob Hill

General location: Southern Eldorado Mountains, south of Nelson and north of Searchlight.

Coordinates: lat 35°36' N., long 114°49' W.

Land classification: The eastern part lies within the Lake Mead recreation area and the western half is designated as public domain, except for local patented mining claims near the towns of Nelson and Searchlight.

Area: 150 (Tertiary granite and quartz monzonite) and 18 (Precambrian granite) km².

Accessibility: U.S. Highway 95 runs southward from Railroad Pass and passes within 8 km of the outcrops. Access to the northernmost exposures is by way of State Highway 60.

Composition: Granite and quartz monzonite.

Age: 26 (+4, -2) Ma, K-Ar, biotite-granite (Schilling, 1965) (Tertiary); 14.0±0.6 Ma, K-Ar, biotite-quartz monzonite (Krueger and Schilling, 1971) (Tertiary). Some plutonic bodies of Precambrian age.

Rocks intruded: Precambrian gneiss and schist.

Aeromagnetic expression:

Anomaly: High (high-amplitude, northwest-trending).

Inferred source: About equal in areal extent to exposed plutonic rocks.

Mining activity: Gold and silver have been mined west of the town of Nelson.

Selected references: Krueger and Schilling, 1971; Schilling, 1965; Volborth, 1973.

CL-6. Spirit Mountain

General location: Newberry Mountains, near the southern tip of Nevada.

Coordinates: lat 35°13' N., long 114°42' W.

Land classification: The eastern half lies within the Lake Mead recreation area and the western part is designated as public domain.

Area: 345 km².

Accessibility: U.S. Highway 95 is west of the exposures and State Highway 77 traverses the exposures.

Composition: Granite.

Age: Precambrian, Tertiary.

Rocks intruded: Tertiary granite intrudes Precambrian granite.

Aeromagnetic expression:

Anomaly: High (short-wavelength, low-amplitude, north-trending) and high (high-amplitude).

Inferred source: Low-amplitude high has unknown source; high-amplitude high is associated with andesitic and basaltic extrusive rocks. The plutonic rocks are not highly magnetic.

Mining activity: Lead and silver deposits have been mined along the west flank of the Newberry Mountains.

Selected reference: Volborth, 1973.

CL-7. Crescent Peak

General location: Northern part of the New York Mountains, west of Searchlight.

Coordinates: lat 35°28' N., long 115°07' W.

Land classification: The southern part of the exposure consists mainly of patented mining claims, and the remainder is public domain.

Area: 2 km².

Accessibility: State Highway 68 is along the north end of the New York Mountains within 3 km of the exposure. The Union Pacific Railroad passes within 13 km of the outcrop.

Composition: Quartz monzonite.

Age: 98.9±3 Ma, K-Ar, biotite (Krueger and Schilling, 1971) (Cretaceous).

Rocks intruded: Precambrian gneiss.

Aeromagnetic expression: None.

Mining activity: None.

Selected references: Bingler and Bonham, 1973; Schilling, 1965; Krueger and Schilling, 1971.

CL-8. Northern Lucy Grey Range

General location: West of the McCullough Range and east of Roach Lake.

Coordinates: lat 35°39' N., long 115°17' W.

Land classification: Public domain.

Area: 23 km².

Accessibility: Interstate 15 and the Union Pacific Railroad are approximately 6 km and 4 km west of the exposure, respectively.

Composition: Granite.

Age: Precambrian.

Rocks intruded: Surrounded by alluvium.

Aeromagnetic expression:

Anomaly: High (north- to northeast-trending, in part over exposed rocks). One of the largest magnetic features, in both amplitude and extent, within Nevada.

Inferred source: Maximum areal extent of source is estimated to be 300 km².

Mining activity: None.

Selected references: Hewett, 1956; Longwell and others, 1965.

LINCOLN COUNTY

Geology

Lincoln County (fig. 5) is located in southeastern Nevada entirely within the Basin and Range province, which consists of elongated north-south mountain ranges separated by wide basins. The crests of the mountain ranges are about 900–1,200 m higher than the adjacent basins.

The bedrock of the county consists of approximately one-third Cenozoic sedimentary rocks, one-third Tertiary volcanic rocks, and one-third igneous, metamorphic, and sedimentary rocks that range in age from Precambrian to Triassic (Tschanz and Pampeyan, 1970).

The rocks have undergone two episodes of thrust faulting—one in the Late Cretaceous and early Tertiary and one post-Oligocene. The Paleozoic rocks have been displaced eastward as much as 26 km over younger rocks that are folded into overturned synclines beneath the thrust (Tschanz and Pampeyan, 1970). A major northeast-trending strike-slip fault of Laramide age, the Arrowhead Mine fault, has been inferred by Tschanz and Pampeyan (1970) in the southwestern part of the county (fig. 5). The fault has an apparent right-lateral displacement of about 40 km. Three post-Miocene left-lateral faults parallel the older right-lateral Arrowhead Mine fault. The older structures have been offset by basin-and-range faulting and partly covered by Cenozoic rocks.

An east-trending structure named the Timpahute Lineament (Ekren and others, 1976, fig. 5) crosses the central part of the county. In the western part of the county, the lineament is expressed by discontinuous east-northeast-trending topography from the Timpahute Range through the North and South Pahroc Ranges (Ekren and others, 1976). Several igneous intrusive bodies occur on or near the lineament, which has been the locus of recent seismicity in the southern part of the North Pahroc Range (Ekren and others, 1976) and is north of a west-southwest-trending zone of seismic activity.

The geologic data were extracted and summarized from the following: Ekren and others (1978) and Tschanz and Pampeyan (1970).

Plutons

LI-1. Groom Range

General location: North end of the Groom Range.
Coordinates: lat 37°35' N., long 115°48' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: 8 km southwest of State Highway 25.

Composition: Granite.

Age: Cretaceous-Tertiary.

Rocks intruded: Prospect Mountain Quartzite (Cambrian) and Chisholm Shale (Cambrian).

Aeromagnetic expression:

Anomaly: High (northeast-trending, long-wave-length); outcrops occur along north flank of anomaly.

Inferred source: Ash-flow tuffs, andesite flows, and related extrusive rocks.

Mining activity: None.

Selected references: Ekren and others, 1978; Tschanz and Pampeyan, 1970.

LI-2. Lincoln Stock

General location: Western part of the Timpahute Range.

Coordinates: lat 37°39' N., long 115°37' W.

Land classification: Public domain and patented mining claims.

Area: 2 km².

Composition: Granite.

Age: 88.1±2.7 Ma, and 92.7±2.9 Ma, K-Ar, biotite (Krueger and Schilling, 1971) (Cretaceous).

Rocks intruded: Guilmette Formation (Devonian—limestone, dolomite, and quartzite), limestone of Mississippian age, Chainman Shale (Mississippian), Scotty Wash Quartzite (Mississippian), and limestone of Pennsylvanian age.

Aeromagnetic expression:

Anomaly: High (same as that referred to in LI-1).

Inferred source: Unknown.

Mining activity: Tungsten has been mined in immediate vicinity of the pluton.

Selected reference: Krueger and Schilling, 1971.

LI-3. Worthington Peak

General location: North end of the Worthington Mountains.

Coordinates: lat 37°57' N., long 115°36' W.

Land classification: Public domain.

Area: 3 km².

Accessibility: 33 km northeast of State Highway 25.

Composition: Granite.

Age: Cretaceous-Tertiary.

Rocks intruded: Pogonip Group (Ordovician—limestone), Eureka Quartzite (Ordovician), and Sevy Dolomite (Devonian).

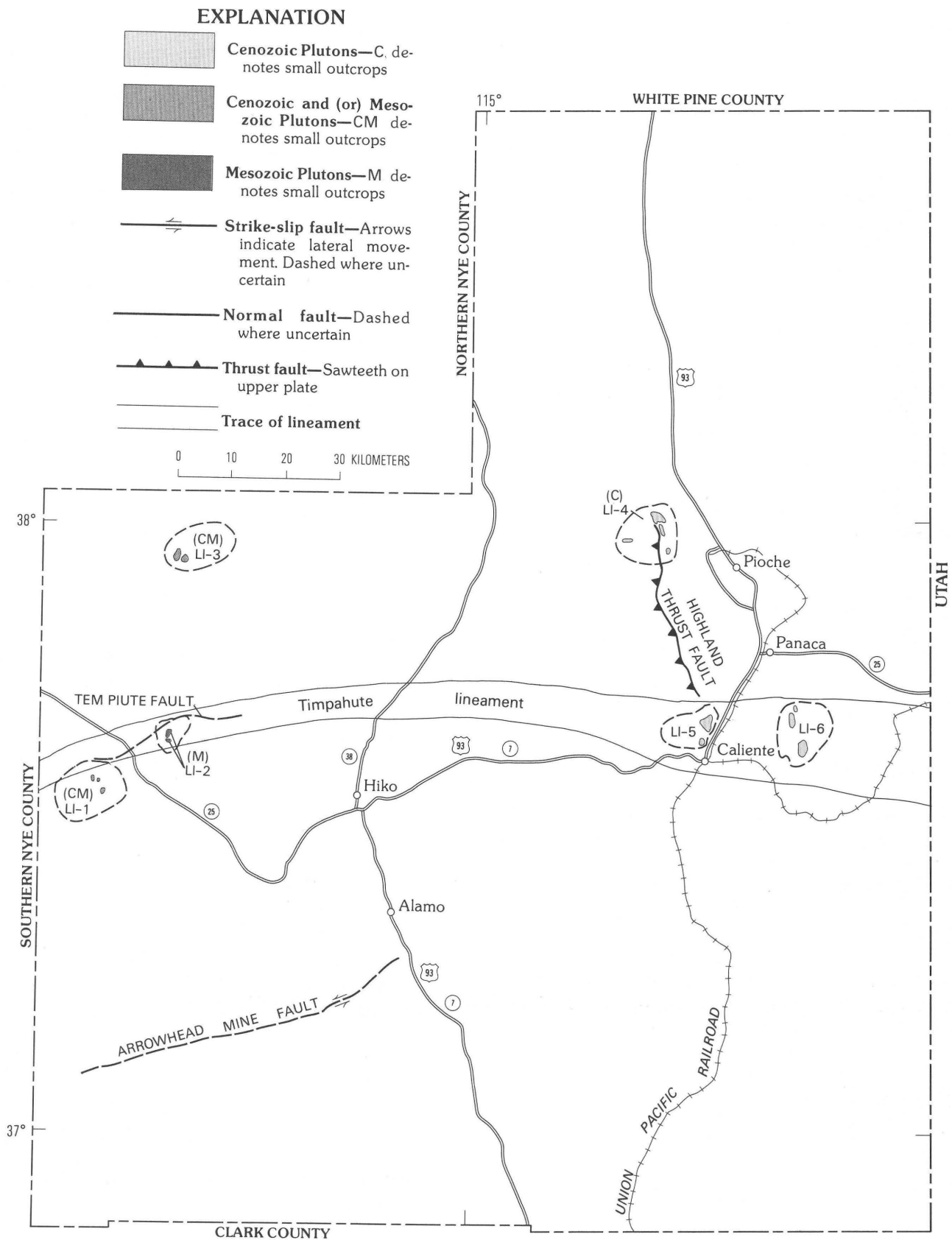


Figure 5. Locations of plutons in Lincoln County.

Aeromagnetic expression:

Anomaly: High (northwest-trending, high-amplitude). Outcrops occur along northeast flank.

Inferred source: Unknown.

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

LI-4. Bristol Range

General location: West flank of the Bristol Range.

Coordinates: lat 38°00' N., long 114°37' W.

Land classification: Public domain.

Area: 3 km².

Accessibility: 7 km west of U.S. Highway 93 and 9 km northwest of the Union Pacific Railroad.

Composition: Quartz monzonite.

Age: 27.7±0.9 Ma, K-Ar, hornblende (Armstrong, 1970a); 34.9±3.3 Ma, K-Ar, hornblende (Johnston, 1972) (Tertiary).

Rocks intruded: Prospect Mountain Quartzite (Cambrian), Chisholm Shale (Cambrian), Lyndon Limestone (Cambrian), Highland Peak Formation (Cambrian—limestone and dolomite), and the Guilmette Formation (Devonian—limestone, dolomite, and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude).

Inferred source: Ash-flow tuff and related extrusive rocks.

Mining activity: None.

Selected references: Armstrong, 1970a; Johnston, 1972.

LI-5. Chief Range

General location: Southern part of the Chief Range.

Coordinates: lat 37°41' N., long 114°30' W.

Land classification: Public domain.

Area: 6 km².

Accessibility: 1 km west of U.S. Highway 93 and Union Pacific Railroad.

Composition: Granodiorite.

Age: Tertiary.

Rocks intruded: Prospect Mountain Quartzite (Cambrian), Pioche Shale (Cambrian), and Cambrian limestone, dolomite, and shale.

Aeromagnetic expression:

Anomaly: High (high-amplitude). Main area of exposed rocks occurs at the east flank.

Inferred source: Andesitic flows and related rocks.

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

LI-6. Cedar Range

General location: Western part of the Cedar Range.

Coordinates: lat 37°39' N., long 114°18' W.

Land classification: Public domain.

Area: 6 km².

Accessibility: 12 km east of U.S. Highway 93. Union Pacific Railroad located 5 km southwest of pluton.

Composition: Granite and diorite.

Age: Tertiary.

Rocks intruded: Tertiary intermediate lava and welded tuff.

Aeromagnetic expression:

Anomaly: High (high-amplitude).

Inferred source: Maximum areal extent estimated to be as much as 15 km².

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

SOUTHERN NYE COUNTY

Geology

The southern part of Nye County (fig. 6) is located in southwestern Nevada.

Volcanic rocks of Tertiary age (27 to 7 m.y.) make up at least 90 percent of the outcrops (Ekren and others, 1971), and sedimentary rocks of late Precambrian and Paleozoic age constitute the remainder. The Tertiary rocks consist chiefly of ash-flow tuffs, silicic lavas, interbedded ash-fall tuff, and tuffaceous sedimentary rocks. Several volcanic centers are possible sources for the volcanic rocks. The area is in the western part of the Cordilleran miogeosyncline.

The area consists primarily of alluvial valleys separated by north-trending mountain ranges and closed basins. Basin-and-range, high-angle, normal faults bound the mountain ranges. Two normal fault systems are present in the area (Ekren and others, 1971)—an early system that consists of two sets of faults that strike northeast and northwest, and a later system that strikes north.

References: Cornwall, 1972; Ekren and others, 1971.

Plutons

SN-1. Microgranite of Timber Mountain

General location: Timber Mountain, west-central Nevada Test Site.

Coordinates: lat 37°02' N., long 116°23' W.

Land classification: Nevada Test Site.

Area: Less than 1 km².

Accessibility: Restricted.

Composition: Granite.

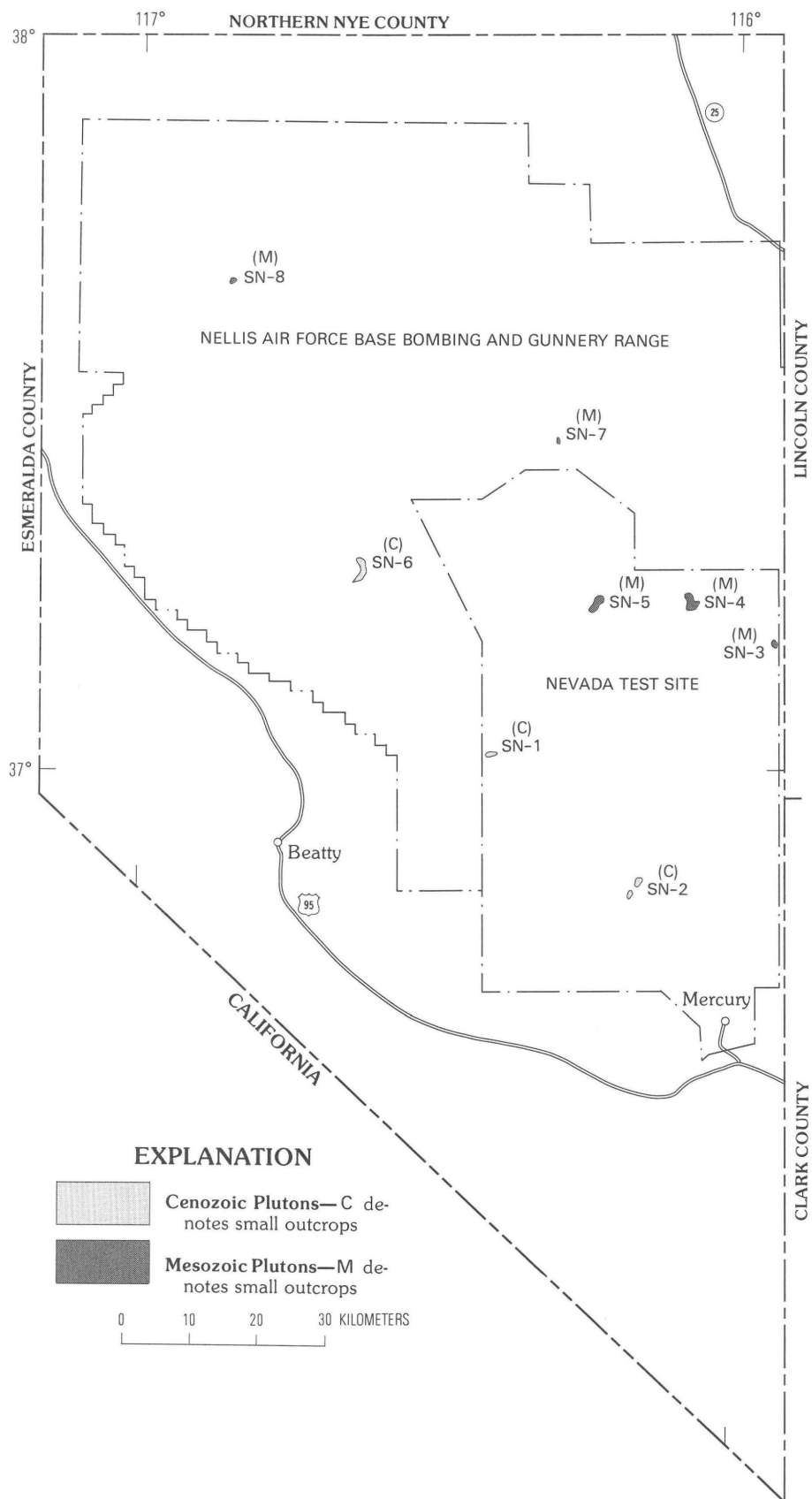


Figure 6. Locations of plutons in southern Nye County.

Age: Tertiary.
Rocks intruded: Tertiary volcanics.
Aeromagnetic expression:
Anomaly: Low (low-amplitude). Exposures occur at nose of anomaly.
Inferred source: Plutonic rock in ring-dike structure (Kane and others, 1981). Source is small.
Mining activity: None.
Selected references: Carr and Quinlivan, 1966; Byers and others, 1976.

SN-2. Wahmonie Granodiorite

General location: Southeast of Lookout Peak, southwestern Nevada Test Site.
Coordinates: lat 36°51' N., long 116°09' W.
Land classification: Nevada Test Site.
Area: Less than 1 km².
Accessibility: Restricted.
Composition: Granodiorite.
Age: Tertiary (Ekren and Sargent, 1965).
Rocks intruded: Tertiary volcanic rocks.
Aeromagnetic expression:
Anomaly: High (high-amplitude, long-wavelength).
Inferred source: Plutonic rocks that increase areally in the subsurface (Bath and others, 1983).
Mining activity: None.
Selected references: Ekren and Sargent, 1965; Ponce, 1981.

SN-3. Twinridge Stock

General location: Halfpint Range, northeastern Nevada Test Site.
Coordinates: lat 37°11' N., long 115°58' W.
Land classification: Nevada Test Site.
Area: Less than 1 km².
Accessibility: Restricted.
Composition: Quartz monzonite.
Age: Cretaceous (Maldonado, 1981).
Rocks intruded: Johnnie Formation (Precambrian—siltstone and limestone) and Stirling Quartzite (Precambrian).
Aeromagnetic expression:
Anomaly: High (low-amplitude, nose).
Inferred source: Plutonic and volcanic rocks. Plutonic rocks inferred to be very limited (Bath and others, 1983).
Mining activity: None.
Selected references: Barnes and others, 1965; Maldonado, 1981.

SN-4. Climax Stock

General location: Southern Belted Range, northeastern Nevada Test Site.

Coordinates: lat 37°14' N., long 116°03' W.
Land classification: Nevada Test Site.
Area: 3 km².
Accessibility: Restricted.
Composition: Quartz monzonite and granodiorite.
Age: 101±3.2 Ma, fission-track, apatite, sphene, and zircon (Naeser and Maldonado, 1981) (Cretaceous).
Rocks intruded: Stirling Quartzite (Precambrian) and Pogonip Group (Ordovician—limestone).
Aeromagnetic expression:
Anomaly: High (west flank of high-amplitude anomaly).
Inferred source: Plutonic rocks that increase laterally in the subsurface (Bath and others, 1983).
Mining activity: Tungsten has been mined.
Selected references: Maldonado, 1977; Naeser and Maldonado, 1981.

SN-5. Gold Meadows Stock

General location: North-central Nevada Test Site.
Coordinates: lat 37°14' N., long 116°13' W.
Land classification: Nevada Test Site.
Area: 2 km².
Accessibility: Restricted.
Composition: Quartz monzonite.
Age: 93.6±4.3 Ma, fission-track, zircon (Naeser and Maldonado, 1981) (Cretaceous).
Rocks intruded: Stirling Quartzite (Precambrian) and Wood Canyon Formation (Precambrian and Cambrian—quartzite, siltstone, and shale).
Aeromagnetic expression:
Anomaly: High (low-amplitude, long-wavelength, northwest flank).
Inferred source: Plutonic rocks that increase areally at depth (Bath and others, 1983).
Mining activity: None.
Selected references: Snyder, 1977; Naeser and Maldonado, 1981; Gibbons and others, 1963.

SN-6. Black Mountain Syenite

General location: Black Mountain (Black Mountain Caldera).
Coordinates: lat 37°16' N., long 116°37' W.
Land classification: Nellis Air Force Base Bombing and Gunnery Range.
Area: 21 km².
Accessibility: 23 km northeast of U.S. Highway 95.
Composition: Syenite.
Age: Tertiary.
Rocks intruded: Tertiary volcanics.
Aeromagnetic expression:
Anomaly: High (high-amplitude, elliptical).

Inferred source: Curvature of anomaly correlates with geometric configuration of the caldera.
Mining activity: None.
Selected references: Christiansen and Noble, 1965; Noble and others, 1965.

SN-7. Gold Reed

General location: Southeast flank of Quartzite Mountain, southern Kawich Range.
Coordinates: lat 37°27' N., long 116°16' W.
Land classification: Nellis Air Force Base Bombing and Gunnery Range.
Area: Less than 1 km².
Accessibility: 61 km northeast of U.S. Highway 95 and 42 km southwest of State Highway 25.
Composition: Granite.
Age: 98.4±4.3 Ma, biotite (R.F. Marvin, written commun., 1980) (Cretaceous).
Rocks intruded: Stirling Quartzite (Precambrian).
Aeromagnetic expression:
Anomaly: High (high-amplitude).
Inferred source: Mostly extrusive rocks, based on the correlation of similar anomalies with extrusive rocks within 20 km of the anomaly center.
Mining activity: None.
Selected reference: Ekren and others, 1971.

SN-8. Cactus Range

General location: Southwest flank of the Cactus Range.
Coordinates: lat 37°40' N., long. 116°52' W.
Land classification: Nellis Air Force Base Bombing and Gunnery Range.
Area: Less than 1 km².
Accessibility: 38 km northeast of U.S. Highway 95 and 75 km southwest of State Highway 25.
Composition: Granite.
Age: Cretaceous(?).
Rocks intruded: Nopah Formation (Cambrian—dolomite) and Eleana Formation (Devonian and Mississippian—argillite, quartzite, and limestone).
Aeromagnetic expression:
Anomaly: High (high-amplitude, northwest-trending southeast flank).
Inferred source: Ash-flow tuffs and related extrusive rocks.
Mining activity: None.
Selected reference: Stewart and Carlson, 1978.

NORTHERN NYE COUNTY

Geology

The northern part of Nye County, north of the 38th parallel (fig. 7), is centrally located within the Basin and Range province, which is characterized by a series of north- to northeast-trending mountain ranges separated by alluvial basins developed during late Tertiary time. The ranges are largely composed of a thick sequence of Tertiary rhyolitic flows and welded and nonwelded silicic ash-flow tuffs. Granitic rocks within the county intrude a wide variety of pre-Cenozoic sedimentary rocks, ranging in age from late Paleozoic to Mesozoic. The intrusives generally are exposed along steep, tilted range fronts marked by high-angle normal faults where erosion has stripped away the Tertiary cover.

Tertiary granitic intrusions occurring along the east margin of the county (White Pine and Grant Ranges) intrude rocks consisting of limestone, dolomite, and minor amounts of shale and quartzite, and ranging in age from Early Cambrian to Devonian. The structure is dominated by north-trending folds and thrusts developed during Laramide time (Sevier orogeny) in the late Mesozoic. These structures are cut by a series of low-angle faults that placed younger rocks over older rocks.

In the central part of the county (Toiyabe and Toiyabe Ranges), Mesozoic and Cenozoic plutonic rocks, mostly quartz monzonite and granodiorite, intrude a wide variety of lithologic assemblages: (1) upper Paleozoic and Mesozoic rocks of siliceous and volcanic assemblage, predominantly composed of chert, argillite, and greenstone; (2) shale and chert of a lower Paleozoic siliceous assemblage; (3) phyllite, shale, and limestone of a lower Paleozoic transitional assemblage; and (4) quartzite, siltstone, and carbonates of a lower Paleozoic carbonate assemblage.

Rocks underlying north-central Nye County have undergone at least two major periods of deformation during Paleozoic and Mesozoic time. During the Antler orogeny, in Late Devonian and Early Mississippian time, siliceous and volcanic assemblage rocks to the west were thrust eastward over transitional and carbonate assemblages. During the Sonoma orogeny, in Late Permian and Early Triassic time, a thick accumulation of chert, limestone, shale, and phyllite in the western part of the county was transported eastward along the Golconda thrust. Both events led to the juxtaposition of the diverse facies described above.

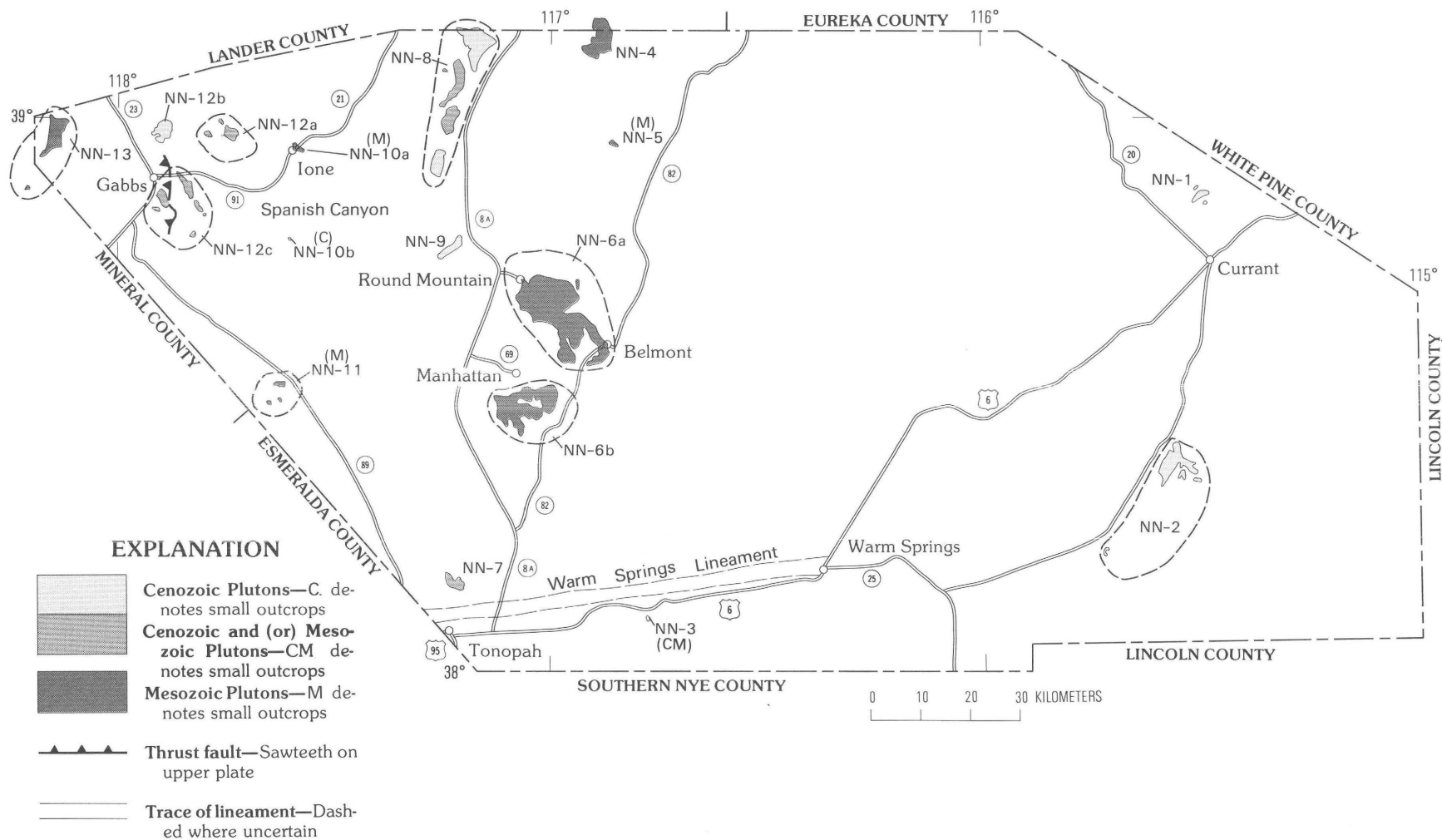


Figure 7. Locations of plutons in northern Nye County.

East of the Toiyabe Range, Mesozoic and Cenozoic granitic rocks intrude thick sequences of intercalated clastic, carbonate, and metavolcanic rocks of late Paleozoic(?) and Mesozoic age. These intruded rocks include the Gabbs, Sunrise, Luning, and Pablo Formations, present to the west in adjoining Mineral County. Deposition was interrupted during the Jurassic by the Nevada orogeny. Folding and thrusting associated with this event were directed southward and eastward. The primary reference for northern Nye County is Kleinhamp and Ziony (1967).

Plutons

NN-1. Railroad and Silver Springs

General location: West flank of the southern White Pine Range.

Coordinates: lat 38°52' N., long 115°29' W.

Land classification: Humboldt National Forest.

Area: 4 km².

Accessibility: State Highway 20 passes within 7 km of the outcrop.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Cambrian shale and limestone.

Aeromagnetic expression:

Anomaly: High (low-amplitude, northwest-trending). The trend is perpendicular to the exposure trend.

Inferred source: Plutonic rocks having a maximum areal extent of from 5 to 10 km². Inference is based on occurrences of two minor exposures northwest and northeast of the main exposure, but within the confines of the anomaly.

Mining activity: None.

Selected references: Lumsden, 1964; Moores and others, 1968; Schilling, 1965.

NN-2. Troy Peak

General location: Adjacent to Timber Mountain in the southern Grant Range.

Coordinates: lat 38°22' N., long 115°34' W.

Land classification: Humboldt National Forest.

Area: 27 km².

Accessibility: A light-duty improved road passes within 3 km of the main exposure and intersects U.S. Highway 6 at Currant.

Composition: Quartz monzonite and granodiorite.

Age: 23 (+4,-2) Ma, K-Ar, biotite (Schilling, 1965) (Tertiary).

Rocks intruded: Prospect Mountain Quartzite (Cambrian), Pole Canyon Limestone (Middle Cambrian), and Pogonip Group (Ordovician—limestone).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, north-trending, south flank).

Inferred source: Plutonic rocks that extend somewhat discontinuously northward from exposed rocks for a distance of 40 km. Maximum areal extent may be as much as 100 or 150 km².

Mining activity: None.

Selected reference: Schilling, 1965.

NN-3. Black Butte

General location: Southeast of the Monitor Range.

Coordinates: lat 38°06' N., long 116°47' W.

Land classification: Public domain.

Area: Less than 1 km².

Accessibility: U.S. Highway 6 lies 2.5 km north of the exposure.

Composition: Granodiorite.

Age: Jurassic(?)—Tertiary.

Rocks intruded: Overlain by Tertiary volcanics.

Aeromagnetic expression:

Anomaly: High (high-amplitude, north flank).

Inferred source: Although part of the source may be ash-flow tuff and andesitic and basaltic flows, most of it is inferred to be granodiorite having a maximum areal extent of from 10 to 15 km².

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

NN-4. Clipper Gap

General location: West flank of the Toiyabe Range along the north border of Nye County.

Coordinates: lat 39°09' N., long 116°53' W.

Land classification: Toiyabe National Forest.

Area: 24 km².

Accessibility: State Highway 8A passes along the west side of Big Smoky Valley about 14 km west of the exposures.

Composition: Quartz monzonite, granodiorite, and granite.

Age: 150 Ma, K-Ar, biotite (Stewart and others, 1977) (Jurassic).

Rocks intruded: Ordovician chert, siltstone, and volcanic rocks.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, elliptical, north-trending).

Inferred source: Same areal extent as exposed rocks.

Mining activity: None.

Selected references: McKee, 1972; Stewart and others, 1977.

NN-5. Northumberland

General location: East flank of the Toquima Range.

Coordinates: lat 38°58' N., long 116°51' W.

Land classification: Toiyabe National Forest.

Area: 2 km².

Accessibility: Light-duty improved State Road 82 passes along the west side of Monitor Valley, approximately 9 km east of the outcrop.

Composition: Granodiorite.

Age: 154±3 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Jurassic).

Rocks intruded: Pogonip Group (Ordovician—limestone), Ordovician limestone, dolomite, and shale.

Aeromagnetic expression: None.

Mining activities: Disseminated gold deposits have been mined.

Selected reference: Silberman and McKee, 1971.

NN-6a and 6b. Belmont and Manhattan

General location: Two large exposures of granitic rock, within 5 km of one another, occur near the south end of the Toquima Range.

Coordinates: Belmont pluton (6a)—lat 38°39' N., long 117° W.

Manhattan pluton (6b)—lat 38°29' N., long 117°04' W.

Land classification: Toiyabe National Forest.

Area: The northern exposure (6a) and southern exposure (6b) are 148 km² and 62 km², respectively.

Accessibility: State Highway 8A passes within 5 km of the Belmont pluton; light-duty State Highway 82, 2.5 km west of the Manhattan pluton crosses the Belmont pluton near Belmont. Light-duty State Highway 69 traverses the Toquima Range and ends at Manhattan.

Composition: 6a—Granite and quartz monzonite.

6b—Granite.

Age: 6a; 76.4±2.8 Ma, and 79.6±2.0 Ma, K-Ar biotite-quartz monzonite (Krueger and Schilling, 1971) (Cretaceous).

6b; Cretaceous.

Rocks intruded: 6a; Gold Hill Formation (Cambrian—quartzite, shale, and limestone) and Ordovician shale and limestone.

6b; Palmetto Formation (Ordovician—shale, limestone, and quartzite) and Ordovician shale and limestone.

Aeromagnetic expression:

6a; Anomaly: High (low-amplitude plateau).

Inferred source: Not highly magnetic.

6b; Anomaly: High (high-amplitude, western half of outcrop area).

Inferred source: Plutonic rock with a maximum areal extent of 100 km².

Mining activity: Silver and gold have been mined within the Round Mountain, Manhattan, and Belmont mining districts. Mineralization occurred in association with Jurassic or Cretaceous granitic intrusives and Tertiary lavas. The principal production has come from the younger gold deposits of Manhattan and Round Mountain.

Selected references: Ferguson, 1924; Ferguson and Cathcart, 1954; Krueger and Schilling, 1971.

NN-7. Black Mountain

General location: 10 km north of Tonopah in the San Antonio Mountains.

Coordinates: lat 38°10' N., long 117°13' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: Interstate Highway 95 lies 8 km southwest, State Highway 8A lies 8 km east, and State Highway 89 lies 9 km west of the outcrop.

Composition: Diorite.

Age: 59 Ma, fission track, sphene; 68 Ma, fission track, zircon (Carlson and others, 1975) (Cretaceous and Tertiary).

Rocks intruded: Ordovician shale and limestone.

Aeromagnetic expression:

Anomaly: High (high-amplitude, northern extremity).

Inferred source: Extrusive rocks similar to those exposed south of the pluton.

Mining activity: None.

Selected reference: Carlson and others, 1975.

NN-8. Toiyabe Range

General location: Northwest of the town of Round Mountain, along the east flank of the Toiyabe Range.

Coordinates: lat 39°02' N., long 117°13' W.

Land classification: Toiyabe National Forest. A small segment of land (1 km²) is designated as Indian Trust Allotments along the east margin of the southernmost exposure.

Area: Beginning with the northernmost and moving southward, the five exposures encompass 30, 13, 1, 10, and 10 km², respectively.

Accessibility: All intrusives are within 5 km west of State Highway 8A, which passes along the west side of Big Smoky Valley.

Composition: Granite and granodiorite.

Age: 53.9 ± 1.5 Ma, K-Ar, biotite (Speed and McKee, 1976); 58 Ma, K-Ar, biotite (Carlson and others, 1975) (Tertiary). Parts of the pluton could be Jurassic-Tertiary in age.

Rocks intruded: Gold Hill Formation (Cambrian—quartzite, shale, and limestone), and Pablo Formation (Mississippian—andesite flows and breccias).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, north-trending), associated with rocks mapped as quartz monzonite and granodiorite.

Inferred source: Maximum areal extent of these rocks is estimated to be 50 km^2 .

Mining activity: Tungsten has been mined along the west margin of the southernmost outcrop.

Selected references: Stewart and others, 1977; Carlson and others, 1975; Speed and McKee, 1976.

NN-9. Broad Creek

General location: East flank of the Toiyabe Range, approximately 14 km northwest of the town of Round Mountain and about 13 km south of the stocks described above as NN-8.

Coordinates: lat $38^{\circ}46'$ N., long $117^{\circ}13'$ W.

Land classification: Toiyabe National Forest.

Area: 7 km^2 .

Accessibility: Outcrop is easily accessible from Highway 8A, which passes within 1.6 km of the exposure.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Palmetto Formation (Ordovician—shale, limestone, and quartzite), Pablo Formation (Mississippian—andesite flows and breccias), and Darrough Felsite (Tertiary).

Aeromagnetic expression:

Anomaly: High (northwest-trending), orthogonal to northeast-trending mapped outline of plutonic rock.

Inferred source: Unknown.

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

NN-10a and 10b. Union Mining District

General location: West flank of the Shoshone Mountains. The northernmost body (10a) is centered near Ione and the southernmost body (10b) occurs near the boundary of the district, approximately 3.4 km south of Spanish Canyon.

Coordinates: lat $38^{\circ}57'$ N., long $117^{\circ}35'$ W., (10a) and lat $38^{\circ}47'$ N., long $117^{\circ}37'$ W., (10b).

Land classification: The district lies within the Toiyabe National Forest except for a small area immediately surrounding the town of Ione.

Area: The outcrop near Ione (10a) is 1 km^2 and the exposure south of Spanish Canyon (10b) is less than 1 km^2 .

Accessibility: An unimproved light-duty road passes along the middle of Ione Valley, through the town of Ione. The road passes within 10 km of the southern exposure.

Composition: 10a—Granodiorite, diorite, and quartz diorite.

10b—Quartz monzonite.

Age: 10a—Mesozoic (Jurassic-Cretaceous).

10b—Mesozoic (Jurassic-Cretaceous).

Rocks intruded: 10a—Pablo Formation (Mississippian—andesite flows and breccias).

10b—Dunlap Formation (Lower Jurassic sandstone, siltstone, and dolomite).

Aeromagnetic expression:

10a—Anomaly: High (long-wavelength, northwest-trending, southeastern margin).

Inferred source: Unknown.

10b—Anomaly: None.

Mining activity: Gold has been mined within the Ione area (10a).

Selected references: Silberling, 1959; Vitaliano, 1963.

NN-11. Royston Hills

General location: South of the Shoshone Mountains.

Coordinates: lat $38^{\circ}31'$ N., long $117^{\circ}37'$ W.

Land classification: Public domain.

Area: 2 km^2 .

Accessibility: Unimproved State Highway 89 is located approximately 1.6 km east of the outcrops.

Composition: Diorite.

Age: Jurassic-Cretaceous.

Rocks intruded: Luning Formation (Upper Triassic—limestone, dolomite, conglomerate, and shale).

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

NN-12a, 12b, and 12c. Paradise Range

General location, 12a: North of Sherman Peak along the east edge of the Paradise Range; referred to as the Lodi Hills pluton.

Coordinates: lat $38^{\circ}59'$ N., long $117^{\circ}44'$ W.

Land classification: Toiyabe National Forest.

Area: 4 km^2 .

Accessibility: State Highway 91 traverses the Paradise Range just north of Gabbs, 9 km south of the main outcrop.

Composition: Granite.

Age: 46.9 ± 2.0 Ma, K-Ar, biotite (Krueger and Schilling, 1971) (Tertiary). Parts of the pluton could be Jurassic-Tertiary.

Rocks intruded: Pablo Formation (Mississippian—andesite flows and breccias).

Aeromagnetic expression:

Anomaly: High (high-amplitude, northwest-trending, southeast margin).

Inferred source: Unknown; maximum areal extent estimated to be 15 km^2 .

Mining activity: None.

Selected reference: Stewart and Carlson, 1978.

General location, 12b: Approximately 10 km north of Gabbs.

Coordinates: lat $38^\circ 59'$ N., long $117^\circ 53'$ W.

Land classification: Public domain.

Area: 8 km^2 .

Accessibility: State Highway 23 passes about 5 km west of the pluton and an unimproved road passes 1.6 km to the east.

Composition: Granite, granodiorite, and diorite.

Age: Tertiary.

Rocks intruded: Luning Formation (Upper Triassic—limestone, dolomite, conglomerate, and shale).

Aeromagnetic expression:

Anomaly: High (northeast-trending, north margin). See previous discussion.

Inferred source: Unknown; maximum extent estimated to be 50 km^2 .

Mining activity: Tungsten has been mined along the south margin of the outcrop.

Selected references: Krueger and Schilling, 1971; Vitaliano, 1963; Vitaliano and Callaghan, 1963.

General location, 12c: 1.6–12 km east and southeast of Gabbs, in the Paradise Range. The large exposure southeast of Gabbs is referred to in the literature as the Gabbs pluton.

Coordinates: The outcrops are centered around lat $38^\circ 51'$ N., long $117^\circ 51'$ W.

Land classification: Toiyabe National Forest.

Area: 15 km^2 .

Accessibility: State Highway 23, provides easy access to the west flank of the Paradise Range. A few unimproved roads provide access to mining claims along the east flank.

Composition: Granodiorite.

Age: Cretaceous-Tertiary.

Rocks intruded: Luning (Upper Triassic—limestone, dolomite, conglomerate, and shale), Gabbs (Triassic—limestone, dolomite, and siltstone), and Sunrise (Jurassic—limestone, dolomite, and siltstone) Formations.

Aeromagnetic expression:

Anomaly: High (high-amplitude, gentle north flank, approximately circular).

Inferred source: Unknown; may be southeast sub-surface extension of exposed rocks; maximum areal extent estimated to be from 5 to 20 km^2 .

Mining activity: Lithium has been mined about 3 km east of Gabbs.

Selected references: Krueger and Schilling, 1971; Vitaliano, 1963; Vitaliano and Callaghan, 1963.

NN-13. Monte Christo Mountains

General location: Southern Monte Christo Mountains

Coordinates: lat $38^\circ 59'$ N., long $118^\circ 09'$ W.

Land classification: Public domain.

Area: 18 km^2 .

Accessibility: Southern Monte Christo Mountains lie approximately 13 km west of State Highway 23. Several improved mining roads traverse the area.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous(?).

Rocks intruded: Excelsior Formation (Middle Triassic(?)—volcanics).

Aeromagnetic expression:

Anomaly: High (high-amplitude, north-trending, elliptical).

Inferred source: Areal extent estimated to be the same as that of exposed rocks.

Mining activity: None.

Selected reference: Kleinhampl and Ziony, 1967.

ESMERALDA COUNTY

Geology

Esmeralda County is located in southwestern Nevada, adjacent to the California border; its geology is arcuate ranges and intervening valleys.

Outcrops in the county consist of sedimentary, igneous, and metamorphic rocks of late Precambrian to Holocene age. Precambrian and Cambrian rocks occur in the southern two-thirds of the county and are metamorphosed along the contact with igneous intrusives. Ordovician rocks are found throughout the county, but Silurian, Devonian, and Pennsylvanian rocks are absent; Permian strata are sparse.

Mesozoic sedimentary rocks occur in the northern part of the county. Granitic rocks of Jurassic age and younger are present throughout the county. Because the plutonic rocks are lithologically similar to those of the Sierra Nevada, Albers and Stewart (1972) suggested that the plutonic bodies (fig. 8) are probably a continuation of the Sierra Nevada batholith.

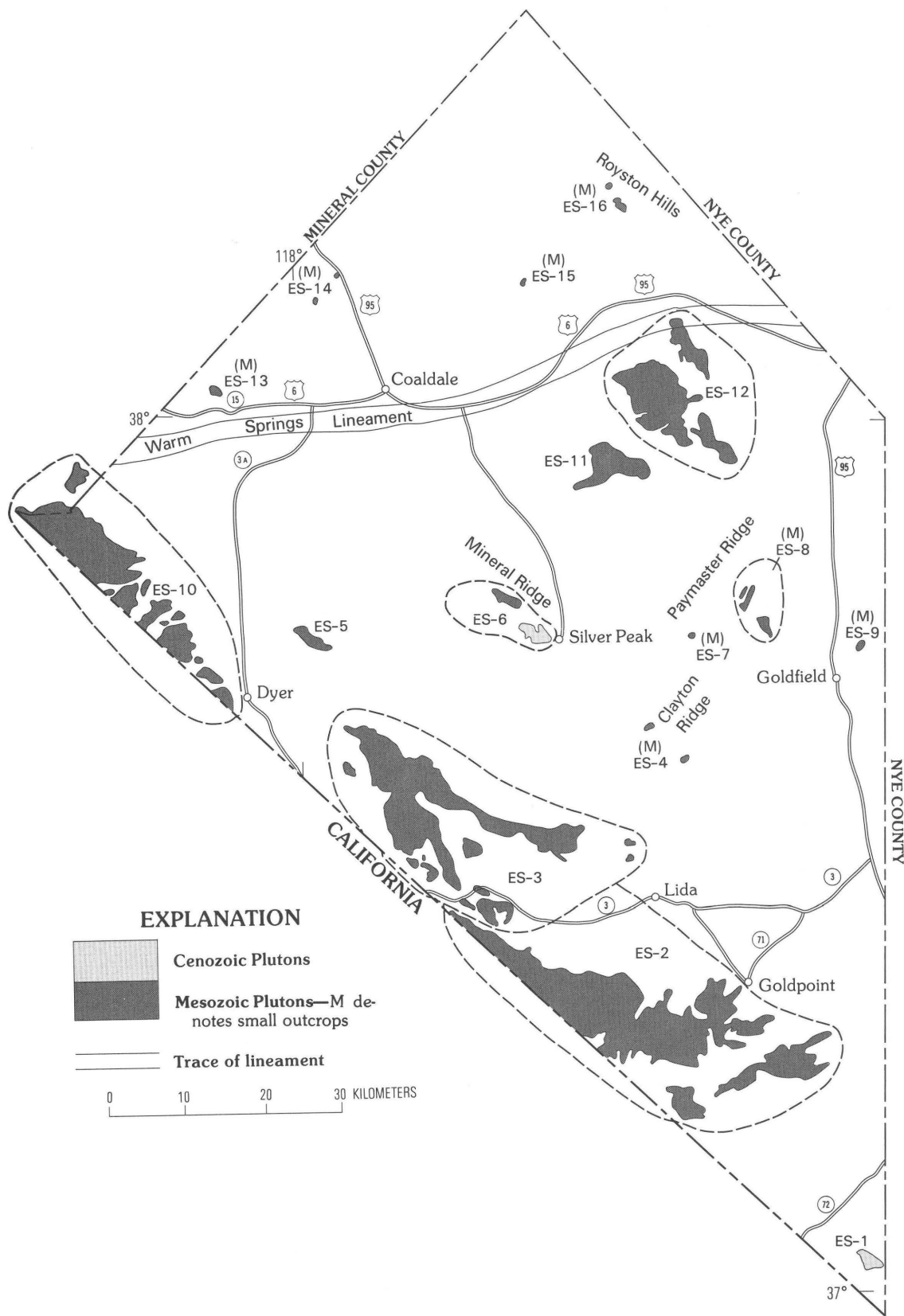


Figure 8. Locations of plutons in Esmeralda County.

Tertiary rocks include tuff, lava flows, volcanic breccia, and sedimentary rocks. The volcanic rocks range in composition from rhyolite to basalt and represent various periods of volcanic activity.

A zone approximately 482 km long and 80–161 km wide (Albers and Stewart, 1972) forms a transition between the northwest-trending Sierra Nevada block to the west and the north-northeast-trending ranges of the Great Basin province to the east. One of the major structures in the county is an orocline that is well developed in the Silver Peak-Palmetto-Montezuma Range (Albers, 1967). The arcuate shape, convex to the south, suggests drag caused by right-lateral shearing (Albers and Stewart, 1972). Oroclines are present in other parts of the county but are not as well developed. Right-lateral strike-slip faults are present in the county and include: (1) Death Valley-Furnace Creek fault zone, which has apparent right-lateral movement, with a separation of at least 29 km within the county (Albers and Stewart, 1972). (2) Soda Spring Valley fault, which is mainly in Mineral County but extends into Esmeralda County and has a separation of at least 13 km. (3) A fault in the Cedar Mountains that is considered to be part of a major fault zone, 805 km long, called the Walker Lane (Locke and others, 1940).

Thrust faults are very common in the pre-Tertiary rocks, where at least 50 percent of the contacts between pre-Tertiary rocks are thrusts (Albers and Stewart, 1972) that formed largely in conjunction with development of the oroclinal structures and the intrusion of the quartz-monzonite plutons. High-angle normal faults of pre-Tertiary and Tertiary age are very common and cut the older structures.

References: Albers, 1967; Albers and Stewart, 1972.

Plutons

ES-1. Grapevine Peak

Location: Northeast flank of Grapevine Peak.

Coordinates: lat 37°02' N., long 117°07' W.

Land classification: Public domain; 0.5 km from the north boundary of Death Valley National Monument.

Area: 4 km².

Accessibility: 6 km southeast of State Highway 72 and 14 km northeast of California State Highway 190.

Composition: Monzonite and diorite.

Age: Tertiary.

Rocks intruded: Nopah Formation (Cambrian—dolomite) and Pogonip Group (Ordovician—limestone).

Aeromagnetic expression:

Anomaly: High (high-amplitude, northern steep gradient).

Inferred source: Unknown; presumed to be plutonic rocks.

Mining activity: None.

Selected reference: Albers and Stewart, 1972.

ES-2. Sylvania

General location: The pluton occurs in the Sylvania Mountains, and extends southeastward to Slate Ridge and Gold Mountain.

Coordinates: lat 37°19' N., long 117°31' W.

Land classification: Predominantly public domain, private land in the Sylvania Mountains area, and patented mining claims in the Gold Mountain and Slate Ridge area.

Area: 244 km².

Accessibility: Approximately 2 km south of State Highway 3 to the northwest exposure of the pluton, approximately 1 km southwest of State Highway 71 to the northeast exposure of the pluton. Dirt roads common throughout the area.

Composition: Quartz monzonite.

Age: 149±6 and 153±5 Ma, K-Ar, biotite (Albers and Stewart, 1972)(Jurassic).

Rocks intruded: Wyman Formation (Precambrian—siltstone and limestone).

Aeromagnetic expression:

Anomaly: Low (high-amplitude, long-wavelength, northwestern trend) associated with western two-thirds of main exposed mass. High (low-amplitude, short-wavelength) associated with eastern third of main exposed mass. Highs (high-amplitude, elongate, east to northeast trend) associated with small plutonic rock masses to south.

Inferred sources: Positive anomalies form an elliptical ring that conforms approximately with the outcrop pattern of the two southern bodies and with the eastern third of the main body. The low is inferred to be caused by a northwest-trending belt of basalts that presumably has high-intensity, reversely polarized, total magnetization. The maximum areal extent of the inferred sources of highs is approximately the same as that of the exposed rocks.

Mining activity: Lead, silver, and gold have been mined.

Selected reference: Albers and Stewart, 1972.

ES-3. Palmetto

General location: Southern part of Silver Peak Range, western half of Palmetto Mountains.

Coordinates: lat 37°34' N., long 117°51' W.

Land classification: Predominantly public domain, private lands, and patented mining claims.

Area: 170 km².

Accessibility: Approximately 5 km east of State Highway 3A. State Highway 3 intersects the southern exposure of the pluton.

Composition: Quartz monzonite.

Age: 129±6 Ma, K-Ar, hornblende; and 188±7 Ma, K-Ar, biotite (Albers and Stewart, 1972) (Jurassic and Cretaceous).

Rocks intruded: Harkless Formation (Lower Cambrian—claystone and limestone), Emigrant Formation (Middle to Upper Cambrian—claystone and limestone), and Palmetto Formation (Ordovician—shale, chert, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: Highs (northwest-trending belt of highs).

Lows (low-amplitude). Highs (long-wavelength).

Inferred source: Belt of highs is associated with plutonic rocks; lows are associated with small exposures of basalt, presumably possessing reversed total magnetization; long-wavelength highs, west of the northwestern extremity of the main mass, and south of the southeastern extremity of the main mass, may reflect buried tracts of plutonic rocks having maximum areal extents of from 10 to 25 km².

Mining activity: Tungsten and gold have been mined within or very near the pluton.

Selected reference: Albers and Stewart, 1972.

ES-4. Clayton Ridge

General location: Two adjacent areas—southern Clayton Ridge and west flank of the Montezuma Range.

Coordinates: lat 37°39' N., long 117°28' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: 16 km southeast of State Highway 47.

Composition: Quartz monzonite.

Age: Jurassic.

Rocks intruded: Campito Formation (Precambrian and Cambrian—siltstone and quartzite).

Aeromagnetic expression:

Anomaly: High (low-amplitude flexure) associated with the northern exposure; high (high-amplitude) having a northern steep gradient, associated with the southern exposure.

Inferred source: A variety of intrusive and extrusive rocks.

Mining activity: Gold and silver have been mined approximately 8 km south of the quartz-monzonite intrusive.

Selected reference: Albers and Stewart, 1972.

ES-5. Dyer

General location: Northwest flank of the Silver Peak Range.

Coordinates: lat 37°45' N., long 118°00' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: Approximately 6 km east of State Highway 3A, and 0.5 km east of an improved surface road that connects with State Highway 3A.

Composition: Quartz monzonite.

Age: 147.0±5 Ma, K-Ar, biotite; 150.2±5 Ma, K-Ar, hornblende (Crowder and others, 1973) (Jurassic).

Rocks intruded: Harkless Formation (Lower Cambrian—claystone and limestone).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelengths having a nose associated with exposed rocks).

Inferred source: Unknown; maximum areal extent is about 100 km².

Mining activity: None.

Selected reference: Crowder and others, 1973.

ES-6. Mineral Ridge

General location: East-central part of Mineral Ridge.

Coordinates: lat 37°45' N., long 117°39' W.

Land classification: Public domain and patented mining claims.

Area: 7 km².

Accessibility: Approximately 2 km west of State Highway 47 and approximately 25 km south of U.S. Highways 6 and 95.

Composition: Quartz monzonite.

Age: 42±2 Ma, K-Ar, biotite; 51±2 Ma, K-Ar, hornblende (Albers and Stewart, 1972) (Tertiary). Parts of the pluton could be Mesozoic.

Rocks intruded: Wyman Formation (Precambrian—siltstone and limestone).

Aeromagnetic expression: None.

Mining activity: Lithium has been mined 1 km east of the intrusive.

Selected references: Albers, 1967; Albers and Stewart, 1972.

ES-7. Paymaster Ridge

General location: Pluton occurs between the Paymaster Ridge and Clayton Ridge.

Coordinates: lat 37°45' N., long 117°28' W.

Land classification: Public domain.

Area: Less than 1 km².

Accessibility: 16 km east of State Highway 47 and approximately 17 km west of U.S. Highway 95.

Composition: Quartz monzonite.

Age: Jurassic-Cretaceous.

Rocks intruded: Campito Formation, (Precambrian and Cambrian—siltstone and quartzite) and Poleta Formation (Cambrian—carbonates, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, north flank of anomaly).

Inferred source: A variety of intrusive and extrusive rocks.

Mining activity: None.

Selected reference: Albers and Stewart, 1972.

ES-8. Montezuma

General location: Exposures of the intrusive are located in the northwest flank of the Montezuma Range and the southern Paymaster Ridge.

Coordinates: lat 37°45' N., long 117°17' W.

Land classification: Predominantly public domain, some patented mining claims.

Area: 6 km².

Accessibility: 8 km west of U.S. Highway 95.

Composition: Quartz monzonite.

Age: Mesozoic.

Rocks intruded: Harkless (Lower Cambrian—claystone and limestone) and Palmetto (Ordovician—shale, chert, limestone, and quartzite) Formations.

Aeromagnetic expression:

Anomaly: Short-wavelength anomalies are largely attributable to basaltic rocks.

Inferred source: The granitic rocks have no magnetic signature.

Mining activity: None.

Selected reference: Albers and Stewart, 1972.

ES-9. Goldfield Hills

General location: Northwestern Goldfield Hills.

Coordinates: lat 37°44' N., long 117°08' W.

Land classification: Patented mining claims.

Area: 1 km².

Accessibility: 1 km east of U.S. Highway 95.

Composition: Quartz monzonite.

Age: 147±3 Ma, K-Ar, biotite; 170 Ma, fission-track, sphene (Ashley and Silberman, 1976) (Jurassic).

Rocks intruded: Overlain by Tertiary volcanic rocks.

Aeromagnetic expression:

Anomaly: High (high-amplitude) having a steep northwest flank associated with exposures of igneous rocks.

Inferred source: Ash-flow tuffs and related extrusive rocks.

Mining activity: None.

Selected reference: Ashley and Silberman, 1976.

ES-10. Inyo Batholith

General location: Northeast flank of the White Mountains.

Coordinates: lat 37°51' N., long 118°21' W.

Land classification: Inyo National Boundary Peak Forest.

Area: 103 km².

Accessibility: 18 km southeast of U.S. Highway 6 and 2 km west of State Highway 3A.

Composition: Quartz monzonite.

Age: 71, 75, and 78 Ma, K-Ar, biotite (Crowder and others, 1973); 157 Ma, K-Ar, biotite (Evernden and Kistler, 1970) (Jurassic and Cretaceous).

Rocks intruded: Wyman Formation (Precambrian—siltstone and limestone), Reed Dolomite (Precambrian), Harkless (Lower Cambrian—claystone and limestone), and Palmetto Formations (Ordovician—shale, chert, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: Highly complex mixture of highs and lows.

Inferred source: Much of the quartz-monzonite terrane is characterized by high-amplitude highs.

Mining activity: None.

Selected references: Crowder and others, 1973; Evernden and Kistler, 1970.

ES-11. Weepah

General location: Northwest Weepah Hills.

Coordinates: lat 37°56' N., long 117°30' W.

Land classification: Public domain.

Area: 22 km².

Accessibility: 10 km southeast of U.S. Highways 6 and 95.

Composition: Quartz monzonite.

Age: Cretaceous(?).

Rocks intruded: Wyman (Precambrian—siltstone and limestone) and Campito Formations (Precambrian and Cambrian—siltstone and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude) connected to the high associated with two exposures of the Lone Mountain pluton (ES-12).

Inferred source: Plutonic rocks having a maximum areal extent about the same as that of exposures.

Mining activity: None.

Selected reference: Albers and Stewart, 1972.

ES-12. Lone Mountain

General location: Lone Mountain

Coordinates: lat 38°01' N., long 117°26' W.

Land classification: Public domain and patented mining claims.

Area: 67 km².

Accessibility: 11 km south of U.S. Highways 6 and 95.

Composition: Quartz monzonite.

Age: 69±1.4 Ma, K-Ar, biotite (Silberman and others, 1975); 63.7 Ma, K-Ar biotite (Edwards and McLaughlin, 1972) (Cretaceous).

Rocks intruded: Wyman (Precambrian—siltstone and limestone), Campito (Precambrian and Cambrian—siltstone and quartzite), and Harkless (Lower Cambrian—claystone and limestone) Formations; Reed Dolomite (Precambrian); and Deep Spring Formation (Precambrian—marble, schist, and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, northwest-trending) associated with the large main mass and smaller southeast mass of the pluton. High (low-amplitude, isolated) associated with the north mass of plutonic rocks.

Inferred source: The anomaly data suggest that the main mass and southeast mass of the Lone Mountain pluton are connected in the subsurface with the Weepah pluton (ES-11). The north mass apparently occurs as an isolated exposure.

Mining activity: None.

Selected references: Albers and Stewart, 1972; Bonham and Garside, 1979; Edwards and McLaughlin, 1972; Silberman and others, 1975.

ES-13. Miller Mountain

General location: Southeast flank of Miller Mountain.

Coordinates: lat 38°01' N., long 118°09' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: 2 km north of U.S. Highway 6 and approximately 11 km east of State Highway 10 (not shown on fig. 8).

Composition: Quartz monzonite.

Age: Cretaceous(?).

Rocks intruded: Campito Formation (Precambrian and Cambrian—siltstone and quartzite).

Aeromagnetic expression:

Anomaly: High (low-amplitude) at the north margin of a crescent-shaped low.

Inferred source: Exposed rocks.

Mining activity: Diatomite has been mined, located 2 km south of the intrusive.

Selected reference: Albers and Stewart, 1972.

ES-14. Candelaria Hills

General location: Southeast flank of the Candelaria Hills.

Coordinates: Two outcrops: lat 38°08' N., long 117°58' W.; lat 38°09' N., long 117°57' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: One outcrop is approximately 5 km southwest of U.S. Highway 95; the other is intersected by U.S. Highway 95.

Composition: Quartz monzonite.

Age: 78 Ma, K-Ar, muscovite (Carlson and others, 1975) (Cretaceous).

Rocks intruded: Palmetto Formation (Ordovician—shale, chert, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength) having a northwest-trending nose, the north and southwest flanks of which are associated with two small exposures.

Inferred source: Unknown buried magnetic rock and andesitic tuffs and flows and associated extrusive rocks.

Mining activity: None.

Selected reference: Carlson and others, 1975.

ES-15. Monte Cristo

General location: Northeastern Monte Cristo Range.

Coordinates: lat 38°09' N., long 117°39' W.

Land classification: Public domain.

Area: Less than 1 km².

Accessibility: 9 km northwest of U.S. Highways 6 and 95.

Composition: Quartz monzonite.

Age: 194 Ma, K-Ar, sericite (Carlson and others, 1975) (Jurassic).

Rocks intruded: Palmetto Formation (Ordovician—shale, chert, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength).

Inferred source: Andesitic extrusive rocks.

Mining activity: None.

Selected reference: Carlson and others, 1975.

ES-16. Southern Royston Hills

General location: South Royston Hills.

Coordinates: lat 38°15' N., long 117°31' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: 12 km north of U.S. Highways 6 and 95.

Composition: Quartz monzonite.

Age: 202 ± 3 Ma, K-Ar, hornblende (Speed and Armstrong, 1971) (Jurassic).

Rocks intruded: Excelsior Formation (Middle Triassic (?))—greenstone, breccia, and tuffaceous sandstone).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength) having a gentle east gradient associated with the small exposures.

Inferred source: Extrusive rocks.

Mining activity: None.

Selected reference: Speed and Armstrong, 1971.

MINERAL COUNTY

Geology

Mineral County (fig. 9) is located along the west margin of the Basin and Range province. Most of the ranges in the county do not display the north to northeast trend characteristic of areas to the east. This discordance can be attributed to influences such as the northwest-trending Sierra Nevada batholith, immediately to the west, and structural features associated with the Walker Lane fault zone (Neilsen, 1965).

The Walker Lane, trending northwest through the county, is a zone of deformation that includes extensive right-lateral strike-slip faults and low-angle normal faults. Deformation probably commenced in Early Jurassic time and has continued through the Cenozoic. A zone of high seismic activity, commonly referred to as the Nevada seismic zone (Gumper and Scholz, 1971), extends north through the county. Two of the earthquakes associated with this zone are the Cedar Mountains earthquake of 1932 and the Excelsior Mountains earthquake of 1934.

Most of the ranges and hills within the county contain exposures of granitic rock. The granitic masses range in size from dikes and small stocks to batholiths, such as the Wassuk Range; they consist mainly of quartz monzonite but range in composition from diorite to granite. The close similarity of textural and compositional characteristics of these granitic masses with those in the Sierra Nevada suggest a satellitic association with the Sierra Nevada batholith.

Most of the granitic bodies intrude sedimentary and volcanic assemblages of Mesozoic age. Many of the intrusions appear to have been along zones of weakness associated with folding, thrusting, and lateral faulting during Mesozoic time.

The overabundance of small isolated outcrops of intrusive rocks throughout the area makes compilation on an individual basis impractical. Therefore, exposures have been grouped into distinct geographic areas, predominantly mountain ranges and hills (fig. 9).

Some of the geologic data were summarized from Ekren and others (1980).

Plutons

M-1. Wassuk Range

General location: North-northwest-trending range along the west border of Mineral County.

Coordinates: lat $38^{\circ}35'$ N., long $118^{\circ}48'$ W.

Land classification: Northern exposures—Walker River Indian Reservation.

Central exposures—Hawthorne Naval Ammunition Depot.

Southern exposures—Private land and Toiyabe National Forest.

Area: 570 km^2 .

Accessibility: U.S. Highway 95 passes along the north end of the east flank of the Wassuk Range. A few unimproved roads penetrate the range and intersect State Highway 31 that continues south along the east flank. Light-duty all-weather State Highway 3C passes along the west flank in Lyon County.

Composition: Quartz monzonite, granodiorite, and granite.

Age: 75 Ma, K-Ar, biotite-hornblende (Evernden and Kistler, 1970); 78 Ma, K-Ar, biotite; 80 Ma, K-Ar biotite; 117 Ma, K-Ar, hornblende; 135 Ma, K-Ar, hornblende (Carlson and others, 1975); 144 Ma, K-Ar, hornblende (Bingler and others, 1980) (Jurassic and Cretaceous).

Rocks intruded: Excelsior Formation (Middle Triassic (?))—greenstone, breccia, and tuffaceous sandstone).

Aeromagnetic expression:

Anomaly: Low (high-amplitude, long-wavelength, northwest-trending) associated with northern exposures of plutonic rocks and basalt. Dipole anomalies are associated with central exposures. Highs and a low are associated with southern exposures.

Inferred source: Plutonic rocks that may exhibit strong internal contrasts of magnetization; basalt.

Mining activity: Gold and silver have been mined southwest of Mount Grant and west of Bald Mountain.

Selected references: Evernden and Kistler, 1970; Carlson and others, 1975; Bingler and others, 1980.

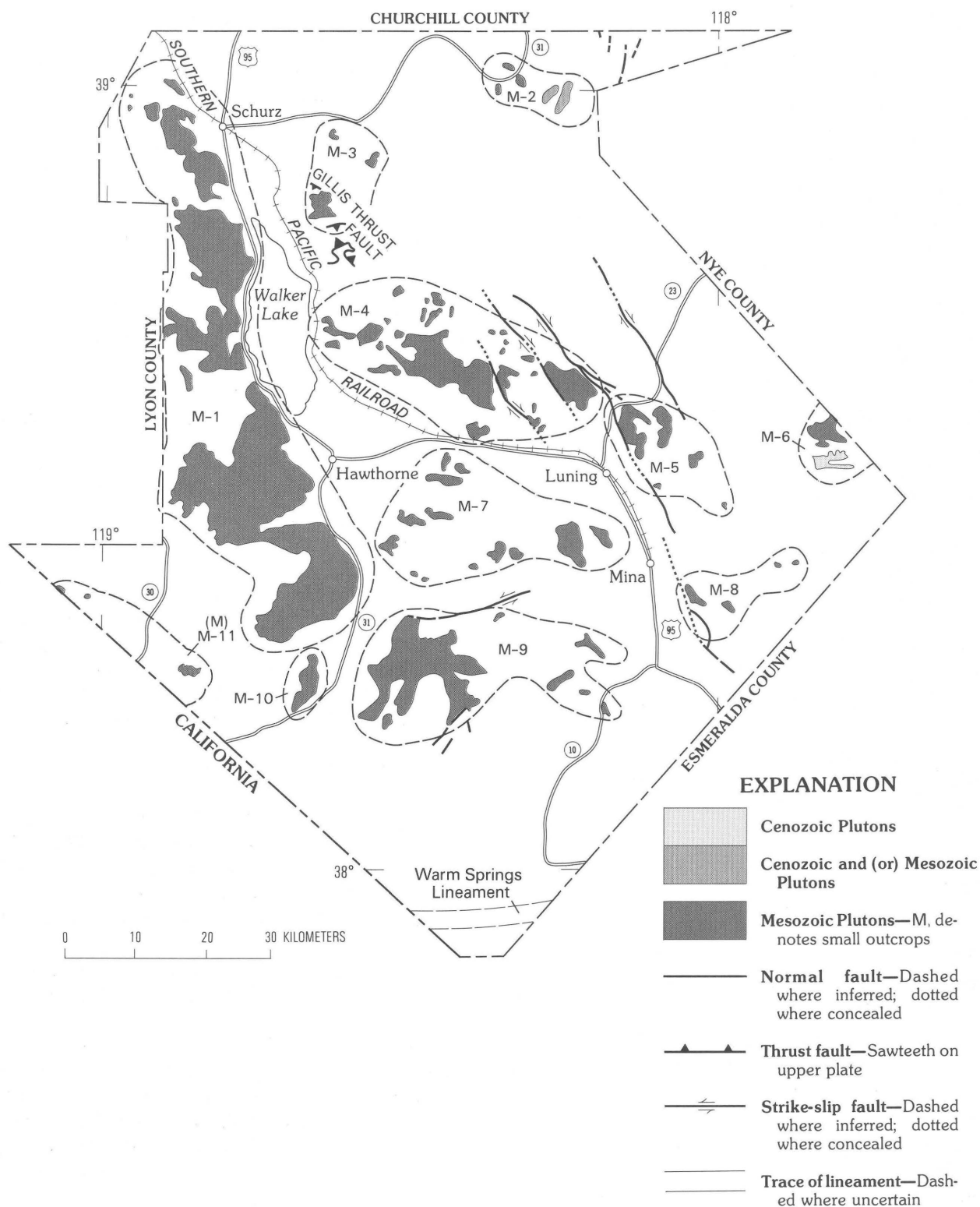


Figure 9. Locations of plutons in Mineral County.

M-2. Rawhide-Eagleville District

General location: Northeastern part of county.

Coordinates: lat 39°00' N., long 118°18' W.

Land classification: Public domain.

Area: 13 km².

Accessibility: State Highway 31 crosses over one of the outcrops and terminates. A light-duty road extends westward from outcrop and intersects U.S. Highway 95.

Composition: Quartz monzonite.

Age: Cretaceous-Tertiary.

Rocks intruded: Excelsior Formation (Middle Triassic(?)—greenstone, breccia, and tuffaceous sandstone).

Aeromagnetic expression:

Anomaly: High (long-wavelength plateau).

Inferred source: Plutonic rocks having a maximum areal extent of about 25 km².

Mining activity: Tungsten has been mined within the area.

Selected references: Ross, 1961; Schilling, 1965.

M-3. Northern Gillis Range

General location: Northeast of Walker Lake.

Coordinates: lat 38°53' N., long 118°36' W.

Land classification: Walker River Indian Reservation.

Area: 12 km².

Accessibility: U.S. Highway 95 and the Southern Pacific Railroad parallel the west flank of the Gillis Range and are, respectively, 10 km and 5 km from the nearest exposure. A light-duty, all-weather road is 2 km north of the north exposures.

Composition: Granite.

Age: Cretaceous(?).

Rocks intruded: Excelsior (Middle Triassic(?)—greenstone, breccia, and tuffaceous sandstone) and Luning (Upper Triassic—limestone, dolomite, conglomerate, and shale) Formations.

Aeromagnetic expression:

Anomaly: High (west-trending) having a north flank associated with the main exposed mass. High (long-wavelength) having a west flank associated with the north exposure.

Inferred source: Extrusive rocks.

Mining activity: None.

Selected reference: Ross, 1961.

M-4. Southern Gillis Range

General location: Northeast of Hawthorne and east of Walker Lake.

Coordinates: lat 38°39' N., long 118°25' W.

Land classification: Public domain, except for a few local patented mining claims.

Area: 135 km².

Accessibility: U.S. Highway 95 and the Southern Pacific Railroad pass along the west flank of the Gillis Range and State Highway 23 extends along the east margin of the range, intersecting U.S. Highway 95 at Luning.

Composition: Granite.

Age: 89 Ma, K-Ar, hornblende; 90 Ma, K-Ar, hornblende; and 94 Ma, K-Ar, biotite (Evernden and Kistler, 1970) (Cretaceous).

Rocks intruded: Excelsior (Middle Triassic(?)—greenstone, breccia, and tuffaceous sandstone) and Luning (Upper Triassic—limestone, dolomite, conglomerate, and shale) Formations.

Aeromagnetic expression:

Anomaly: None associated with main exposure. Highs (short-wavelength) associated with southeastern extremity of main mass.

Inferred source: Extrusive rocks.

Mining activity: Silver has been mined along the east flank of the range and gold and silver mined along the southwest flank, midway between Hawthorne and Luning.

Selected references: Ferguson and Muller, 1949; Evernden and Kistler, 1970.

M-5. Southern Gabbs Valley Range

General location: Northeast of Luning in east part of county.

Coordinates: lat 38°32' N., long 118°06' W.

Land classification: Public domain and several patented mining claims.

Area: 30 km².

Accessibility: U.S. Highway 95 and Southern Pacific Railroad parallel the Gabbs Valley Range on the west side, and State Highway 23 provides easy access to the northern exposures.

Composition: Quartz monzonite, granodiorite, and diorite.

Age: Cretaceous(?).

Rocks intruded: Luning (Upper Triassic—limestone, dolomite, conglomerate, and shale), Gabbs (Triassic—limestone, dolomite, and siltstone), and Sunrise (Jurassic—limestone, dolomite, and siltstone) Formations.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude) associated with plutonic rocks.

Inferred source: Plutonic rock inferred to extend continuously in the subsurface from northwestern to southeastern exposures. Maximum areal extent is about 15 km².

Mining activity: None.

Selected reference: Ross, 1961.

M-6. Cedar Mountain

General location: Near the east corner of county.

Coordinates: lat 38°32' N., long 117°49' W.

Land classification: Public domain.

Area: 21 km².

Accessibility: U.S. Highway 95 is 28 km southwest of the outcrops. Unimproved mining roads intersect Highway 95 at Mina and extend into the area. State Highway 89 (Nye County) passes 6 km northeast of the outcrop, along the east flank of Cedar Mountain.

Composition: Granodiorite and quartz monzonite.

Age: 40±10 Ma, lead-alpha, zircon (Schilling, 1965; Marvin and Dobson, 1979) (Tertiary). Parts of the pluton could be Mesozoic.

Rocks intruded: Luning Formation (Upper Triassic—limestone, dolomite, conglomerate, and shale).

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Granitic rocks.

Mining activity: None.

Selected references: Ferguson and Muller, 1949; Gianella and Callaghan, 1934; Knopf, 1921; Schilling, 1965; Marvin and Dobson, 1979.

M-7. Garfield Hills

General location: Southeast of Hawthorne and north of the Excelsior Mountains.

Coordinates: lat 38°28' N., long 118°21' W.

Land classification: Predominantly public domain. Numerous patented mining claims are scattered throughout the area.

Area: 44 km².

Accessibility: U.S. Highway 95 and the Southern Pacific Railroad pass along the east and north flanks of the hills, and State Highway 31 is near the west boundary of the hills.

Composition: Quartz monzonite, granodiorite, granite, and diorite.

Age: Cretaceous(?).

Rocks intruded: Excelsior (Middle Triassic(?)—greenstone, breccia, and tuffaceous sandstone), Luning (Upper Triassic—limestone, dolomite, conglomerate, and shale), Gabbs (Triassic—limestone, dolomite, and siltstone), and Sunrise (Jurassic—limestone, dolomite, and siltstone) Formations.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Two easternmost bodies of plutonic rocks. Anomalies farther west are associated with basalt.

Mining activity: None.

Selected references: Ferguson and Muller, 1949; Ferguson and others, 1954.

M-8. Pilot Mountains

General location: Southeast of Mina.

Coordinates: lat 38°20' N., long 118°00' W.

Land classification: Public domain.

Area: 8 km².

Accessibility: U.S. Highway 95 passes 6 km west of the outcrops.

Composition: Granodiorite.

Age: 68.7±1.8 Ma, K-Ar, biotite (Schilling, 1965) (Cretaceous).

Rocks intruded: Excelsior (Middle Triassic(?)—greenstone, breccia, and tuffaceous sandstone) and Luning (Upper Triassic—limestone, dolomite, conglomerate, and shale) Formations.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Plutonic rocks; the two principal sources of anomalies have areal extents of about 10 km² and about 15 km², respectively.

Mining activity: None.

Selected references: Ferguson and Muller, 1949; Phoenix and Cathcart, 1952; Schilling, 1965.

M-9. Excelsior Mountains

General location: Southeast of Hawthorne and west of the Pilot Mountains.

Coordinates: lat 38°16' N., long 118°29' W.

Land classification: The western half of the main granitic mass is located within Toiyabe National Forest. The eastern outcrops are within public domain.

Area: 123 km².

Accessibility: State Highway 31 borders the northwest edge of the Excelsior Mountains. U.S. Highway 95 and state Highway 10 pass east and southeast of the Excelsior Mountains, respectively.

Composition: Quartz monzonite and granodiorite.

Age: 86 Ma, K-Ar, biotite; 101 Ma, K-Ar, hornblende; 102 Ma, K-Ar, hornblende (Evernden and Kistler, 1970); 92 Ma, K-Ar, biotite (Marvin and Cole, 1978) (Cretaceous).

Rocks intruded: Excelsior (Middle Triassic—limestone, dolomite, conglomerate, and shale) and Dunlap (Jurassic—sandstone, conglomerate, limestone, and greenstone) Formations.

Aeromagnetic expression:

Anomaly: Grouping of short-wavelength, high-amplitude highs and lows.

Inferred Source: Plutonic rocks with areal extent of 5 km².

Mining activity: Tungsten has been mined along the northwest flank of the Excelsior Mountains.

Selected references: Callaghan and Gianella, 1935; Ferguson and others, 1954; Marvin and Cole, 1978; Evernden and Kistler, 1970.

M-10. Anchorite Hills

General location: South of the Wassuk Range.

Coordinates: lat 38°15' N., long 118°40' W.

Land classification: Toiyabe National Forest.

Area: 13 km².

Accessibility: State Highway 31 passes along the east edge of the outcrop.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous(?).

Rocks intruded: Overlain by Tertiary volcanic rocks.

Aeromagnetic expression: None associated with granitic rocks.

Mining activity: None.

Selected reference: Ross, 1961.

M-11. Aurora Mining District

General location: Southwest of Wassuk Range, near the Nevada-California State line (includes two outcrops northwest of district).

Coordinates: lat 38°16' N., long 118°52' W.

Land classification: Public domain, private land, and Toiyabe National Forest.

Area: 6 km².

Accessibility: State Highway 31 passes 11 km southeast of the outcrops. Light-duty Highway 3C is 9 km northwest of the south exposures and 10 km southeast of the northern exposures.

Composition: Granite.

Age: Cretaceous(?).

Rocks intruded: Excelsior Formation (Middle Triassic (?)—greenstone, breccia, and tuffaceous sandstone).

Aeromagnetic expression:

Anomaly: High (flexure).

Inferred source: Plutonic rocks.

Mining activity: None.

Selected reference: Ross, 1961.

LYON COUNTY

Geology

Lyon County (fig. 10) is located in western Nevada, within the western Great Basin. The county lies on the east border of the Cretaceous Sierra Nevada batholith. The western part of the county is a gradational physiographic and structural transition between the Sierra Nevada and the Basin and Range province.

The granitic bodies in the county are considered to be the eastern continuation of the Sierra Nevada batholith (Moore, 1969), with pre-Cretaceous rocks present as roof pendants on the batholith. The pre-Cretaceous rocks consist of metamorphosed volcanic rocks and minor, reworked, volcanic rocks of Triassic and Jurassic age. The granitic bodies are overlain unconformably by Tertiary volcanic rocks and, to a lesser extent, by basalt flows of Tertiary and Quaternary age.

Deformation occurred during two periods: one preceding and accompanying the emplacement of the Cretaceous granitic rocks, and another in late Tertiary and Quaternary time that caused normal faulting, warping, and tilting (Moore, 1969). The major structural feature in the area is the Walker Lane fault zone, located in the extreme north-northeastern part of the county. The geologic data were summarized from Moore (1969).

Plutons

L-1. Round Mountain

General location: Southwestern part of the Pine Grove Hills.

Coordinates: lat 38°30' N., long 119°10' W.

Land classification: Toiyabe National Forest.

Area: 12 km².

Accessibility: State Highway 22 is just west of the pluton.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic metavolcanic rocks.

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Moore, 1969.

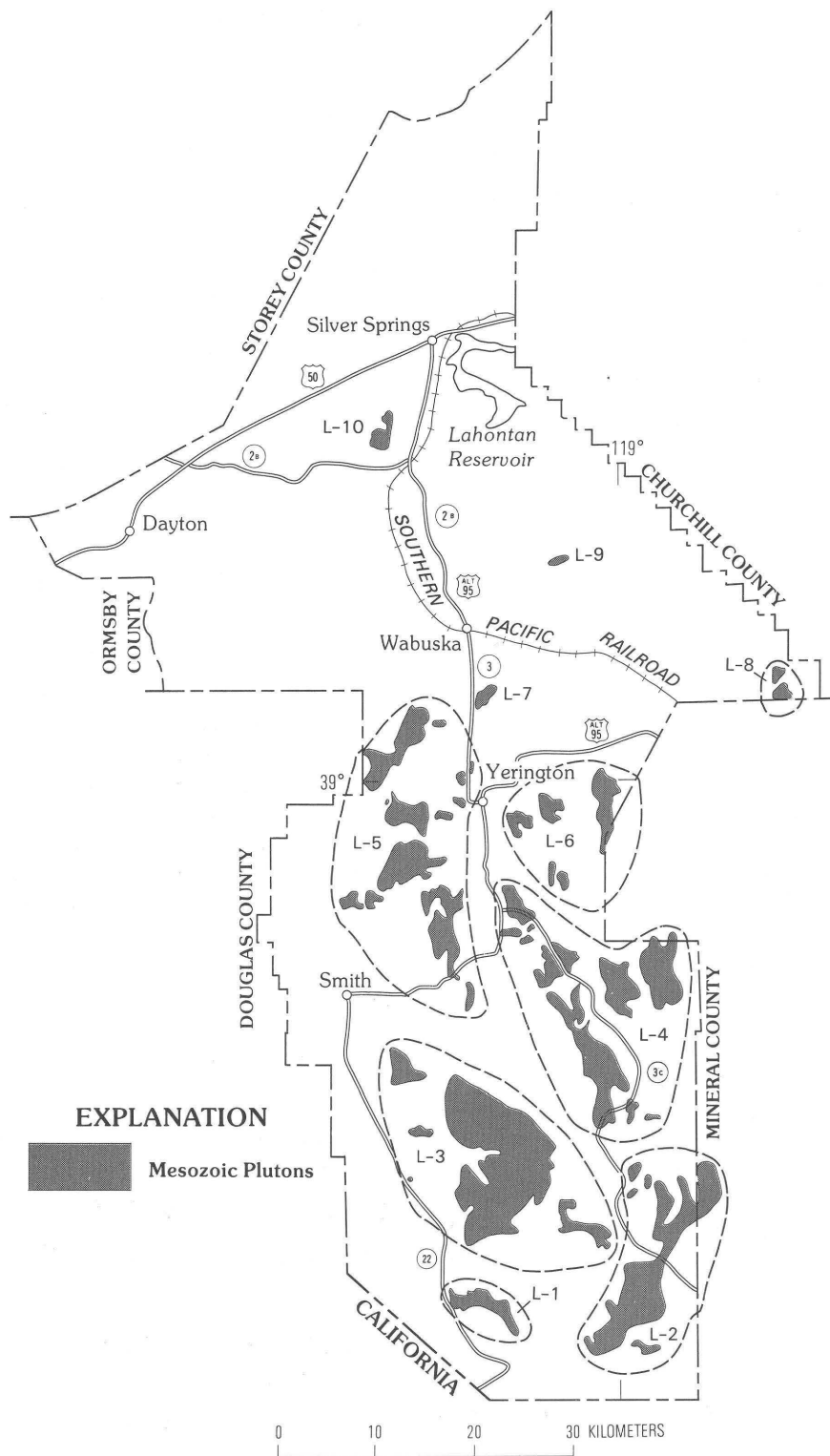


Figure 10. Locations of plutons in Lyon County.

L-2. East Walker River

General location: Southernmost Pine Grove Hills, southeastern part of the county.

Coordinates: lat 38°33' N., long 118°57' W.

Land classification: Public domain, private land, and national forest.

Area: 64 km².

Accessibility: State Highway 3C intersects pluton.

Composition: Quartz monzonite and granodiorite.
Age: Cretaceous.
Rocks intruded: Triassic and Jurassic metavolcanic rocks.
Aeromagnetic expression: None, or very little.
Mining activity: Gold and silver have been mined.
Selected reference: Moore, 1969.

L-3. Pine Grove Hills

General location: Central and southern part of the Pine Grove Hills.
Coordinates: lat 38°39' N., long 119°07' W.
Land classification: Toiyabe National Forest, patented mining claims, and public domain.
Area: 147 km².
Accessibility: Main outcrop is 2 km east of State Highway 22 and 5 km west of State Highway 3C.
Composition: Quartz monzonite and granodiorite.
Age: 87.0±2.7 and 90.0±2.7 Ma, K-Ar, biotite (Krueger and Schilling, 1971) (Cretaceous).
Rocks intruded: Triassic and Jurassic metasedimentary rocks.
Aeromagnetic expression:
Anomaly: Highs and lows.
Inferred source: Pluton having complex distribution of magnetization.
Mining activity: None.
Selected reference: Krueger and Schilling, 1971.

L-4. Wilson District

General location: Eastern part of the county near the East Walker River.
Coordinates: lat 38°46' N., long 119°03' W.
Land classification: Private land and public domain.
Area: 90 km².
Accessibility: State Highway 3C intersects exposures of the pluton.
Composition: Quartz monzonite and granodiorite.
Age: Cretaceous.
Rocks intruded: Triassic and Jurassic metavolcanic rocks.
Aeromagnetic expression:
Anomaly: Highs (low-amplitude).
Inferred source: Unknown.
Mining activity: None.
Selected references: Moore, 1969.

L-5. Singatse Range

General location: Outcrops occur all along the Singatse Range, west-central part of county.
Coordinates: lat 38°55' N., long 119°15' W.

Land classification: Public domain, patented mining claims, private land, and Bureau of Reclamation withdrawals.

Area: 84 km².

Accessibility: The central part of the outcrop is 4 km west of State Highway 3; State Highway 3 intersects part of the pluton to the south. The northernmost outcrop is 4 km west of U.S. Highway 95 Alternate.

Composition: Granite, quartz monzonite, and granodiorite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic metasedimentary rocks.

Aeromagnetic expression:

Anomaly: Highs (low-amplitude, long-wavelength).

Inferred source: Weakly magnetized plutonic rocks.

Mining activity: Copper has been mined at the Yerington open pit.

Selected reference: Moore, 1969.

L-6. Yerington

General location: Luth Hill and other unnamed hills east and southeast of Yerington and west of Wassuk Range.

Coordinates: lat 38°59' N., long 119°05' W.

Land classification: Public domain, patented mining claims, and private land.

Area: 19 km².

Accessibility: Westernmost outcrop is 2 km east of State Highway 3; easternmost outcrop is 10 km southwest of the Southern Pacific Railroad.

Composition: Granite, quartz monzonite, granodiorite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic metavolcanic and metasedimentary rocks.

Aeromagnetic expression:

Anomaly: High (short-wavelength).

Inferred source: Easternmost exposure of plutonic rocks.

Mining activity: None.

Selected reference: Moore, 1969.

L-7. Mason Butte

General location: Mason Butte, northeast of the Singatse Range.

Coordinates: lat 39°05' N., long 119°09' W.

Land classification: Private land.

Area: 1 km².

Accessibility: 1 km east of State Highway 3 and 5 km southwest of the Southern Pacific Railroad.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous.

Rocks intruded: Bounded by alluvium.

Aeromagnetic expression:

Anomaly: High (long-wavelength); northwestern part is associated with the plutonic rock exposure.

Inferred source: Unknown.

Mining activity: None.

Selected reference: Moore, 1969.

L-8. Long Valley

General location: Southeast flank of the Desert Mountains.

Coordinates: lat 39°05' N., long 118°48' W.

Land classification: Walker River Indian Reservation.

Area: 4 km².

Accessibility: 10 km northeast of State Highway 3 (U.S. Highway 95 Alt.) and 1 km west of U.S. Highway 95.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous.

Rocks intruded: Overlain by Tertiary andesitic and rhyolitic volcanic rocks.

Aeromagnetic expression:

Anomaly: High (high-amplitude, northwest-trending, elongate, southeast flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 25 km².

Mining activity: None.

Selected reference: Moore, 1969.

L-9. Desert Mountains

General location: South flank of the Desert Mountains.

Coordinates: lat 39°13' N., long 119°03' W.

Land classification: Public domain.

Area: Less than 1 km².

Accessibility: 11 km east of State Highway 2B (U.S. Highway 95 Alternate) and 9 km north of the Southern Pacific Railroad.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic metavolcanic rocks.

Aeromagnetic expression:

Anomaly: High (low-amplitude, oval).

Inferred source: Plutonic rocks having a maximum areal extent of 1 km² (buried part).

Mining activity: None.

Selected reference: Moore, 1969.

L-10. Churchill Butte

General location: Churchill Butte, southwest of the Lahontan Reservoir.

Coordinates: lat 39°20' N., long 119°16' W.

Land classification: Public domain.

Area: 3 km².

Accessibility: 2 km north of State Highway 2B and 4 km south of U.S. Highway 50.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic metasedimentary rocks.

Aeromagnetic expression:

Anomaly: Low (long-wavelength).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Moore, 1969.

CHURCHILL COUNTY

Geology

Churchill County (fig. 11), in west-central Nevada, can be divided into two topographic areas. The western half of the county is dominated by relatively low relief, encompasses the Carson Sink, and is underlain by Pleistocene sediments of Lake Lahontan. The eastern part is marked by northeast-trending mountain ranges separated by intervening graben valleys or low east-west divides.

The county is characterized on the east by Paleozoic rocks and on the west by Mesozoic rocks. The Paleozoic assemblage consists of chert, greenstone, and clastic and volcanic rocks exposed mainly along the east border of the county. Pre-Tertiary rocks exposed in the county, with the exception of granitic plutons, are largely Middle Triassic to Middle Jurassic in age. The Mesozoic sedimentary units consist chiefly of a shallow-water facies of conglomerate, sandstone, shale, limestone, and dolomite and an offshore facies of dolomite, limestone, and subordinate clastic rocks. At several places these rocks are metamorphosed; the degree of metamorphism usually depends on the proximity to intrusive rock masses.

Most of the granitic rocks found within the county have been assigned a Cretaceous(?) age. The only pluton assigned a Tertiary age is exposed on the east side of the Stillwater Range. The granitic intrusives are chiefly granodiorite and quartz monzonite in composition.

Historic faults in western Nevada, north of Walker Lake, occur within a well-defined, north-trending, arcuate, linear zone known as the "Churchill arc" (Shawe, 1965). Many of these faults occur along the margins of the large grabens forming Dixie and Pleasant Valleys (in Pershing County) and their northern extensions. Faults within the arc change from predominantly strike slip at the south end (near the Walker Lane fault zone) to mainly dip slip at the north end (near the north county

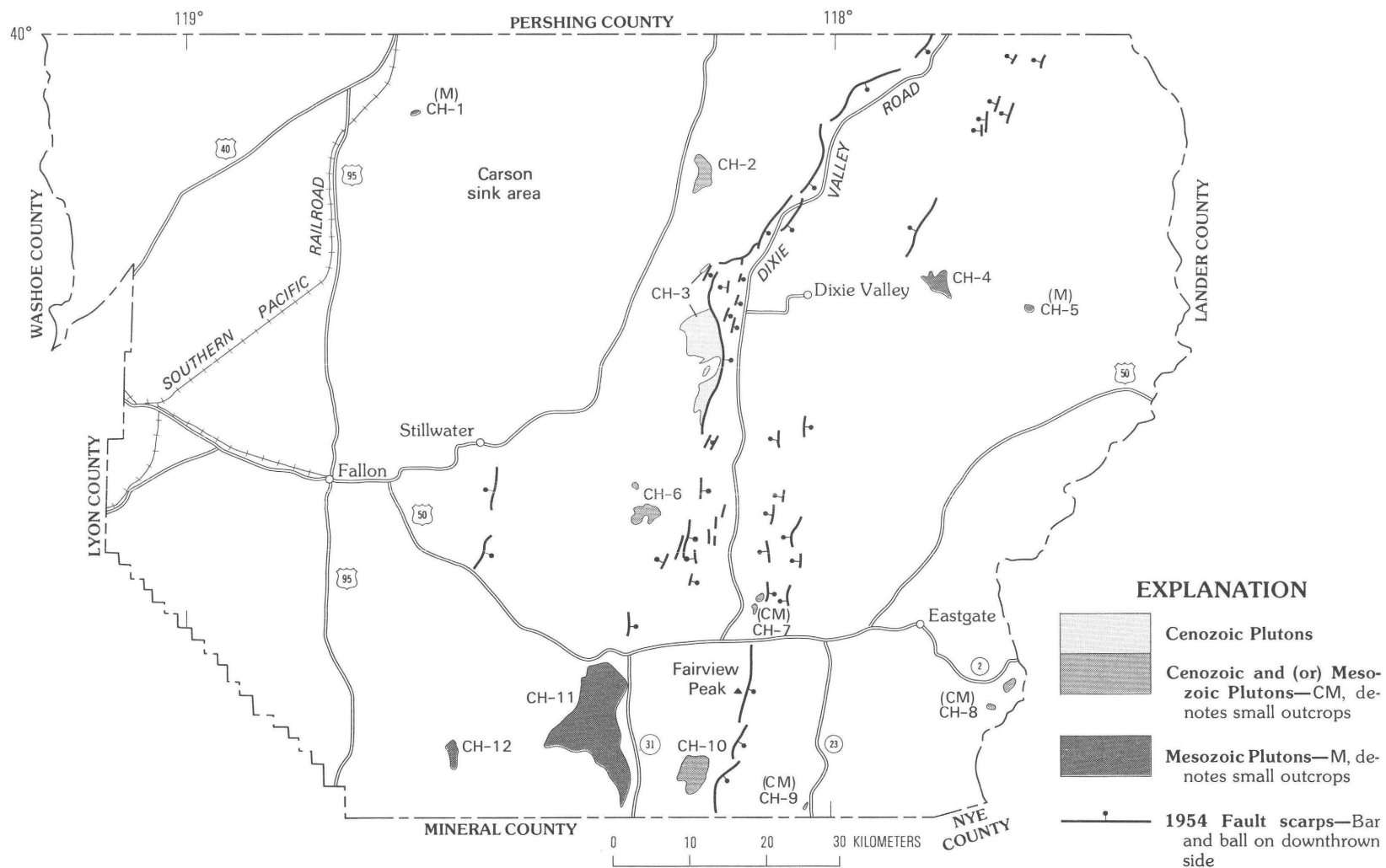


Figure 11. Locations of plutons in Churchill County.

line). In 1954, several earthquakes occurred within the county that resulted in considerable damage to manmade structures in the Fallon area. Fault scarps are still present near Stillwater and in the Dixie Valley—Fairview Peak area. Central Churchill County also is within a major narrow zone of high seismicity and recent faulting, which extends from Owens Valley (in California) to Winnemucca (in Humboldt County), termed the Nevada seismic zone (Gumper and Scholz, 1971).

Much of the geologic information in this compilation has been synthesized from Willden and Speed (1974).

Plutons

CH-1. Topog Peak

General location: Southwestern part of West Humboldt Range in northwestern part of county.

Coordinates: lat 39°54' N., long 118°39' W.

Land classification: Private land and Bureau of Reclamation withdrawals of public domain.

Area: Less than 1 km².

Accessibility: The Southern Pacific Railroad and U.S. Highway 95 are 6 km and 9 km, respectively, west of the outcrop. U.S. Highway 40 intersects U.S. Highway 95 northwest of the area.

Composition: Quartz monzonite and granodiorite.

Age: 75.9±1.5 Ma, K-Ar, biotite (Speed and Armstrong, 1971) (Cretaceous).

Rocks intruded: Jurassic siltstone and limestone.

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Speed and Armstrong, 1971.

CH-2. White Cloud Canyon

General location: West flank of the Stillwater Range in northern part of county.

Coordinates: lat 39°50' N., long 118°12' W.

Land classification: Public domain and patented mining claims.

Area: 8 km².

Accessibility: A gravel road flanks the west side of the Stillwater Range, passes 2 km west of the outcrop, and joins a paved road at the town of Stillwater, 44 km southwest of the exposure.

Composition: Granite.

Age: Jurassic-Tertiary.

Rocks intruded: Triassic limestone and shale.

Aeromagnetic expression: None.

Mining activity: Gold, silver, and tungsten have been mined within the contact metamorphic aureole surrounding the pluton; the area is known as the White Cloud mining district.

Selected reference: Willden and Speed, 1974.

CH-3. I x I Canyon

General location: East flank of the Stillwater Range.

Coordinates: lat 39°38' N., long 118°13' W.

Land classification: Public domain.

Area: 41 km².

Accessibility: A gravel road, intersecting U.S. Highway 50, 29 km south of the main exposure, extends along the west side of Dixie Valley and passes 2 km east of the intrusive body.

Composition: Quartz monzonite.

Age: 28±2 Ma, K-Ar, biotite (Speed and Armstrong, 1971a) (Tertiary).

Rocks intruded: Triassic shale and siltstone and Tertiary volcanic rocks.

Aeromagnetic expression:

Anomaly: High (high-amplitude, north-trending, north and east flanks).

Inferred source: Plutonic rocks having a maximum areal extent of about 25 km².

Mining activity: None.

Selected reference: Speed and Armstrong, 1971.

CH-4. Meadow Springs

General location: West flank of the Clan Alpine Mountains in the northern half of the county.

Coordinates: lat 39°42' N., long 117°51' W.

Land classification: Public domain.

Area: 6 km².

Accessibility: The nearest maintained road in the vicinity of the intrusive is the gravel road extending along the west side of Dixie Valley, 23 km west of the exposure.

Composition: Granodiorite and quartz monzonite.

Age: 103±2 Ma, K-Ar, biotite (Speed and Armstrong, 1971) (Cretaceous).

Rocks intruded: Triassic siltstone and sandstone.

Aeromagnetic expression:

Anomaly: High (high-amplitude, elongate, northern flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 75 km².

Mining activity: Antimony has been mined several kilometers north of the outcrop.

Selected reference: Speed and Armstrong, 1971.

CH-5. Tungsten Mountain

General location: East flank of the Clan Alpine Mountains.

Coordinates: lat 39°41' N., long 117°43' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: U.S. Highway 50 passes along the east side of Edwards Creek Valley, 14 km southeast of the outcrop.

Composition: Granodiorite.

Age: 87.4±2 Ma, K-Ar, biotite (Speed and Armstrong, 1971) (Cretaceous).

Rocks intruded: Triassic siltstone, mudstone, limestone, and conglomerate.

Aeromagnetic expression: None.

Mining activity: Scheelite has been mined along the contact between granodiorite and Upper Triassic rocks.

Selected reference: Speed and Armstrong, 1971.

CH-6. Mountain Wells Mining District

General location: Southern part of the Stillwater Range.

Coordinates: lat 39°27' N., long 118°18' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: The main outcrop 10 km west of the Dixie Valley improved road and 17.5 km north of U.S. Highway 50.

Composition: Granodiorite.

Age: Jurassic-Tertiary.

Rocks intruded: Triassic shale, sandstone, siltstone, and dolomite.

Aeromagnetic expression:

Anomaly: High (short-wavelength, oval).

Inferred source: Subsurface extension of southern exposure, having a maximum areal extent of about 5 km².

Mining activity: None.

Selected reference: Willden and Speed, 1974.

CH-7. Chalk Mountain

General location: Southeast edge of Dixie Valley.

Coordinates: lat 39°20' N., long 118°08' W.

Land classification: Public domain and local mining claims.

Area: 1 km².

Accessibility: The Dixie Valley improved road and U.S. Highway 50 are 1.5 km west and 4 km south, respectively, of the southern exposure.

Composition: Granodiorite.

Age: Jurassic-Tertiary.

Rocks intruded: Triassic limestone and dolomite.

Aeromagnetic expression:

Anomaly: High (elliptical, nose, north flank).

Inferred source: Unknown.

Mining activity: Lead has been mined.

Selected reference: Willden and Speed, 1974.

CH-8. Eastgate Mining District

General location: Southeastern part of county, near Lander County line.

Coordinates: lat 39°13' N., long 117°46' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: Main outcrop lies 2 km southeast of State Highway 2, which intersects U.S. Highway 50 west of Eastgate.

Composition: Quartz monzonite.

Age: Jurassic-Tertiary.

Rocks intruded: Triassic and Jurassic metavolcanic rocks.

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength; north and west flanks).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Willden and Speed, 1974.

CH-9. Bell Flat

General location: Southeast of Bell Flat, near Mineral County line.

Coordinates: lat 39°05' N., long 118°03' W.

Land classification: Public domain.

Area: Less than 1 km².

Accessibility: State Highway 23 passes along the east edge of the exposure.

Composition: Granodiorite and quartz monzonite.

Age: Jurassic-Tertiary.

Rocks intruded: Overlain by Tertiary volcanic rocks.

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Slemmons, 1957.

CH-10. Slate Mountain

General location: Southeastern part of county, near the Mineral County line.

Coordinates: lat 39°08' N., long 118°14' W.

Land classification: Public domain.

Area: 14 km².

Accessibility: The intrusive occurs 5.5 km east of State Highway 31.

Composition: Quartz monzonite and granodiorite.

Age: Jurassic-Tertiary.

Rocks intruded: Triassic-Jurassic volcanoclastic rocks and limestone.

Aeromagnetic expression:

Anomaly: High (nose, southwest flank).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Willden and Speed, 1974.

CH-11. Sand Springs Range

General location: Northern half of Sand Springs Range, in southern part of county.

Coordinates: lat 39°11' N., long 118°23' W.

Land classification: Public domain, U.S. Navy bombing target area, and U.S. Department of Energy (formerly U.S. Atomic Energy Commission) land.

Area: 98 km².

Accessibility: U.S. Highway 50 flanks the north edge of the pluton and State Highway 31 passes along the west side of Fairview Valley, less than 2 km east of the outcrop.

Composition: Granite, granodiorite, and quartz monzonite.

Age: 76±2 Ma, K-Ar, biotite; 79.6±2 Ma, K-Ar, biotite (Schilling, 1965) (Cretaceous).

Rocks intruded: Triassic and Jurassic volcanoclastic rocks and limestone.

Aeromagnetic expression:

Anomaly: High (low-amplitude).

Inferred source: Plutonic and volcanic rocks.

Mining activity: None.

Selected reference: Schilling, 1965.

CH-12. Barnett Hills

General location: Southwestern part of the county, southeast of Fallon.

Coordinates: lat 39°09' N., long 118°36' W.

Land classification: Public domain and Walker River Indian Reservation.

Area: 2 km².

Accessibility: The outcrop is located about 13 km east of U.S. Highway 95.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Overlain by Tertiary volcanics.

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength, northwest-trending, east margin).

Inferred source: Plutonic and volcanic rocks.

Mining activity: None.

Selected reference: Tocher, 1956.

LANDER COUNTY

Geology

Lander County (fig. 12) is located in central and north-central Nevada and is made up of north-northeast-trending mountain ranges separated by wide basins.

The county is underlain by sedimentary, igneous, and metamorphic rocks from Early Cambrian to Holocene age. The lower Paleozoic sediments were deposited in the Cordilleran geosyncline and are divided into two assemblages: (1) carbonate or eastern assemblage that forms the eastern (miogeosyncline) part of the geosyncline and consists of limestone, dolomite, and minor shale and quartzite; and (2) siliceous and volcanic or western assemblage that forms the western (eugeosyncline) part of the geosyncline and consists of chert, clastic sedimentary, intercalated volcanic, and pyroclastic rocks.

The lower Paleozoic rocks were folded and faulted in Late Devonian and Early Mississippian time, during the Antler orogeny (Stewart and others, 1977); siliceous and volcanic rocks have been thrust eastward over carbonate rocks. The axis of the Antler orogeny lies near Lander County where, by Middle Pennsylvanian time, the orogenic belt had been eroded; clastic material was deposited in troughs, forming sedimentary rocks ranging in age from Pennsylvanian to Permian.

Mesozoic rocks are represented in the county by deposits derived from local uplifts and consist of coarse clastic rocks and limestones. Other Mesozoic rocks include quartz monzonite and granodiorite of Jurassic and Cretaceous age.

Tertiary rocks consist mostly of volcanic types, with intrusive and sedimentary rocks less common. The volcanic rocks include tuffs, lavas, and breccias that range from rhyolite to basalt.

The rocks in Lander County have been affected by several major orogenic episodes (Stewart and others, 1977), as follows:

1. The Antler orogeny (Late Devonian and Early Mississippian), during which a thick assemblage of siliceous and volcanic rocks was transported from west to east along the Roberts Mountains thrust. A carbonate assemblage forms the lower plate of this thrust.
2. The Sonoma orogeny (Late Permian and Early Triassic), during which the area was subjected to folding and faulting. One of the major structures that developed was the Golconda thrust that transported the siliceous and volcanic assemblage eastward.

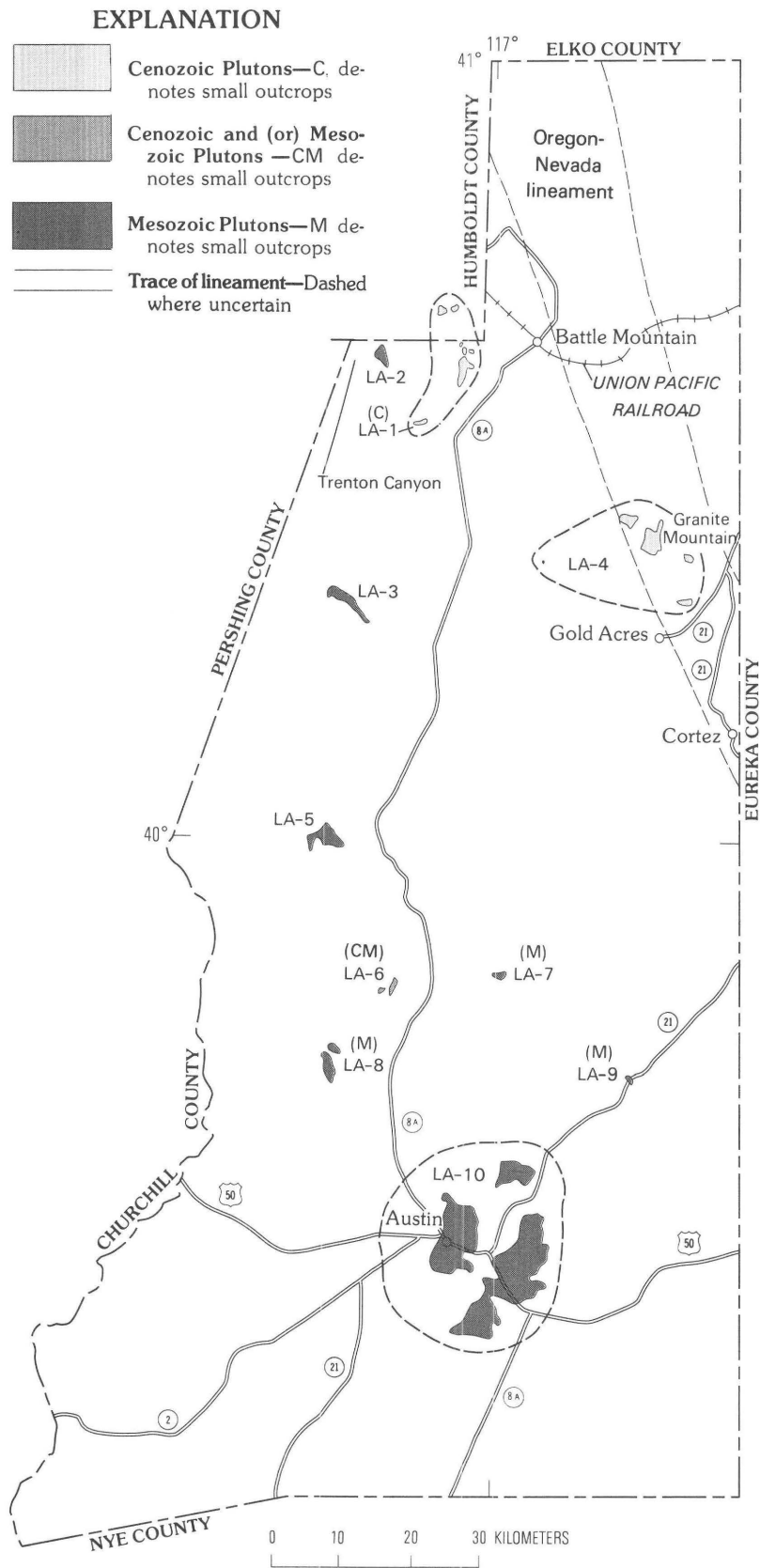


Figure 12. Locations of plutons in Lander County.

3. Basin and range deformation (Tertiary and Quaternary), consisting of high-angle normal faults bounding uplifted fault-block mountain ranges trending east-northeast, resulting in the present topography of the county.
4. The Oregon-Nevada lineament, a major structural feature, located in the northeastern part of the county. The lineament consists of closely spaced, partly en echelon faults extending from Oregon into Nevada; it is defined in Nevada by north-northwest-trending faults, voluminous lava domes and flows of Miocene age, and a conspicuous linear aeromagnetic anomaly (Stewart and others, 1975).

The northwest-trending fault zones that define the lineament are segmented by northeast-trending basin-and-range faults (Stewart and others, 1975). The lineament has been interpreted to be the surface expression of a deep-seated fracture zone that may have a complex history of strike-slip and tensional movement (Stewart and others, 1975).

The geologic data were summarized from Stewart and others (1975; 1977).

Plutons

LA-1. Copper Canyon Stock

General location: East flank of Battle Mountain, with northernmost outcrops extending into Humboldt County.

Coordinates: lat 40°36' N., long 117°02' W.

Land classification: Private land, public domain, and patented mining claims.

Area: 6 km².

Accessibility: Major southern outcrops 4 km west of State Highway 8A, and northern outcrops 5 km southwest of Southern Pacific Railroad tracks.

Composition: Granodiorite and quartz monzonite.

Age: 38.2±0.8 Ma, K-Ar, biotite; 38.2±0.8 Ma, K-Ar, hornblende (Silberman and McKee, 1971) (Tertiary).

Rocks intruded: Harmony Formation (Cambrian—sandstone, shale, and limestone), Pumpnickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics), and Antler sequence (Pennsylvanian and Permian—limestone, sandstone, shale, and conglomerate).

Aeromagnetic expression:

Anomaly: High (high-amplitude, northeast flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 15 km².

Mining activity: Copper and gold have been mined along east and southeast flanks of Battle Mountain.

Selected references: Blake and others, 1979; Silberman and McKee, 1971; Theodore and others, 1973.

LA-2. Trenton Canyon Stock

General location: West flank of Battle Mountain at Trenton Canyon.

Coordinates: lat 40°37' N., long 117°08' W.

Land classification: Private land and public domain.

Area: 2 km².

Accessibility: 14 km northwest of State Highway 8A.

Composition: Granodiorite.

Age: 87.0±1.7 Ma, K-Ar, biotite, 87.2±1.7 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Cretaceous).

Rocks intruded: Pumpnickel (Pennsylvanian and Permian—chert, siltstone, and pyroclastics) and Havallah (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone) Formations and Antler sequence (Pennsylvanian and Permian—limestone, sandstone, shale, and conglomerate).

Aeromagnetic expression:

Anomaly: High (high-amplitude, steep north gradient).

Inferred source: Plutonic rocks having a maximum areal extent of about 15 km².

Mining activity: Copper and gold have been mined along the east and southeast flanks of Battle Mountain.

Selected reference: Silberman and McKee, 1971.

LA-3. Mc Coy Stock

General location: Northern part of the Fish Creek Mountains.

Coordinates: lat 40°18' N., long 117°15' W.

Land classification: Public domain.

Area: 4 km².

Accessibility: 11 km west of State Highway 8A.

Composition: Granodiorite, quartz monzonite with some granite, and diorite.

Age: 87±2.7 Ma, K-Ar, biotite; 90±2.7 Ma, K-Ar, biotite (Krueger and Schilling, 1971), and 153±3 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Jurassic and Cretaceous).

Rocks intruded: Cane Spring Formation (Triassic—sandstone, limestone, and conglomerate), and Osobb Formation (Triassic—limestone, dolomite, shale, and conglomerate).

Aeromagnetic expression:

Anomaly: High (west-trending).

Inferred source: Extrusive and intrusive rocks.

Mining activity: None.

Selected references: Miller and Silberman, 1977; Krueger and Schilling, 1971; Silberman and McKee, 1971.

LA-4. Granite Mountain Stock

General location: Granite Mountain and vicinity, northern part of the Shoshone Range.

Coordinates: lat 40°22' N., long 116°45' W.

Land classification: Private land, public domain, and patented mining claims.

Area: 11 km².

Accessibility: Main outcrop is 10 km northwest of State Highway 21.

Composition: Granodiorite and quartz monzonite.

Age: 36.7±0.7 Ma, K-Ar, hornblende; 38.0±0.8 Ma, K-Ar, biotite (Silberman and McKee, 1971); 40±20 Ma, K-Ar, biotite; 50±10 Ma, Pb-Alpha, zircon (Marvin and Dobson, 1979) (Tertiary).

Rocks intruded: Valmy Formation (Ordovician—chert, quartzite, greenstone, and pillow lava), Roberts Mountains Formation (Silurian and Devonian—limestone), Slaven Chert (Devonian), Panther Canyon Member of the Augusta Mountain Formation (Triassic—dolomite, limestone, shale, sandstone, and conglomerate).

Aeromagnetic expression:

Anomaly: Low (low-amplitude) associated with northern exposure. High (high-amplitude) associated with central exposure. High (nose) associated with southern exposure.

Inferred source: Plutonic rocks having a maximum areal extent of about 15 km².

Mining activity: Gold and clay have been mined in the northern part of the Shoshone Range.

Selected references: Silberman and McKee, 1971; Silberman and others, 1969; Marvin and Dobson, 1979.

LA-5. Cain Creek Stock

General location: 10 km south of the south edge of the Fish Creek Mountains near Cain Creek.

Coordinates: lat 40°00' N., long 117°12' W.

Land classification: Public domain, and private land.

Area: 7 km².

Accessibility: 5 km west of State Highway 8A.

Composition: Granodiorite.

Age: 155±3 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Jurassic).

Rocks intruded: Overlain by alluvium and Tertiary volcanic rocks.

Aeromagnetic expression:

Anomaly: High (elongate, northwest-trending, northwest flank).

Inferred source: Although a small part of anomaly is associated with basalt, the predominant source is inferred to be plutonic rocks having a maximum areal extent of about 15 to 25 km².

Mining activity: None.

Selected references: Carlson and others, 1975; Silberman and McKee, 1971.

LA-6. Steiner Spring

General location: Northern part of the Shoshone Mountains.

Coordinates: lat 39°48' N., long 117°07' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: 5 km west of State Highway 8A.

Composition: Granodiorite and quartz monzonite.

Age: Jurassic-Tertiary(?).

Rocks intruded: Valmy Formation (Ordovician—chert, quartzite, greenstone, and pillow lava).

Aeromagnetic expression: None well-defined.

Mining activity: None.

Selected reference: Stewart and others, 1975; 1977.

LA-7. Iowa Creek Stock

General location: Northwest flank of the northern Toiyabe Range, near Iowa Creek.

Coordinates: lat 39°50' N., long 117°00' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: 8 km east of State Highway 8A.

Composition: Granite and quartz monzonite.

Age: 67.9±2.7 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Cretaceous).

Rocks intruded: Valmy Formation. (Ordovician—chert, quartzite, greenstone, and pillow lava).

Aeromagnetic expression: None well-defined.

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

LA-8. Ravenswood Stock

General location: Shoshone Mountains, near Gilberts Creek.

Coordinates: lat 39°42' N., long 117°12' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: 8 km west of State Highway 8A.

Composition: Granite and quartz monzonite.

Age: 71.4±1.4 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Cretaceous).

Rocks intruded: Cambrian quartzite and shale.

Aeromagnetic expression:

Anomaly: High (low-amplitude).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

LA-9. Steiner Creek

General location: Northwest flank of Simpson Park Mountains, 6 km northeast of Steiner Creek.

Coordinates: lat 39°42' N., long 116°47' W.

Land classification: Private land.

Area: 1 km².

Accessibility: State Highway 21 bisects exposure.

Composition: Granite.

Age: 168±3 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Jurassic).

Rocks intruded: Roberts Mountains Formation (Silurian and Devonian—limestone).

Aeromagnetic expression:

Anomaly: High (flat summit).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

LA-10. Austin

General location: Central part of the Toiyabe Range, near Austin.

Coordinates: lat 39°28' N., long 117°00' W.

Land classification: Toiyabe National Forest, private land, and patented mining claims.

Area: 161 km².

Accessibility: U.S. Highway 50 bisects the main exposures.

Composition: Quartz monzonite and granodiorite, minor diorite, and alaskite.

Age: 157 Ma, K-Ar, biotite (Krueger and Schilling, 1971); 73 Ma, K-Ar, biotite; 80 Ma, K-Ar, muscovite; 138 Ma, K-Ar, biotite; 152 Ma, K-Ar, hornblende; and 155 Ma, K-Ar, biotite (Carlson and others, 1975) (Jurassic and Cretaceous).

Rocks intruded: Cambrian quartzite and shales, Valmy Formation (Ordovician—chert, quartzite, greenstone, and pillow lava), and Slaven Chert (Devonian).

Aeromagnetic expression:

Anomaly: High associated with northern exposure. High (high-amplitude) that transects two major southern exposures and forms part of a magnetic lineament that extends for at least 100 km.

Inferred source: Unknown.

Mining activity: None.

Selected references: Krueger and Schilling, 1971; Carlson and others, 1975.

EUREKA COUNTY

Geology

Eureka County (fig. 13) is located within the north-central part of the Basin and Range province, where most of the ranges trend in a north to northeast direction and are bounded by fault scarps on one or both sides. Movement along many of the faults has tilted the ranges eastward or southeastward. This tilting of the ranges is clearly shown by steep fault scarps along the west borders and the gradual merging with alluvium on the east flanks.

The most prominent feature of the geology in the county is the Roberts Mountains thrust, a major structural element of the Antler orogenic belt. This thrust brings into contact thick sections of rock of early and middle Paleozoic age that contrast greatly in lithology. The upper plate of the thrust is almost entirely siliceous, consisting of sandstone, quartzite, shale, greenstone, and chert, whereas the lower eastern assemblage contains a sequence of rocks composed almost entirely of carbonates. After the major thrusting event, coarse clastics, eroded from highlands to the west, were deposited over the older facies. This overlap assemblage was subsequently folded and thrust faulted by intermittent orogenic movements during late Paleozoic and Mesozoic time.

During the Mesozoic and extending into Tertiary time, many of the granitic rock masses were emplaced along zones of structural weakness associated with past deformation. The intrusives are chiefly composed of quartz monzonite and granodiorite, although several exposures are composed of alaskite. Mineralized areas, commonly associated with the intrusives, are mainly silver-gold-lead-zinc replacement deposits in eastern assemblage (carbonate) host rocks.

The Oregon-Nevada lineament, trending in a north-northwest direction, extends into the southwestern part of the county. The lineament is marked by closely spaced faults, centers of volcanic activity, and a conspicuous aeromagnetic anomaly (Stewart and others, 1975). The lineament may represent the surface expression of a deep-seated fracture zone and may be related to a system of interrelated strike-slip and tension zones.

Much of the information summarized for Eureka County is from Roberts and others (1967).

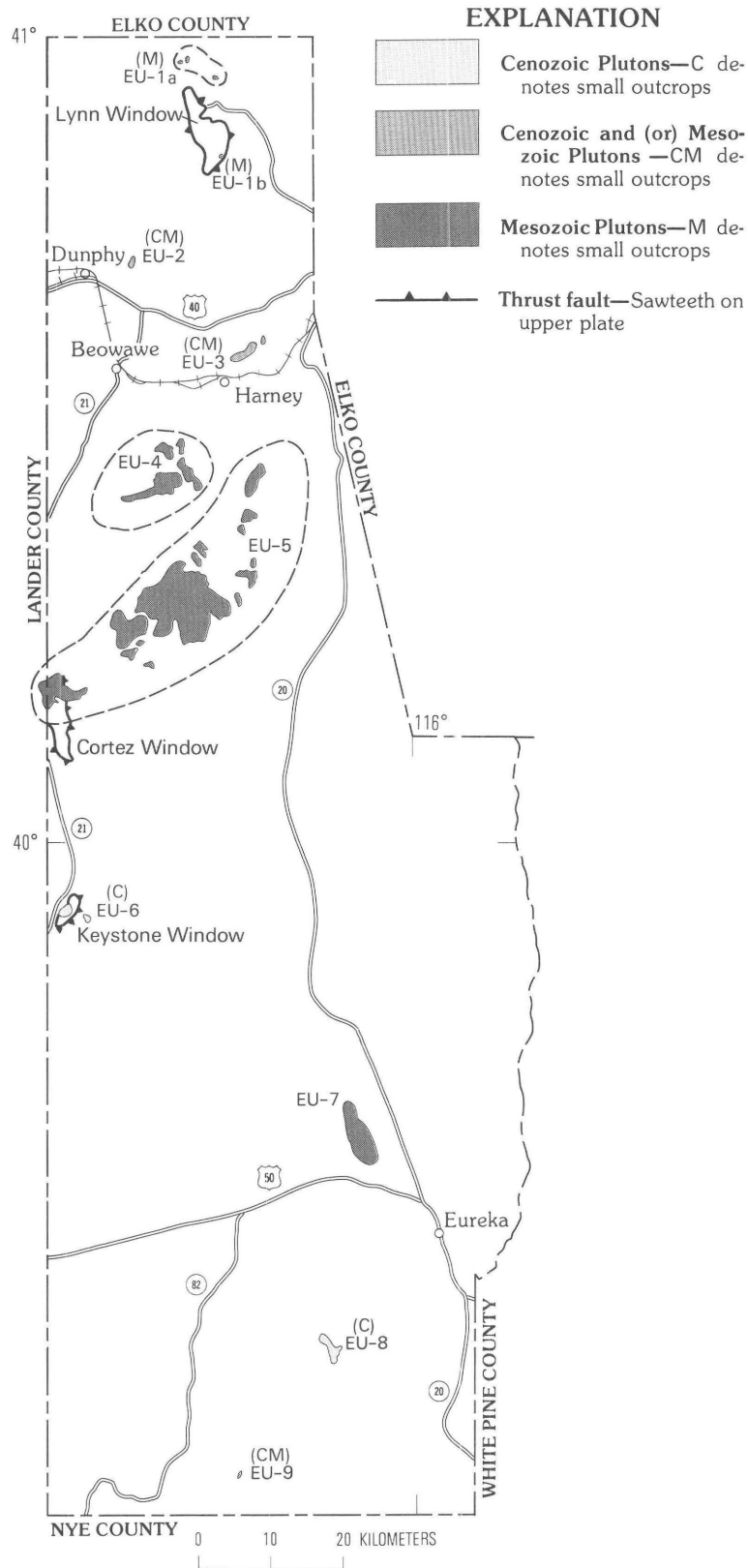


Figure 13. Locations of plutons in Eureka County.

Plutons

EU-1a and 1b. Tuscarora Mountains

General location, 1a: North-central part of county, north of the Lynn mining district.

Coordinates: lat 40°57' N., long 116°21' W.

Land classification: Private land (railroad).

Area: 4 km².

Accessibility: U.S. Highway 40 is 33 km south of the outcrops. Western Pacific and Southern Pacific Railroads pass 40 km south of the area. A hard-surface secondary road extends northwest from Carlin to the Carlin Mine, approximately 4 km south of the outcrops.

Composition: Granodiorite, granite, and diorite.

Age: 121±5 Ma, K-Ar, biotite (Hausen and Kerr, 1968) (Cretaceous).

Rocks intruded: Vinini Formation (Ordovician—chert and shale).

Aeromagnetic expression:

Anomaly: Highs and lows.

Inferred source: Plutonic rocks.

Mining activity: Gold and silver have been mined in the immediate vicinity of the northwestern exposure. Gold has been mined within the Lynn mining district, south and southwest of the exposures.

General location, 1b: Northwest of Marys Mountain.

Coordinates: lat 40°50' N., long 116°18' W.

Land classification: Private land (railroad).

Area: Less than 1 km².

Accessibility: U.S. Highway 40 and Western Pacific Railroad pass 23 km and 30 km south of the area, respectively. The Carlin Mine secondary road is 6 km east of the outcrop.

Composition: Granite.

Age: 108±3 Ma, K-Ar, biotite (Morton and others, 1977) (Cretaceous).

Rocks intruded: Hamburg Dolomite (Cambrian) and Eureka Quartzite (Ordovician).

Aeromagnetic expression:

Anomaly: Highs and lows.

Inferred source: Plutonic rocks.

Mining activity: The exposure is near the Lynn mining district, where gold and silver have been mined.

Selected references: Morton and others, 1977; Hausen and Kerr, 1968.

EU-2. Boulder Valley

General location: Northeast of the Shoshone Range in the northern part of the county.

Coordinates: lat 40°43' N., long 116°27' W.

Land classification: Private land.

Area: 3 km².

Accessibility: U.S. Highway 40 is about 4 km south of the exposure. Western Pacific and Southern Pacific Railroads lie 5 km south of the area.

Composition: Quartz monzonite.

Age: Cretaceous-Tertiary(?).

Rocks intruded: Vinini Formation (Ordovician—chert and shale).

Aeromagnetic expression:

Anomaly: High (long-wavelength, north-trending, west flank).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Roberts and others, 1967.

EU-3. Buck Rake

General location: South end of the Tuscarora Mountains, north of the Humboldt River.

Coordinates: lat 40°37' N., long 116°16' W.

Land classification: Private land (railroad).

Area: 5 km².

Accessibility: U.S. Highway 40 is 5 km north of the main exposure. Western Pacific and Southern Pacific Railroads pass about 1.5 km south of the area.

Composition: Quartz monzonite.

Age: Cretaceous-Tertiary(?).

Rocks intruded: Jurassic and Cretaceous volcanic rocks.

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength, south flank).

Inferred source: Unknown.

Mining activity: Iron has been mined south of the main granitic body.

Selected reference: Roberts and others, 1967.

EU-4. Dry Hills

General location: Southern Dry Hills, south of the Humboldt River.

Coordinates: lat 40°27' N., long 116°24' W.

Land classification: Public domain and private land.

Area: 22 km².

Accessibility: State Highway 21 extends southward from U.S. Highway 40 and passes 8.5 km west of the west exposures.

Composition: Granodiorite and monzodiorite.

Age: Cretaceous(?).

Rocks intruded: Brock Canyon Formation(?) (Permian and Pennsylvanian—sandstone) and Permian(?) quartz latite porphyry.

Aeromagnetic expression:

Anomaly: Low (low-amplitude).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Muffler, 1964.

EU-5. Cortez Mountains

General location: Prominent northeast-trending range south of the Humboldt River.

Coordinates: lat 40°19' N., long 116°22' W.

Land classification: Public domain and private land.

Area: 138 km².

Accessibility: The westernmost exposure is about 13 km southeast of State Highway 21. Light-duty improved State road 21 passes south of the exposures.

Composition: Granodiorite, quartz monzonite with minor diorite, tonalite, and alaskite.

Age: 125 Ma, K-Ar, biotite-quartz monzonite; 145 Ma, K-Ar, biotite-quartz monzonite; 124 Ma, K-Ar, biotite-granodiorite; 147 Ma, K-Ar, biotite-granodiorite; 150 Ma, K-Ar, hornblende-diorite (Schilling, 1965), and 150 Ma, K-Ar, biotite-quartz monzonite (Armstrong, 1970b) (Jurassic and Cretaceous).

Rocks intruded: Brock Canyon Formation (Permian and Pennsylvanian—sandstone).

Aeromagnetic expression:

Anomaly: Lows (low-amplitude) associated with most of the plutonic rocks. High (high-amplitude, north flank) associated with basalt.

Inferred source: Extrusive and intrusive rocks.

Mining activity: Gold and silver have been mined approximately 8 km southwest of the main body in the Buckhorn mining district.

Selected references: Armstrong, 1970b; Gilluly and Masursky, 1965; Muffler, 1964; Schilling, 1965; Stewart and others, 1975; Stewart and others, 1977; Wells and others, 1971.

EU-6. Walti

General location: Simpson Park Mountains near the west county line.

Coordinates: lat 39°55' N., long 116°34' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: Light-duty improved State road 21 intersects State Highway 21 and passes within 1 km of the western exposures.

Composition: Granodiorite.

Age: 33.4±0.7 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Tertiary).

Rocks intruded: Vinini Formation (Ordovician—chert and shale) and carbonates (Devonian).

Aeromagnetic expression:

Anomaly: High (high-amplitude, equidimensional, steep north flank).

Inferred source: Plutonic rocks having a maximum areal extent of 15 km².

Mining activity: None.

Selected references: Silberman and McKee, 1971; Stewart and others, 1975.

EU-7. Whistler Mountain

General location: Northwest of Eureka.

Coordinates: lat 39°38' N., long 116°06' W.

Land classification: Public domain.

Area: 23 km².

Accessibility: State Highway 20 passes 3 km east.

Composition: Quartz monzonite (alaskite?).

Age: 165 (+25, -8) Ma, K-Ar, biotite (Schilling, 1965) (Jurassic).

Rocks intruded: Paleozoic carbonates and Vinini Formation (Ordovician—chert and shale).

Aeromagnetic expression: None.

Mining activity: None.

Selected references: Merriam and Anderson, 1942; Schilling, 1965.

EU-8. Wood Cone Peak

General location: South Mahogany Hills.

Coordinates: lat 39°29' N., long 116°06' W.

Land classification: Public domain.

Area: 3 km².

Accessibility: U.S. Highway 50 passes 20 km north of the outcrop.

Composition: Granodiorite.

Age: 34.1±1.5 Ma, K-Ar, biotite (Marvin and Cole, 1978) (Tertiary).

Rocks intruded: Pogonip Group (Ordovician—limestone) and Eureka Quartzite (Ordovician).

Aeromagnetic expression:

Anomaly: High (short wavelength, elliptical north-trending, steep north flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 10 km².

Mining activity: None.

Selected reference: Marvin and Cole, 1978.

EU-9. Ninemile Canyon

General location: North Antelope Range.

Coordinates: lat 39°13' N., long 116°17' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: The outcrop is located 35 km south of U.S. Highway 50, and 10 km east of State Highway 82.

Composition: Quartz monzonite, granodiorite.

Age: Jurassic-Tertiary(?).

Rocks intruded: Pogonip Group (Ordovician—limestone).

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Roberts and others, 1967.

WHITE PINE COUNTY

Geology

White Pine County (fig. 14) is located in east-central Nevada where elongated north-trending mountain ranges are separated by wide basins.

The county is underlain by rocks of sedimentary, igneous, and metamorphic origin, that range from Precambrian to Pliocene in age. The Precambrian to Lower Triassic sedimentary rocks make up the Cordilleran miogeosyncline. Middle Triassic, Upper Triassic, or Jurassic sedimentary rocks have not been identified in the county. Cretaceous rocks occur in the westernmost part of the county (Hose and others, 1976).

Tertiary deposits consist of sedimentary and volcanic rocks. The volcanic rocks include ash-flow tuffs and lavas that range from rhyolite through andesite.

Plutonic rocks are of Jurassic, Cretaceous, and Tertiary age and range from granite, through quartz monzonite, to granodiorite (Hose and others, 1976).

The area was not exposed to any major tectonism during the Paleozoic Era, but two later major tectonic events took place in the county. The first event, during late Mesozoic to early Tertiary, consisted of high-angle normal faulting, thrust faulting, and folding. The second tectonic event took place during the Tertiary and Quaternary periods, reaching its climax in late Miocene (Hose and others, 1976) and consisted of high-angle faulting that resulted in elongated fault-block mountain ranges and basins that form the present topography.

Geologic data were summarized from Hose and others (1976).

Plutons

WP-1. Southern Snake Range

General location: North end of the southern Snake Range.

Coordinates: lat 38°58' N., long 114°13' W.

Land classification: Humboldt National Forest.

Area: 84 km².

Accessibility: Northernmost major exposure is 3 km south of U.S. Highways 50 and 6.

Composition: Quartz monzonite and granodiorite.

Age: More than 50 radiometric age determinations ranging from 17 to 240 m.y., with most consistent determinations ranging from 156 to 160 Ma; the latest age determinations of 145±2.0 Ma, and 170± Ma, lead-alpha, zircon (Marvin and Dobson, 1979) (Jurassic).

Rocks intruded: McCoy Creek Group of Misch and Hazzard (1962) (Precambrian—quartzite, schist, and pelitic rocks), Stella Lake Quartzite of Misch and Hazzard (1962) (Precambrian), Prospect Mountain Quartzite (Precambrian and Cambrian), Pioche Shale (Cambrian), and Cambrian limestone and shale.

Aeromagnetic expression:

Anomaly: High (long-wavelength, west flank).

Inferred source: Unknown.

Mining activity: Gold placer deposits have been found in the northwestern part of the range, and tungsten has been mined in the southeastern part of the range.

Selected references: Hose and others, 1976; Lee and others, 1970; Marvin and Dobson, 1979; Misch and Hazzard, 1962.

WP-2. Northern Snake Range

General location: South end of the northern Snake Range.

Coordinates: lat 39°15' N., long 114°12' W.

Land classification: Humboldt National Forest.

Area: 39 km².

Accessibility: 9 km north of U.S. Highways 50 and 6.

Composition: Quartz monzonite and granodiorite.

Age: K-Ar determination on micas range from 17.0 to 156 Ma (Lee and others, 1970) (Tertiary to Jurassic).

Rocks intruded: Cambrian shale, limestone, and quartzite; Pogonip Group (Ordovician—limestone); Eureka Quartzite (Ordovician); Guilmette

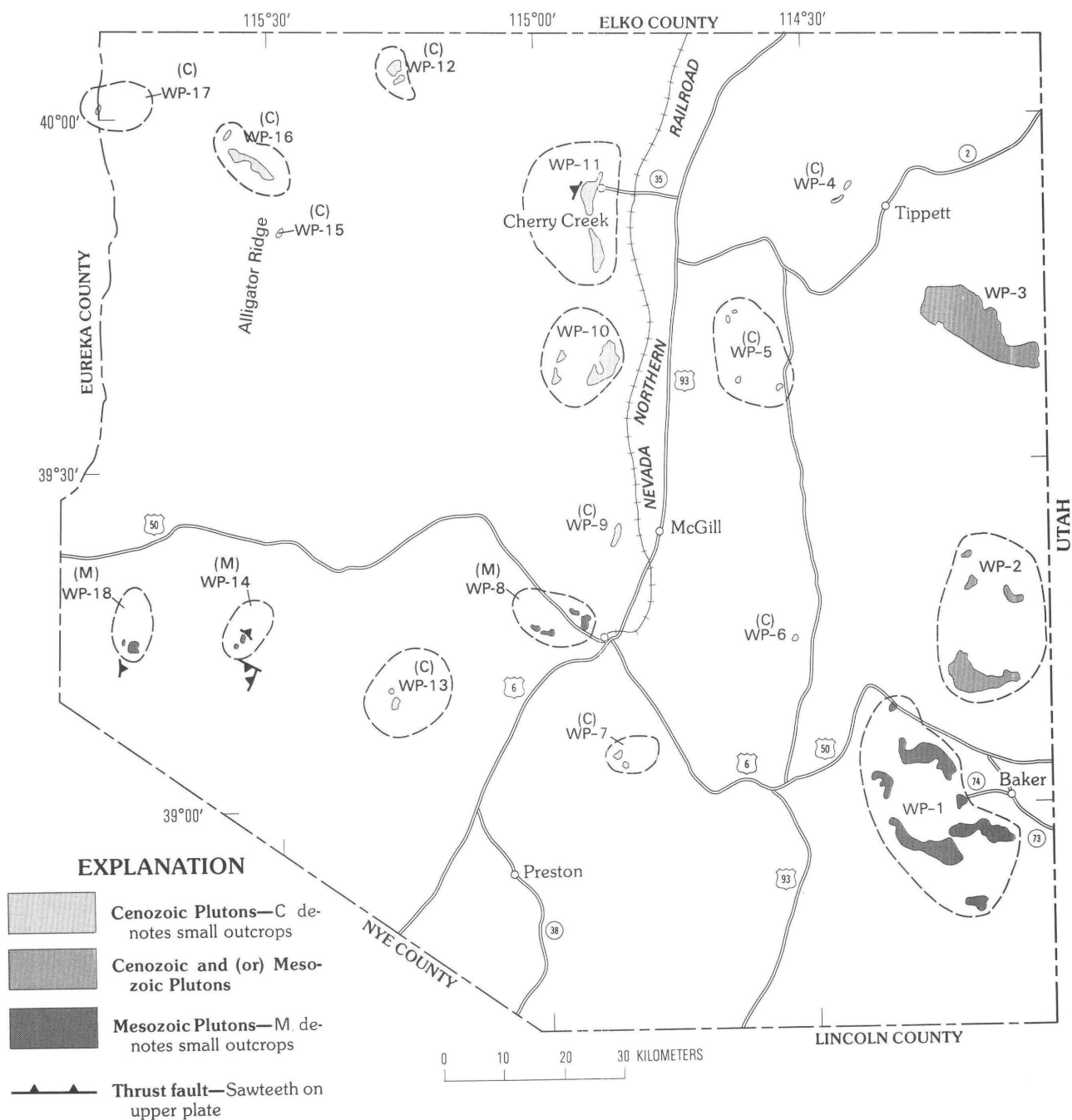


Figure 14. Locations of plutons in White Pine County.

Formation (Devonian—limestone); Sevy and Simonson Dolomites (Devonian—limestone); Pilot Shale (Devonian and Mississippian); Joana Limestone (Mississippian); and Chainman Shale (Mississippian).

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Lee and others, 1970.

WP-3. Kern Mountains

General location: Kern Mountains near Utah State line.

Coordinates: lat 39°42' N., long 114°12' W.

Land classification: Public domain, private land, and patented mining claims.

Area: 107 km².

Accessibility: 10 km southeast of State Highway 2.

Composition: Granodiorite with some quartz monzonite and granite.

Age: 23.3±0.6 Ma, K-Ar, biotite; 48.2±1.0 Ma, K-Ar, muscovite; 72±7 Ma, Rb-Sr, whole rock (Hose and others, 1976) (Cretaceous and Tertiary).

Rocks intruded: Ordovician and Silurian sedimentary rocks, Sevy and Simonson Dolomites (Devonian), Pilot Shale (Devonian and Mississippian), Joana Limestone (Mississippian), Chainman Shale (Mississippian), Ely Limestone (Pennsylvanian and Permian), and Riepe Spring Limestone of Stewart and Carlson (1978) (Pennsylvanian and Permian).

Aeromagnetic expression:

Anomaly: Low (long-wavelength, west-trending), perhaps coupled with a high to the south.

Inferred source: Unknown.

Mining activity: None.

Selected references: Hose and others, 1976; Steele, 1960.

WP-4. Antelope Range

General location: Central part of the Antelope Range.

Coordinates: lat 39°53' N., long 114°27' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: 7 km northwest of State Highway 2.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Ordovician and Silurian sedimentary rocks, Sevy and Simonson Dolomites (Devonian), Rib Hill Sandstone (Permian), and Arcturus Formation (Permian--limestone, sandstone, and siltstone).

Aeromagnetic expression:

Anomaly: Low.

Inferred source: Unknown.

Mining activity: None.

Selected reference: Hose and others, 1976.

WP-5. Northern Schell Creek Range

General location: Northern Schell Creek Range.

Coordinates: lat 39°37' N., long 114°37' W.

Land classification: Humboldt National Forest and private land.

Area: 2 km².

Accessibility: 8 km east of U.S. Highway 93, and 11 km east of Nevada Northern Railroad.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Pogonip Group (Ordovician--limestone), Eureka Quartzite (Ordovician), Pilot Shale (Devonian and Mississippian), Joana Limestone (Mississippian), Chainman Shale (Mississippian), Ely and Riepe Spring Limestones (Pennsylvanian and Permian), and Park City Group (Permian--limestone and dolomite).

Aeromagnetic expression:

Anomaly: Highs and lows.

Inferred source: Unknown.

Mining activity: None.

Selected reference: Hose and others, 1976.

WP-6. Indian Creek

General location: East flank of the central Schell Creek Range.

Coordinates: lat 39°16' N., long 114°31' W.

Land classification: Humboldt National Forest.

Area: Less than 1 km².

Accessibility: 23 km north of U.S. Highways 50 and 6, and 1 km west of an unnumbered paved road.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: McCoy Creek Group (Precambrian--quartzite, schist, and pelitic rocks).

Aeromagnetic expression:

Anomaly: High (low-amplitude, long-wavelength, west-trending).

Inferred source: Granitic rocks having a maximum areal extent of about 100 km².

Mining activity: None.

Selected reference: Misch and Hazzard, 1962.

WP-7. Southern Egan Range

General location: East flank of the southern part of the Egan Range, near Ward Gulch.

Coordinates: lat 39°05' N., long 114°52' W.

Land classification: Public domain and private land.

Area: 2 km².

Accessibility: 9 km southwest of U.S. Highways 50 and 6.

Composition: Quartz monzonite.

Age: 35.1±1.3 Ma, K-Ar, biotite (McKee and Marvin, 1976) (Tertiary).

Rocks intruded: Arcturus Formation (Permian--limestone, sandstone, and siltstone), Ely and Riepe Spring Limestones (Pennsylvanian and Permian).

Aeromagnetic expression:

Anomaly: Regional.

Inferred source: Unknown.

Mining activity: Lead and silver have been mined in vicinity of pluton.

Selected reference: McKee and Marvin, 1976.

WP-8. Saxton Peak

General location: Egan Range.

Coordinates: lat 39°16' N., long 115°00' W.

Land classification: Patented mining claims.

Area: 8 km².

Accessibility: Outcrops occur on both north and south sides of U.S. Highway 50. Nevada Northern Railroad runs north and south of outcrops.

Composition: Monzonite and quartz monzonite.

Age: 109 ± 1.5 Ma, K-Ar, hornblende (McDowell and Kulp, 1967); 115 ± 3 Ma, fission track, sphene, zircon, and apatite (Hose and others, 1976) (Cretaceous).

Rocks intruded: Guilmette Formation (Devonian), Pilot Shale (Devonian and Mississippian), Joana Limestone (Mississippian), Chainman Shale (Mississippian), Rib Hill Sandstone (Permian), Arcturus Formation (Permian—limestone, sandstone, and siltstone), and Ely and Riepe Spring Limestones (Pennsylvanian and Permian).

Aeromagnetic expression:

Anomaly: High (high-amplitude, steep north flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 10 km^2 .

Mining activity: Copper, gold, and silver have been mined. The granitic intrusives occur near the Ruth open-pit operation.

Selected references: Brokaw, 1967; Hose and others, 1976; McDowell and Kulp, 1967.

WP-9. Heusser Mountain

General location: Heusser Mountain, Egan Range.

Coordinates: lat $39^{\circ}29'$ N., long $114^{\circ}52'$ W.

Land classification: Public domain.

Area: 3 km^2 .

Accessibility: 7 km west of U.S. Highway 93 and 3 km west of the Nevada Northern Railroad.

Composition: Quartz monzonite.

Age: 33.6 ± 0.7 Ma, K-Ar, biotite (Armstrong, 1970a), and 30 ± 10 Ma, lead-alpha, zircon (Marvin and Dobson, 1979) (Tertiary).

Rocks intruded: McCoy Creek Group (Precambrian—quartzite, schist, and pelitic rocks).

Aeromagnetic expression:

Anomaly: High (west flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 50 km^2 .

Mining activity: None.

Selected references: Armstrong, 1970a; Marvin and Dobson, 1979.

WP-10. Northern Egan Range

General location: East flank of the northern Egan Range.

Coordinates: lat $39^{\circ}38'$ N., long $114^{\circ}52'$ W.

Land classification: Public domain.

Area: 25 km^2 .

Accessibility: 8 km west of U.S. Highway 93 and 4 km west of Nevada Northern Railroad.

Composition: Granite porphyry and quartz monzonite.

Age: 36.2 ± 0.7 Ma, K-Ar, no material indicated in reference (Armstrong, 1970a) (Tertiary).

Rocks intruded: McCoy Creek Group (Precambrian—quartzite, schist, and pelitic rocks), Silurian and Ordovician sedimentary rocks, Simonson and Sevy Dolomites (Devonian), Guilmette Formation (Devonian—limestone), Pilot Shale (Devonian and Mississippian), Joana Limestone (Mississippian), Chainman Shale (Mississippian), Rib Hill Sandstone (Permian), Arcturus Formation (Permian—limestone, sandstone, and siltstone), Ely and Riepe Spring Limestones (Pennsylvanian and Permian).

Aeromagnetic expression:

Anomaly: High (low-amplitude, north-trending, north flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 25 km^2 .

Mining activity: None.

Selected reference: Armstrong, 1970a.

WP-11. Cherry Creek Range

General location: North end of the Egan Range.

Coordinates: lat $39^{\circ}49'$ N., long $114^{\circ}53'$ W.

Land classification: Public domain, private land, and patented mining claims.

Area: 16 km^2 .

Accessibility: 1 km west of the end of State Highway 35, 14 km west of U.S. Highway 93, and 7 km west of the Nevada Northern Railroad.

Composition: Quartz monzonite.

Age: 40.3 ± 4 Ma, fission track, sphene and zircon (Hose and others, 1976) (Tertiary).

Rocks intruded: McCoy Creek Group (Precambrian—quartzite, schist, and pelitic rocks); Cambrian, Silurian, and Ordovician sedimentary rocks; Pilot Shale (Devonian and Mississippian); Joana Limestone (Mississippian); and Chainman Shale (Mississippian).

Aeromagnetic expression:

Anomaly: High (low-amplitude, long-wavelength).

Inferred source: Plutonic rocks having a maximum areal extent of about 25 km^2 .

Mining activity: None.

Selected reference: Hose and others, 1976.

WP-12. Maverick Springs Range

General location: East flank of the Maverick Springs Range.

Coordinates: lat $40^{\circ}05'$ N., long $115^{\circ}16'$ W.

Land classification: Public domain.

Area: 6 km^2 .

Accessibility: 72 km north of U.S. Highway 50 and 3 km northwest of a dirt road.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Rib Hill Sandstone (Permian) and Park City Group (Permian—limestone and dolomite).

Aeromagnetic expression:

Anomaly: Short-wavelength, low-amplitude flexure.

Inferred source: Exposed plutonic rocks.

Mining activity: None.

Selected reference: Hose and others, 1976.

WP-13. Limestone Peak

General location: West flank of Limestone Peak.

Coordinates: lat 39°10' N., long 115°17' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: 22 km south of U.S. Highway 50 and 19 km northwest of U.S. Highway 6.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Surrounded by alluvium.

Aeromagnetic expression:

Anomaly: High (low-amplitude nose).

Inferred source: Granitic rocks.

Mining activity: None.

Selected reference: Brokaw and others, 1973.

WP-14. Mount Hamilton

General location: West flank of Mount Hamilton, White Pine Range.

Coordinates: lat 39°15' N., long 115°34' W.

Land classification: Humboldt National Forest, private land, and patented mining claims.

Area: 1 km².

Accessibility: 16 km south of U.S. Highway 50.

Composition: Quartz monzonite.

Age: 90.4±2 Ma, K-Ar, biotite-chlorite (Armstrong, 1970b); 128±1.5 Ma, lead-alpha, zircon (Marvin and Dobson, 1979) (Cretaceous).

Rocks intruded: Cambrian limestone and shale.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, circular, steep north flank).

Inferred source: Plutonic rocks having a maximum areal extent of about 100 km².

Mining activity: None.

Selected references: Armstrong, 1970b; Marvin and Dobson, 1979.

WP-15. Alligator Ridge

General location: North end of Alligator Ridge.

Coordinates: lat 39°50' N., long 115°29' W.

Land classification: Public domain.

Area: 1 km².

Accessibility: 49 km north of U.S. Highway 50 and 8 km west of a dirt road.

Composition: Quartz monzonite.

Age: Tertiary.

Rocks intruded: Devonian quartzite, dolomite, and limestone. Formerly included in the Nevada Formation of Hose and others, 1976 (now abandoned).

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Hose and others, 1976.

WP-16. Little Bald Mountain

General location: Little Bald Mountain.

Coordinates: lat 39°57' N., long 115°33' W.

Land classification: Public domain and patented mining claims.

Area: 7 km².

Accessibility: 59 km north of U.S. Highway 50.

Composition: Granite and quartz monzonite.

Age: Tertiary.

Rocks intruded: Cambrian limestone and shale, Pogonip Group (Ordovician—limestone), Eureka Quartzite (Ordovician), Ordovician and Silurian sedimentary rocks, and Devonian sedimentary rocks formerly included in the Nevada Formation of Hose and others, 1976 (now abandoned).

Aeromagnetic expression:

Anomaly: Low (low-amplitude flexure).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Hose and others, 1976.

WP-17. Northern Diamond Mountains

General location: North end of the Diamond Mountains.

Coordinates: lat 40°01' N., long 115°50' W.

Land classification: Public domain.

Area: Less than 1 km².

Accessibility: 71 km north of U.S. Highway 50 and 5 km east of State Highway 46 (Eureka County).

Composition: Quartz monzonite.

Age: 45±10 Ma, lead-alpha, zircon (Marvin and Dobson, 1979) (Tertiary).

Rocks intruded: Ely and Riepe Spring Limestones (Pennsylvanian and Permian).

Aeromagnetic expression:

Anomaly: Low (low-amplitude).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Marvin and Dobson, 1979.

WP-18. Pancake Range

General location: North end of the Pancake Range.

Coordinates: lat 39°14' N., long 115°46' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: 15 km south of U.S. Highway 50.

Composition: Granodiorite.

Age: 108±3 Ma, K-Ar, biotite (Hose and others, 1976) (Cretaceous).

Rocks intruded: Pilot Shale (Devonian and Mississippian), Joana Limestone (Mississippian), Chainman Shale (Mississippian), and Diamond Peak Formation (Mississippian—siltstone, claystone, and sandstone).

Aeromagnetic expression:

Anomaly: High (north-trending, southeast flank associated with plutonic rock). Low (low-amplitude, short-wavelength) centered over the main exposure.

Inferred source: Granitic rocks.

Mining activity: None.

Selected references: Hose and others, 1976; Nolan and others, 1974.

ELKO COUNTY

Geology

Elko County (fig. 15), in the northeast part of the State, lies in the Great Basin and has typical Basin and Range topography. The southern and western parts of the county are dominated by long, narrow ranges with north to northeast trends. In the northern part of the county the ranges exhibit a less definite trend. In the northwest, where the Basin and Range province borders the Columbia Plateaus province, the ranges are irregular in shape and are deeply dissected by canyons.

Many of the exposed plutons within the county intrude thick Paleozoic sedimentary units. The Paleozoic rocks generally belong to two distinct facies: the western facies consists mainly of slate, chert, metamorphosed volcanic rock, and sandstone; the eastern carbonate facies consists of limestone, dolomite, and minor amounts of quartzite, conglomerate, and shale. Most of the Paleozoic formations have been intensely folded and broken by thrust and normal faults. At a few localities, intrusives penetrate Triassic sandstone, shale, and limestone; these sedimentary rocks represent outliers of rocks that are more extensive in Utah.

The plutons in this county range from Jurassic to Tertiary and are commonly described as quartz monzonite or granodiorite. The granitic masses situated along the north border of the State have been described by previous workers as probably genetically related to the Idaho batholith.

Much of the geologic information concerning granitic rocks in Elko County has been abstracted from Granger and others (1957).

Plutons

EL-1. Mountain City District

General location: Mountain City.

Coordinates: lat 41°51' N., long 115°56' W.

Land classification: Northwestern exposures and the western part of the largest exposure are on the Duck Valley Indian Reservation. Eastern outcrops are on Humboldt National Forest lands.

Area: 127 km².

Accessibility: State Highway 51 crosses over the largest exposure in the Independence Range and is within 16 km of the extreme northeast exposures.

Composition: Granodiorite and quartz monzonite.

Age: Range from 80 to 90 Ma, K-Ar, biotite (Coats and others, 1965); 70±20 and 110±15 Ma, lead-alpha, zircon (Schilling, 1965) (Cretaceous; parts of the pluton could be Jurassic-Tertiary).

Rocks intruded: Undifferentiated Antler orogenic sedimentary rocks that include Paleozoic volcanics, limestone, conglomerate, and phyllite.

Aeromagnetic expression:

Anomaly: High (high-amplitude, west-trending) associated with the main mass of plutonic rocks.

Inferred source: Plutonic rocks that may extend westward in the subsurface for a distance of 30 km and that may have a maximum extent of 75 km².

Mining activity: Silver has been mined near the two south exposures.

Selected references: Coats, 1971; Coats and others, 1965; Schilling, 1965.

EL-2. Alder-Tennessee Mountain District (Bearpaw Mountain and Bruneau River)

General location: East of Mountain City, near north county (and State) border.

Coordinates: lat 41°53' N., long 115°36' W.

Land classification: Humboldt National Forest.

Area: 136 km².

Accessibility: The southernmost outcrop is 17 km northeast of State Highway 51.

Composition: Granodiorite.

Age: 73 Ma, K-Ar, biotite (Coats and others, 1965) (Cretaceous).

Rocks intruded: Paleozoic eastern assemblage sediments (quartzite, siltstone, limestone, and dolomite) and Paleozoic transitional assemblage (phyllite, shale, and limestone).

Aeromagnetic expression:

Anomaly: Low (long-wavelength) associated with western two-thirds of north exposure. High (circular) associated with east third. Highs (high-amplitude) associated with larger south exposure.

Inferred source: Plutonic rocks having an areal extent about the same as that of the exposures.

Mining activity: Tungsten, silver, and gold have been mined near the southwest margin of the main exposure.

Selected reference: Coats and others, 1965.

EL-3. Coleman Canyon

General location: Northeast of Wild Horse.

Coordinates: lat 41°44' N., long 115°43' W.

Land classification: Humboldt National Forest.

Area: 3 km².

Accessibility: State Highway 51 passes about 7.5 km southwest of the pluton.

Composition: Diorite.

Age: 152.1±5 Ma, K-Ar, biotite (Coats and McKee, 1972) (Jurassic).

Rocks intruded: Paleozoic slate, shale, and limestone.

Aeromagnetic expression:

Anomaly: High (low-amplitude, short-wavelength, elliptical).

Inferred source: Plutonic rocks having the same areal extent as that of the exposures.

Mining activity: Tungsten, silver, and gold have been mined directly north of the pluton.

Selected reference: Coats and McKee, 1972.

EL-4. White Elephant Butte (Elk Mountains)

General location: Northeastern part of county.

Coordinates: lat 41°54' N., long 115°05' W.

Land classification: Humboldt National Forest.

Area: 10 km².

Accessibility: U.S. Highway 93, extending northward from Wells, passes 29 km southeast of the exposure.

Composition: Granodiorite.

Age: 100±10 Ma, lead alpha, zircon (Marvin and Cole, 1978) (Cretaceous).

Rocks intruded: Cambrian limestone and dolomite.

Aeromagnetic expression:

Anomaly: High (very high amplitude, elliptical).

Inferred source: A plutonic body of 10 km² maximum areal extent may underlie the southeastern part of the anomaly.

Mining activity: None.

Selected references: Coats and others, 1965; Marvin and Cole, 1978.

EL-5. Contact District

General location: Granite Range, northeastern part of county.

Coordinates: lat 41°51' N., long 114°40' W.

Land classification: Public domain, private land, and patented mining claims.

Area: 161 km².

Accessibility: The Union Pacific Railroad and U.S. Highway 93 pass between two major outcrops.

Composition: Granodiorite.

Age: 140±5 Ma, K-Ar, hornblende and 147±4 Ma, K-Ar, biotite (McDowell, 1971); 150 Ma, K-Ar, biotite (Coats and others, 1965) (Jurassic).

Rocks intruded: Paleozoic limestone and shale.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, west-trending).

Inferred source: A plutonic rock body having a maximum areal extent of 50 km² may underlie the eastern part of the anomaly.

Mining activity: None.

Selected references: Coats and others, 1965; McDowell, 1971.

EL-6. Delano Peak

General location: Northeastern part of county.

Coordinates: lat 41°38' N., long 114°15' W.

Land classification: Public domain and patented mining claims.

Area: 5 km².

Accessibility: U.S. Highway 93 and State Highway 30 pass 45 km west and 37 km southeast of the outcrop, respectively. The Southern Pacific Railroad nearly parallels State Highway 30, and the Union Pacific Railroad nearly parallels U.S. Highway 93.

Composition: Quartz monzonite and granodiorite.

Age: 134.2±1.5 Ma, K-Ar, biotite; 136.0±2.0 Ma, K-Ar, biotite (Slack, 1974) (Cretaceous).

Rocks intruded: Permian siltstone, sandstone, limestone, and dolomite.

Aeromagnetic expression:

Anomaly: High (low-amplitude, long-wavelength).

Inferred source: Unknown.

Mining activity: None.

Selected reference: Slack, 1974.

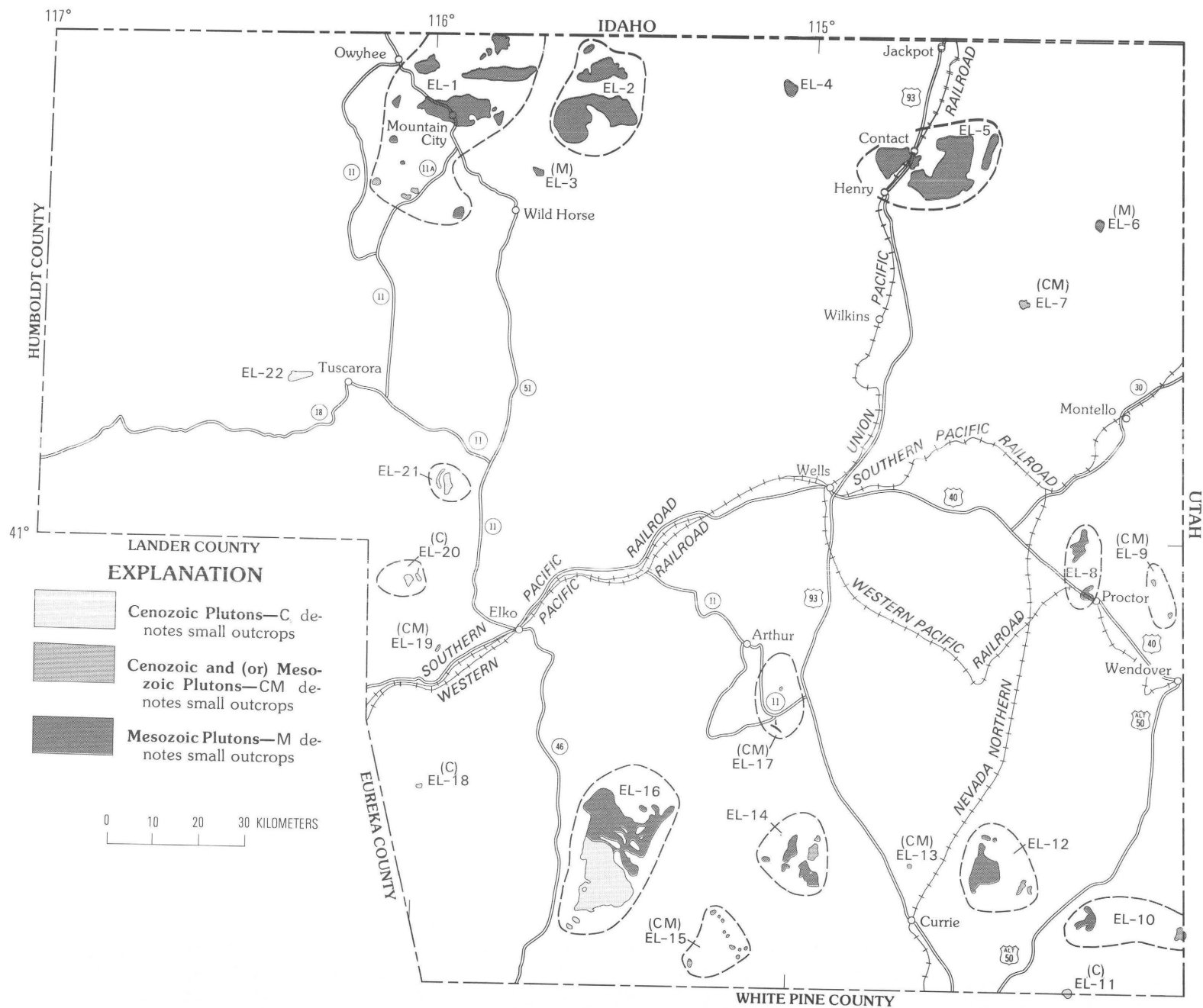


Figure 15. Locations of plutons in Elko County.

EL-7. Tony Mountain

General location: Northeastern part of county, south of Tony Mountain.

Coordinates: lat 41°29' N., long 114°27' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: The intrusive body is 24.5 km east of U.S. Highway 93 and 28.5 km east of the Union Pacific Railroad. The Southern Pacific Railroad passes about 30 km to the south, and State Highway 30 traverses a mountain pass 44 km to the south.

Composition: Granodiorite, quartz monzonite.

Age: Jurassic-Tertiary(?).

Rocks intruded: Permian limestone, dolomite, shale, and sandstone.

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Granger and others, 1957.

EL-8. Silver Zone Pass

General location: Northern Toana Range.

Coordinates: lat 40°57' N., long 114°18' W.

Land classification: Public domain and private land (railroad).

Area: 16 km².

Accessibility: The north exposure is 27 km southwest of Montello and 54.5 km southeast of Wells. The south exposure lies 27.5 km northwest of the border town of Wendover.

Composition: Granodiorite.

Age: 124±5 Ma, K-Ar, biotite (McDowell, 1971); 150 Ma, K-Ar, biotite (Coats and others, 1965) (Jurassic and Cretaceous).

Rocks intruded: Cambrian and Ordovician limestone, dolomite, quartzite, shale, and siltstone.

Aeromagnetic expression:

Anomaly: Low (low-amplitude, long-wavelength).

Inferred source: Unknown.

Mining activity: None.

Selected references: Coats and others, 1965; McDowell, 1971.

EL-9. Southern Pilot Range

General location: Along the east border of the county at the Utah State line and north of Wendover.

Coordinates: lat 40°54' N., long 114°06' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: The outcrops lie approximately 11 km northeast of U.S. Highway 40 and 13 km northeast of the Western Pacific Railroad.

Composition: Granite.

Age: Jurassic-Tertiary(?).

Rocks intruded: Mississippian and Pennsylvanian limestone, dolomite, siltstone, and sandstone.

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Granger and others, 1957.

EL-10. White Horse Flat

General location: Extreme southeastern part of county.

Coordinates: lat 40°16' N., long 114°16' W.

Land classification: Public domain and patented mining claims.

Area: 10 km².

Accessibility: U.S. Highway Alternate 50 crosses Antelope Valley 5 km northwest of the west exposure. The Nevada Northern Railroad passes through Currie about 35 km west of the exposure.

Composition: Quartz monzonite.

Age: 140 (+21, -7) Ma, K-Ar, biotite (Schilling, 1965) (Jurassic; parts of pluton could be Jurassic-Tertiary).

Rocks intruded: Mississippian and Pennsylvanian limestone, dolomite, siltstone, and sandstone.

Aeromagnetic expression:

Anomaly: High (high-amplitude, elongate, northwest-trending).

Inferred source: Plutonic rocks having a maximum areal extent of about 50 km².

Mining activity: None.

Selected references: Schilling, 1965; Armstrong, 1966.

EL-11. Kingsley Mountains

General location: Extreme southeastern part of county, south end of Kingsley Mountains.

Coordinates: lat 40°07' N., long 114°21' W.

Land classification: Public domain and patented mining claims.

Area: 2 km².

Accessibility: The exposure is 10 km southeast of U.S. Highway 50 Alternate and 31 km east of the Nevada Northern Railroad.

Composition: Quartz monzonite.

Age: 33.4±0.7 Ma, K-Ar, biotite (McKee and Marvin, 1976); 35 Ma, K-Ar, biotite; and 40 Ma, lead-alpha, zircon (Schilling, 1965) (Tertiary).

Rocks intruded: Cambrian dolomite and limestone.

Aeromagnetic expression: None.

Mining activity: None.

Selected references: McKee and Marvin, 1976; Schilling 1965.

EL-12. Dolly Varden Mountains

General location: Southeastern part of county, northern Antelope Range.

Coordinates: lat 40°21' N., long 114°32' W.

Land classification: Public domain and mining claims.

Area: 39 km².

Accessibility: The main mass occurs 7 km southeast of the Nevada Northern Railroad, 15.5 km northeast of U.S. Highway 93, and 15 km northwest of U.S. Highway Alternate 50.

Composition: Monzonite and syenite.

Age: 125 (+19, -6) Ma, K-Ar, biotite-hornblende (Schilling, 1965) (Cretaceous; parts of pluton could be Jurassic-Tertiary).

Rocks intruded: Permian limestone and shale.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, northwest-trending).

Inferred source: Plutonic rocks having a maximum areal extent of about 50 km².

Mining activity: Copper has been mined.

Selected reference: Schilling, 1965.

EL-13. Currie

General location: North of Currie, in southeastern part of county.

Coordinates: lat 40°22' N., long 114°46' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: U.S. Highway 93 is 4 km west and the Nevada Northern Railroad passes 6 km east of the exposure.

Composition: Granodiorite.

Age: Jurassic-Tertiary.

Rocks intruded: Overlain by Tertiary volcanics.

Aeromagnetic expression:

Anomaly: West flank of high associated with the Dolly Varden pluton.

Inferred source: Rocks of the Currie and Dolly Varden pluton may be connected at depth, despite observed contrasts of mineralogic and petrologic composition.

Mining activity: None.

Selected reference: Granger and others, 1957.

EL-14. Delcer Buttes

General location: Northwest of Currie.

Coordinates: lat 40°23' N., long 115°03' W.

Land classification: Public domain.

Area: 37 km².

Accessibility: The eastern exposures lie 11 km west of U.S. Highway 93, and the Nevada Northern Railroad passes through Currie 22 km southeast of the largest outcrop.

Composition: Granodiorite and quartz monzonite.

Age: 149 Ma, K-Ar, biotite (Armstrong and Suppe, 1973) (Jurassic; parts of pluton could be Jurassic-Tertiary).

Rocks intruded: Permian limestone, dolomite, shale, and sandstone.

Aeromagnetic expression:

Anomaly: High (long-wavelength).

Inferred source: Plutonic rocks having a maximum areal extent of about 150 km².

Mining activity: None.

Selected reference: Armstrong and Suppe, 1973.

EL-15. Maverick Springs Range

General location: Northern Maverick Springs Range.

Coordinates: lat 40°15' N., long 115°15' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: U.S. Highway 93 is about 40 km northeast of central outcrop.

Composition: Granodiorite, quartz monzonite.

Age: Jurassic-Tertiary.

Rocks intruded: Permian limestone, dolomite, shale, siltstone, and sandstone.

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Granger and others, 1957.

EL-16. Southern Ruby Mountains

General location: Southern Ruby Mountains.

Coordinates: lat 40°23' N., long 115°32' W.

Land classification: Humboldt National Forest (northwest edge of body is designated as private land).

Area: 253 km².

Accessibility: State Highway 46 is 5 km west of the exposure.

Composition: Granite.

Age: 26 to 30 Ma, K-Ar, biotite; 30 to 40 Ma, lead-alpha, zircon (Schilling, 1965) (Tertiary; parts of the pluton could be Jurassic-Tertiary).

Rocks intruded: Devonian limestone, sandstone, quartzite, and Mesozoic metasedimentary rocks.

Aeromagnetic expression: None.

Mining activity: None.

Selected references: Coats and others, 1965; Schilling, 1965; Sharp, 1942.

EL-17. East Humboldt

General location: Southern East Humboldt Range.
Coordinates: lat 40°41' N., long 115°06' W.
Land classification: Humboldt National Forest, private land, and public domain.
Area: 2 km².
Accessibility: State Highway 11 passes within 5 km of the outcrops and connects with U.S. Highway 93 about 5 km east of the area.
Composition: Diorite.
Age: Jurassic-Tertiary.
Rocks intruded: Permian siltstone, sandstone, limestone, and dolomite and Triassic siltstone and limestone.
Aeromagnetic expression: None.
Mining activity: None.
Selected reference: Granger and others, 1957.

EL-18. Railroad Mining District

General location: Southwest edge of county.
Coordinates: lat 40°31' N., long 116°01' W.
Land classification: Public domain, private land, and patented mining claims.
Area: 2 km².
Accessibility: The outcrop is about 28 km southwest of State Highway 51.
Composition: Quartz monzonite.
Age: 33 (+5, -2) Ma, K-Ar, biotite (Schilling, 1965); 37.3±1.9 Ma, K-Ar, biotite (Marvin and Dobson, 1979) (Tertiary).
Rocks intruded: Paleozoic shale, siltstone, sandstone, limestone, quartzite, and conglomerate.
Aeromagnetic expression:
Anomaly: High (high-amplitude, equidimensional, steep north flank).
Inferred source: Plutonic rocks having a maximum areal extent of about 15 km².
Mining activity: None.
Selected references: Schilling, 1965; Marvin and Dobson, 1979; Armstrong, 1966.

EL-19. Adobe Range

General location: West of Elko.
Coordinates: lat 40°48' N., long 115°59' W.
Land classification: Private land.
Area: 2 km².
Accessibility: The exposure lies 4 km northwest of U.S. Highway 40 (Interstate 80) and the Southern Pacific and Western Pacific Railroads.
Composition: Granodiorite(?).
Age: Jurassic-Tertiary.

Rocks intruded: Pennsylvanian and Permian limestone, conglomerate, and siltstone and Devonian and Mississippian shale, siltstone, sandstone, and conglomerate.

Aeromagnetic expression:

Anomaly: High (low-amplitude, circular).

Inferred source: Plutonic rocks having a maximum areal extent of about 10 km².

Mining activity: None.

Selected reference: Granger and others, 1957.

EL-20. Swales Mountain

General location: Southernmost peak of the Independence Mountains.
Coordinates: lat 40°56' N., long 116°03' W.
Land classification: Public domain and private land.
Area: 5 km².
Accessibility: State Highway 11 (also called 51) passes 12 km east, and U.S. Highway 40 (Interstate 80) is 19 km southeast of the outcrops.
Composition: Quartz monzonite and granodiorite with some diorite.
Age: 38.3±1.3 Ma, K-Ar, biotite (Evans and Ketner, 1971) (Tertiary).
Rocks intruded: Vinini (Ordovician—chert and shale) and Roberts Mountains Formations (Silurian and Devonian—limestone).
Aeromagnetic expression:
Anomaly: High (low-amplitude, circular).
Inferred source: Plutonic rocks having a maximum areal extent of about 10 km².
Mining activity: None.
Selected reference: Evans and Ketner, 1971.

EL-21. Nannie's Peak

General location: Northwest of Elko at Lone Mountain.
Coordinates: lat 41°07' N., long 115°58' W.
Land classification: Public domain and private land.
Area: 8 km².
Accessibility: The main mass occurs 7.5 km west of State Highway 11 (also called 51).
Composition: Quartz monzonite.
Age: 12 Ma, K-Ar, no mineral indicated in reference (Lovejoy, 1959) (Tertiary).
Rocks intruded: McClellan Creek sequence (Devonian—limestone).
Aeromagnetic expression:
Anomaly: High (high-amplitude).
Inferred source: Plutonic rocks having a maximum areal extent of about 15 km².
Mining activity: None.
Selected reference: Lovejoy, 1959.

EL-22. Dry Creek Mountain

General location: West of Tuscarora.

Coordinates: lat 41°19' N., long 116°20' W.

Land classification: Public domain and private land.

Area: 7 km².

Accessibility: The east margin of the body lies about 8 km west of State Highway 18 and 17.5 km west-northwest of the intersection of Highway 18 and State Highway 11.

Composition: Granodiorite.

Age: 38.4±1.5 Ma, K-Ar, biotite (McKee and Marvin, 1976) (Tertiary).

Rocks intruded: Ordovician chert, shale, quartzite, greenstone, limestone, and volcanic rock.

Aeromagnetic expression:

Anomaly: High (high-amplitude).

Inferred source: Granitic rocks having a maximum areal extent of about 75 km².

Mining activity: None.

Selected reference: McKee and Marvin, 1976.

HUMBOLDT COUNTY

Geology

Humboldt County (fig. 16) is located in the northwestern part of the State. The southern and central parts of the county have topography typical of the Basin and Range province. The northeastern part of the county, a broad plateau underlain by volcanic rocks, is the southern extension of the Columbia Plateaus province. The northwestern part of the county is also a broad plateau that appears to be a transition zone between the Columbia Plateaus province on the north and the Basin and Range province on the south (Willden, 1964).

Rocks of Cambrian, Ordovician, Mississippian, Pennsylvanian, Permian, Triassic, Jurassic(?), Cretaceous, and Tertiary ages are found in the county.

The Cambrian, Ordovician, Mississippian, and Pennsylvanian rocks are in the southeastern part of the county and consist of clastic sedimentary rocks, with some carbonate and basic volcanic rocks. The Permian rocks consist of carbonate rocks, sandstone, chert, shale, conglomerate, and basic volcanic rocks (Willden, 1964). Triassic rocks are found in the central part of the county and consist of fine-grained clastic rocks and some quartzite and limestone. Cretaceous rocks that occur throughout the county consist of sandstone, siltstone, conglomerate, and granitic intrusives. Tertiary rocks consist of rhyolitic to dacitic welded tuff and lava flows.

The regional structure of the county is not well known. Four periods of compressive deformation have affected the area (Willden, 1964), followed by normal faulting during the Tertiary. The Paleozoic rocks were folded and thrust faulted during the Antler orogeny (Late Devonian and Early Mississippian time) and again in Permian time. Triassic rocks were then folded and thrust faulted, followed by deformation of Cretaceous rocks in Late Cretaceous or early Tertiary time. Tertiary basin-and-range faults were superposed on the older structural complex.

The Oregon-Nevada lineament, in the northeastern part of the county, consists of closely spaced, partly en echelon faults that extend from Oregon into Nevada. The segment of the lineament in Nevada is composed of closely spaced north-northwest-trending faults.

The geologic data were summarized from Willden (1964).

Plutons

H-1. Disaster Peak

General location: Northern part of the Trout Creek Mountains (Montana Mountains) near Disaster Peak.

Coordinates: lat 41°51' N., long 118°11' W.

Land classification: Public domain.

Area: 93 km².

Accessibility: 31 km east of State Highway 140 and 37 km west of U.S. Highway 95.

Composition: Granodiorite.

Age: Cretaceous.

Rocks intruded: Overlain by Tertiary volcanics.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude, northwest-trending series).

Inferred source: Plutonic rocks having a maximum areal extent about the same as that of exposure.

Mining activity: None.

Selected reference: Willden, 1964.

H-2. Bilk Creek Mountains (Kings River Range)

General location: Northern part of the Bilk Creek Mountains (Kings River Range).

Coordinates: lat 41°52' N., long 118°30' W.

Land classification: Predominantly public domain.

Area: 131 km².

Accessibility: State Highway 140 borders the western outcrop.

Composition: Granodiorite.

Age: 90.6 ± 3.2 Ma, K-Ar, biotite (Smith and others, 1971) (Cretaceous).

Rocks intruded: Overlain by Tertiary volcanic rocks.

Aeromagnetic expression:

Anomaly: Highs (short-wavelength).

Inferred source: Basaltic flows and ash-flow tuff.

Mining activity: None.

Selected reference: Smith and others, 1971.

H-3. Pueblo Mountains

General location: East flank of the Pueblo Mountains.

Coordinates: lat $41^{\circ}59'$ N., long $118^{\circ}41'$ W.

Land classification: Public domain and patented mining claims.

Area: 4 km^2 .

Accessibility: 3 km north of State Highway 140.

Composition: Quartz monzonite.

Age: 92.4 ± 1.3 Ma, K-Ar, biotite (Harrold, 1972) (Cretaceous).

Rocks intruded: Permian and Triassic chlorite schist, hornfels, quartz-mica schist, and marble.

Aeromagnetic expression:

Anomaly: High (short-wavelength, doubly lobed).

Inferred source: Composite extrusive and intrusive rocks.

Mining activity: None.

Selected reference: Harrold, 1972.

H-4. Duffer Peak

General location: Duffer Peak, Pine Forest Range.

Coordinates: lat $41^{\circ}40'$ N., long $118^{\circ}45'$ W.

Land classification: Public domain and private land.

Area: 364 km^2 .

Accessibility: Northernmost outcrop is 1 km south of State Highway 140, southernmost outcrop is 26 km west of State Highway 140.

Composition: Granodiorite and quartz diorite.

Age: 93.6 ± 1.5 Ma, 101 ± 2.0 Ma, and 107 ± 2.1 Ma, K-Ar, biotite-quartz diorite (Harrold, 1972); 160 ± 2.0 Ma, lead-alpha, zircon-granodiorite (Marvin and Dobson, 1979) (Jurassic and Cretaceous).

Rocks intruded: Happy Creek Volcanic Complex (Triassic? and Jurassic) and Triassic and Jurassic limestone, phyllite, slate, and quartzite.

Aeromagnetic expression:

Anomaly: Highs and lows arranged in a complex pattern.

Inferred source: The highest amplitude anomalies are associated with diorite; lower amplitude anomalies are associated with granodiorite.

Mining activity: None.

Selected references: Harrold, 1972; Marvin and Dobson, 1979.

H-5. Santa Rosa Peak

General location: Santa Rosa Peak, central part of the Santa Rosa Range.

Coordinates: lat $41^{\circ}32'$ N., long $117^{\circ}38'$ W.

Land classification: Predominantly Humboldt National Forest and private land.

Area: 133 km^2 .

Accessibility: Main outcrop is 6 km east of U.S. Highway 95, and 5 km west of State Highway 8B.

Composition: Granodiorite.

Age: 97.8 ± 3 Ma, K-Ar, biotite; 99.5 ± 5 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Cretaceous).

Rocks intruded: Grass Valley Formation (Triassic—shale, quartzite, and limestone), Winnemucca Formation (Triassic—shale, slate, carbonate rocks, sandstone, and quartzite), and Raspberry Formation (Triassic—phyllite, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: Highs and lows, complexly distributed.

Inferred source: Plutonic rocks.

Mining activity: Tungsten has been mined in southern part of the Santa Rosa Range.

Selected reference: Silberman and McKee, 1971.

H-6. Osgood Mountain Stock

General location: Northern part of the Osgood Mountains at Adam Peak.

Coordinates: lat $41^{\circ}10'$ N., long $117^{\circ}15'$ W.

Land classification: Private land and public domain.

Area: 19 km^2 .

Accessibility: 32 km east of U.S. Highway 95 and 7 km north of State Highway 18.

Composition: Granodiorite.

Age: 88.3 ± 1.8 Ma, K-Ar, biotite; 89.9 ± 1.8 Ma, K-Ar, hornblende; 92 ± 1.8 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Cretaceous).

Rocks intruded: Preble Formation (Cambrian—shale, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: High (high-amplitude, elliptical, north-trending).

Inferred source: Pluton having maximum areal extent of about 5 km^2 .

Mining activity: None.

Selected references: Silberman and McKee, 1971; Silberman and others, 1974.

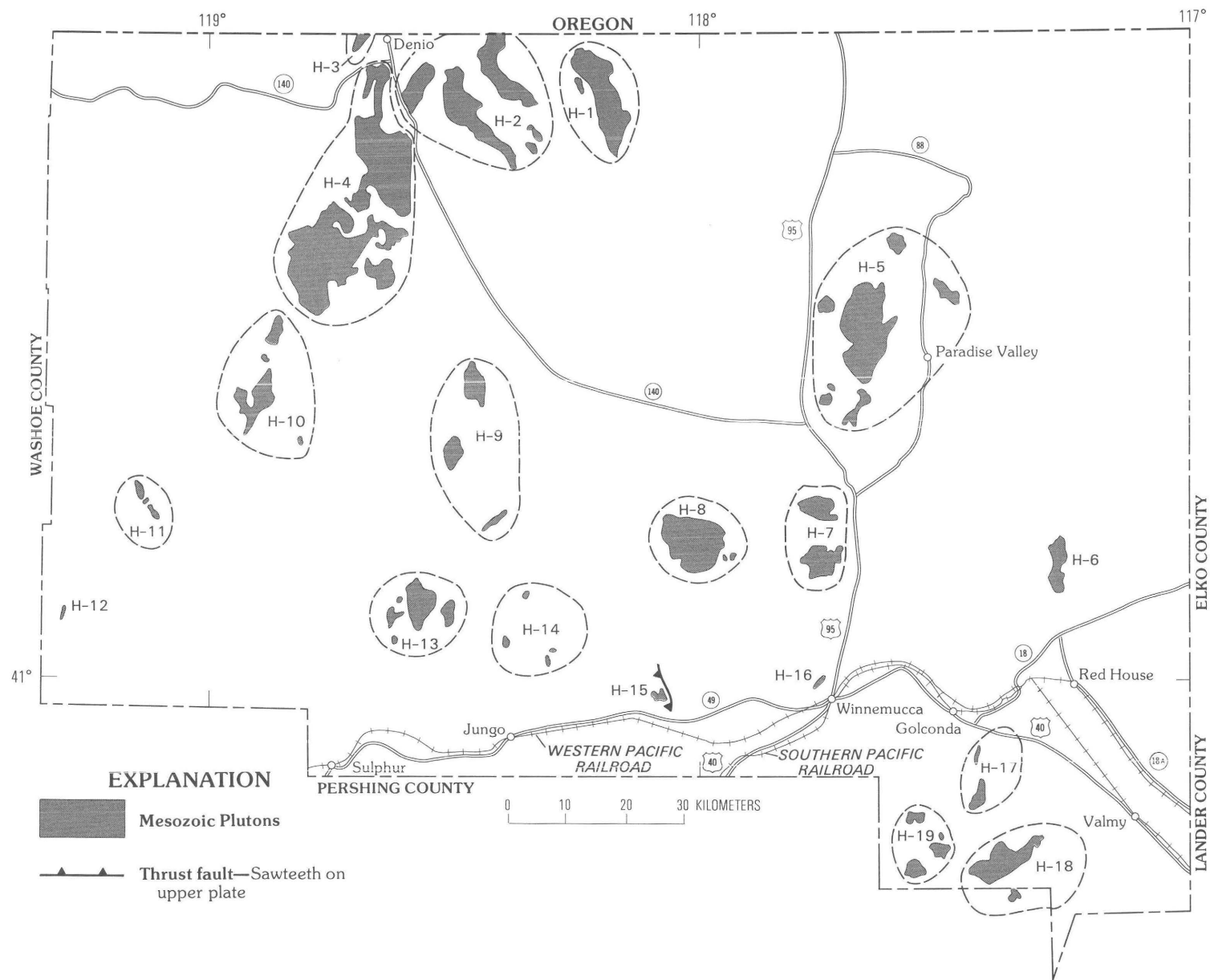


Figure 16. Locations of plutons in Humboldt County.

H-7. Bloody Run Hills

General location: Bloody Run Hills, southern part of the Santa Rosa Range.

Coordinates: lat 41°10' N., long 117°44' W.

Land classification: Private land and public domain.

Area: 37 km².

Accessibility: 2 km west of U.S. Highway 95.

Composition: Granodiorite.

Age: Cretaceous.

Rocks intruded: Singas Formation (Triassic—phyllite, limestone, and quartzite).

Aeromagnetic expression:

Anomaly: Highs (high-amplitude, oval).

Inferred source: Plutonic rocks having maximum areal extents about the same as those of exposures.

Mining activity: None.

Selected reference: Willden, 1964.

H-8. Slumbering Hills

General location: Central part of the Slumbering Hills.

Coordinates: lat 41°13' N., long 118°00' W.

Land classification: Public domain and private land.

Area: 76 km².

Accessibility: 23 km west of U.S. Highway 95.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Triassic and Jurassic phyllite, slate, and quartzite.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength, west-trending).

Inferred source: Plutonic rocks that appear to extend westward 20 km and southward 10 km; may be connected to Jungo Hills pluton of H-14, 25 km to the southwest; maximum areal extent of subsurface plutonic rocks is about 200 to 300 km².

Mining activity: Gold has been mined just north of pluton.

Selected reference: Willden, 1964.

H-9. Northern Jackson Mountains

General location: Northern part of the Jackson Mountains.

Coordinates: lat 41°22' N., long 118°28' W.

Land classification: Public domain, private land, and patented mining claims.

Area: 32 km².

Accessibility: Northern outcrop 9 km southwest of State Highway 140, southern outcrop 22 km southwest of State Highway 140.

Composition: Granodiorite and diorite.

Age: 170±2.0 Ma, lead-alpha, zircon (Marvin and Dobson, 1979) (Jurassic).

Rocks intruded: Permian and Triassic volcanic and sedimentary rocks, Happy Creek Volcanic complex (Triassic? and Jurassic), and King Lear Formation (Cretaceous—conglomerate, siltstone, graywacke, and limestone).

Aeromagnetic expression:

Anomaly: Highs (high-amplitude, northeast-trending).

Inferred source: Plutonic rocks having a maximum areal extent of about 35 km².

Mining activity: None.

Selected reference: Marvin and Dobson, 1979.

H-10. Battle Creek

General location: East flank of the northern part of the Black Rock Range.

Coordinates: lat 41°26' N., long 118°53' W.

Land classification: Public domain and private land.

Area: 34 km².

Accessibility: 40 km southwest of State Highway 140.

Composition: Granodiorite.

Age: 96.3±3.5 Ma, K-Ar, biotite (Smith and others, 1971) (Cretaceous).

Rocks intruded: Overlain by Tertiary volcanic rocks.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Intrusive and extrusive rocks.

Mining activity: None.

Selected reference: Smith and others, 1971.

H-11. Pahute Peak

General location: Within the Black Rock Range.

Coordinates: lat 41°17' N., long 119°07' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: 24 km northeast of State Highway 34 (Washoe County).

Composition: Granodiorite.

Age: 170±20 m.y., lead-alpha, zircon (Marvin and Dobson, 1979) (Jurassic).

Rocks intruded: Overlain by Tertiary volcanic and sedimentary rock.

Aeromagnetic expression:

Anomaly: High (high-amplified, long-wavelength, northwest-trending).

Inferred source: Extrusive and intrusive rocks.

Mining activity: None.

Selected reference: Marvin and Dobson, 1979.

H-12. Donnelly Peak

General location: Calico Mountains.
Coordinates: lat 41°06' N., long 119°16' W.
Land classification: Public domain.
Area: 2 km².
Accessibility: 8 km east of State Highway 34 (Washoe County).
Composition: Granodiorite.
Age: Cretaceous(?).
Rocks intruded: Triassic and Jurassic phyllite, slate, and quartzite.
Aeromagnetic expression:
Anomaly: High (high-amplitude, short-wavelength, elliptical).
Inferred source: Plutonic rocks having a maximum areal extent of from 1 to 5 km².
Mining activity: None.
Selected reference: Willden, 1964.

H-13. Navajo Peak

General location: Southern part of the Jackson Mountains at Navajo Peak.
Coordinates: lat 41°08' N., long 118°32' W.
Land classification: Public domain and private land.
Area: 38 km².
Accessibility: 22 km north of State Highway 49, and 18 km north of Western Pacific Railroad.
Composition: Granodiorite, diorite, and some syenite.
Age: Cretaceous(?).
Rocks intruded: Permian and Triassic volcanic and sedimentary rocks, Happy Creek Volcanic complex (Triassic? and Jurassic), and King Lear Formation (Cretaceous—conglomerate, siltstone, graywacke, and limestone).
Aeromagnetic expression:
Anomaly: High (high-amplitude).
Inferred source: Plutonic rocks having an areal extent about the same as that of exposures.
Mining activity: Gold has been mined near pluton.
Selected reference: Willden, 1964.

H-14. Jungo Hills

General location: Jungo Hills, southwest of Desert Valley.
Coordinates: lat 41°04' N., long 118°22' W.
Land classification: Public domain and private land.
Area: 3 km².
Accessibility: Southern outcrop is 13 km north of State Highway 49 and Western Pacific Railroad.
Composition: Granodiorite and diorite.
Age: Jurassic and Cretaceous.

Rocks intruded: Permian and Triassic volcanic and sedimentary rocks and Happy Creek Volcanic Complex (Triassic? and Jurassic).

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength) that noses southwestward from high of Slumbering Hills pluton (H-8).

Inferred source: Plutonic rocks; maximum areal extent associated with steepest gradients is about 15 km².

Mining activity: None.

Selected reference: Willden, 1964.

H-15. Blue Mountain

General location: Southwest flank of Blue Mountain.
Coordinates: lat 40°59' N., long 118°03' W.
Land classification: Private land and public domain.
Area: 3 km².
Accessibility: 2 km north of State Highway 49 and 4 km north of Western Pacific Railroad.
Composition: Diorite.
Age: Jurassic and Cretaceous.
Rocks intruded: Triassic and Jurassic phyllite, slate, and quartzite.
Aeromagnetic expression:
Anomaly: High (high-amplitude, northwest-trending).
Inferred source: Plutonic rocks having a maximum areal extent of about 10 km².
Mining activity: None.
Selected reference: Willden, 1964.

H-16. Winnemucca Mountain

General location: Southeast flank of Winnemucca Mountain, approximately 4 km northwest of Winnemucca.
Coordinates: lat 41°00' N., long 117°44' W.
Land classification: Private land and public domain.
Area: 1 km².
Accessibility: 2 km west of Interstate Highway 95, 2 km northwest of State Highway 49, and 4 km northwest of Western Pacific and Southern Pacific Railroads.
Composition: Diorite.
Age: Jurassic and Cretaceous.
Rocks intruded: Winnemucca Formation (Triassic—shale, sandstone, limestone, and quartzite).
Aeromagnetic expression:
Anomaly: High (low-amplitude, nose).
Inferred source: Unknown.
Mining activity: None.
Selected reference: Willden, 1964.

H-17. Edna Mountain

General location: Northwest of Pumpernickel Valley.
Coordinates: lat 40°49' N., long 117°24' N.

Land classification: Public domain and private land.

Area: 5 km².

Accessibility: Main outcrop is 8 km southwest of U.S. Highway 40 and 12 km south of Southern Pacific Railroad.

Composition: Granodiorite.

Age: 101 Ma, K-Ar, biotite; 106 Ma, K-Ar, biotite and hornblende; and 104 Ma, K-Ar, muscovite (Erickson and others, 1978)(Cretaceous).

Rocks intruded: Edna Mountain Formation (Permian—sandstone and quartzite), Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics), and Antler Peak Limestone (Pennsylvanian and Permian).

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength, oval).

Inferred source: Plutonic rocks having maximum areal extent of about 5 km².

Mining activity: None.

Selected reference: Erickson and others, 1978.

H-18. Buffalo Mountain

General location: Southeast of Pumpernickel Valley.

Coordinates: lat 40°43' N., long 117°21' W.

Land classification: Public domain.

Area: 38 km².

Accessibility: 14 km southwest of U.S. Highway 40 and the Southern Pacific Railroad.

Composition: Granodiorite.

Age: 145±3 Ma, K-Ar, hornblende; 151±3 Ma, K-Ar, biotite; 153±3 Ma, K-Ar, biotite; and 157±3 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Jurassic).

Rocks intruded: Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics), Havallah Formation (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone), Cane Spring Formation (Triassic—limestone and dolomite), and Augusta Mountain Formation (Triassic—limestone and dolomite).

Aeromagnetic expression:

Anomaly: High (high-amplitude, chevron-shaped).

Inferred source: Plutonic rocks having a maximum areal extent of about 10 km².

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

H-19. Gregg Canyon

General location: East flank of the Sonoma Range.

Coordinates: lat 40°43' N., long 117°32' W.

Land classification: Private land and public domain.

Area: 13 km².

Accessibility: Northernmost outcrop is 17 km southwest of U.S. Highway 40 and 18 km southeast of Southern Pacific Railroad.

Composition: Granodiorite.

Age: 104±2 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Cretaceous).

Rocks intruded: Osgood Mountain Quartzite (Cambrian?), Preble Formation (Cambrian—shale, limestone, and quartzite), Valmy Formation (Ordovician—shale, quartzite, and greenstone), Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics), and Havallah Formation (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone).

Aeromagnetic expression:

Anomaly: High (high-amplitude, northwest-trending).

Inferred source: Plutonic rocks having a maximum areal extent of about 15 km².

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

PERSHING COUNTY

Geology

Pershing County (fig. 17) is located in the northwestern part of the State. The county is characterized by north-northeast-trending mountain ranges separated by narrow valleys.

The county is underlain by sedimentary, metamorphic, and igneous rocks of Cambrian to Holocene age. The Cambrian, Ordovician, Mississippian, Pennsylvanian, and Permian rocks are found in the eastern part of the county. They consist predominantly of clastic sedimentary, some carbonate, and minor volcanic rocks. Triassic and Jurassic rocks are found throughout the county and consist of clastic sedimentary rocks, some carbonate and volcanic rocks, granodiorite, leucogranite, and quartz monzonite intrusives.

The Cretaceous rocks are granodiorite and quartz monzonite intrusives. No sedimentary rocks of Cretaceous age are present in the county. Tertiary rocks in the county consist of tuff, lava flows, breccia of

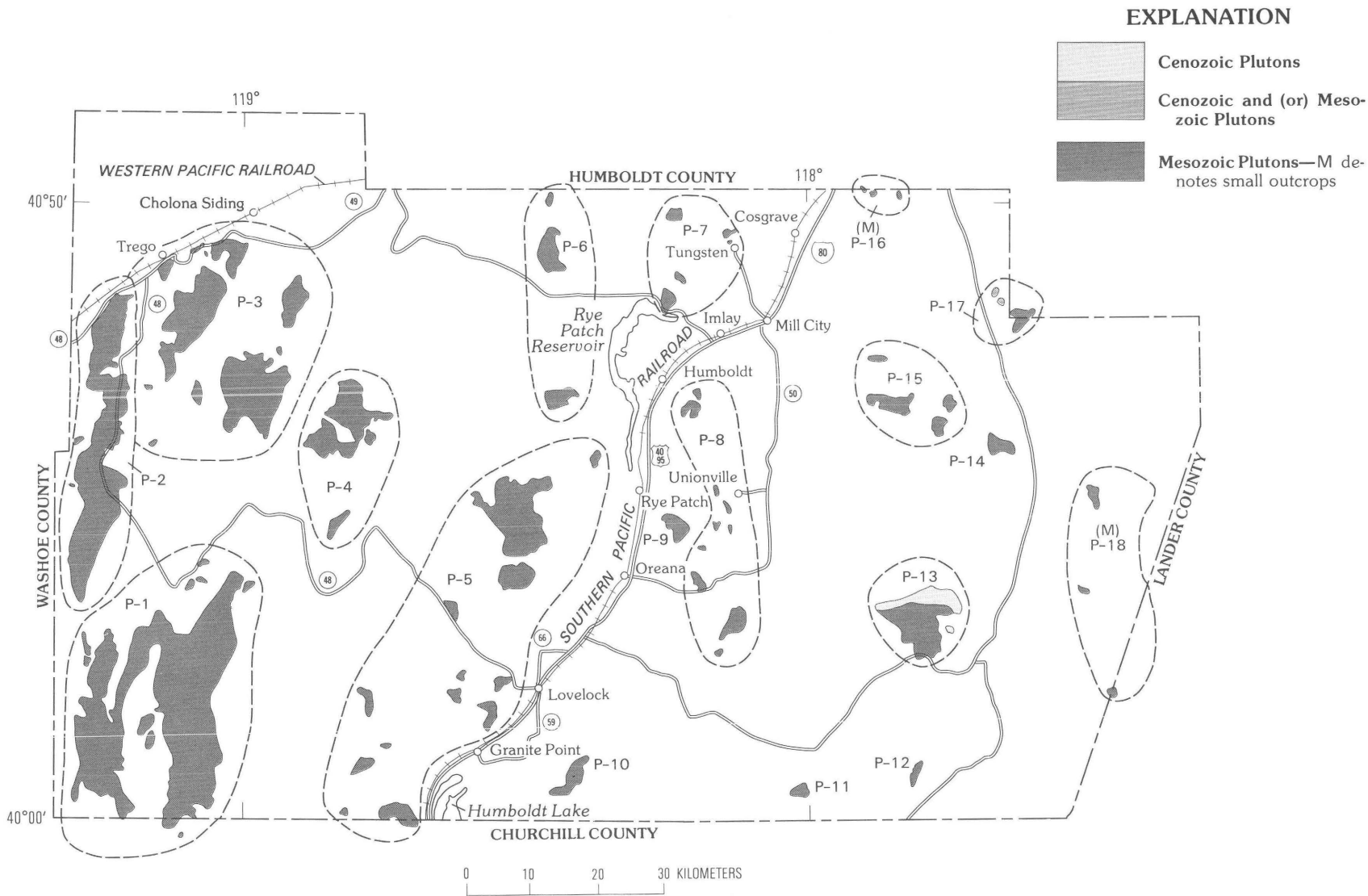


Figure 17. Locations of plutons in Pershing County.

rhyolitic, andesitic, and basaltic composition, and sedimentary rocks. Basaltic flows of Tertiary and Quaternary age are also present.

The area has undergone four major periods of deformation that caused folding, thrusting, and high-angle normal faulting (Johnson, 1977). The periods of deformation are: (1) Antler orogeny of Late Devonian and Early Mississippian age, (2) Sonoma orogeny of Late Permian and Early Triassic age, (3) Nevadan orogeny of Jurassic and Cretaceous age, and (4) basin and range deformation of Tertiary and Quaternary age.

The geologic information was summarized from Johnson (1977) and Tatlock (1969).

Plutons

P-1. Nightingale-Shawave

General location: Nightingale and Shawave Mountains, southwestern part of the county.

Coordinates: lat 40°10' N., long 119°07' W.

Land classification: Public domain, with some private lands.

Area: 402 km².

Accessibility: Westernmost exposure is 7 km east of State Highway 34 (Washoe County). The northern part of the major exposure is 4 km south of State Highway 48.

Composition: Granodiorite.

Age: 90.2±6.1 Ma, K-Ar, biotite and 91.3±3.8 Ma, K-Ar, hornblende (Smith and others, 1971) (Cretaceous).

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, and carbonate.

Aeromagnetic expression:

Anomaly: Highs.

Inferred source: Northwest extension of highs at the north margin of the exposures may be underlain by plutonic rocks having a maximum areal extent of about 50 km².

Mining activity: None.

Selected references: Tatlock, 1969; Smith and others, 1971.

P-2. Selenite

General location: Selenite Range, western part of the county.

Coordinates: lat 40°30' N., long 119°15' W.

Land Classification: Public domain and private land.

Area: 193 km².

Accessibility: 6 km east of State Highway 34 and 0.5 km south of the Western Pacific Railroad tracks. State Highway 48 intersects the northern and central part of the exposed pluton.

Composition: Granodiorite.

Age: 91.2±3.1 Ma, K-Ar, biotite; 93.9±6 Ma, K-Ar, hornblende (Smith and others, 1971) (Cretaceous).

Rocks intruded: Permian volcanic and sedimentary rocks and Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: Highs (north-trending belt).

Inferred source: Plutonic rocks having areal extent about the same as that of exposures.

Mining activity: Gypsum has been mined on the west flank and in central part of the Selenite Range.

Selected reference: Smith and others, 1971.

P-3. Heineke

General location: Pahsupp Mountain area.

Coordinates: lat 40°35' N., long 119°00' W.

Land classification: Public domain.

Area: 198 km².

Accessibility: 0.5 km south of Western Pacific Railroad, and northern exposure intersected by State Highway 49.

Composition: Granodiorite.

Age: Cretaceous.

Rocks intruded: Permian volcanic and sedimentary rocks and Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength).

Inferred source: Plutonic rocks probably connected to Selenite pluton (P-2); maximum areal extent is about 75 to 100 km².

Mining activity: None.

Selected references: Johnson, 1977; Tatlock, 1969.

P-4. Seven Troughs

General location: Seven Troughs Range, western half of the county.

Coordinates: lat 40°33' N., long 118°48' W.

Land classification: Public domain and patented mining claims.

Area: 67 km².

Accessibility: Central exposure is 11 km northwest of State Highway 48.

Composition: Granodiorite with some leucogranite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Plutonic rocks having a maximum areal extent of from 200 to 300 km².

Mining activity: Gold and silver have been mined along east flank of mountain range.

Selected references: Johnson, 1977; Tatlock, 1969.

P-5. Trinity Range

General location: Trinity Range, central and south-central parts of the county.

Coordinates: lat 40°24' N., long 118°30' W.

Land classification: Public domain, private land, and Bureau of Reclamation withdrawals.

Area: 150 km².

Accessibility: Main outcrop is 13 km west of U.S. Highways 95 and 40 and the Southern Pacific Railroad, and 12 km northeast of State Highway 48.

Composition: Granodiorite.

Age: 89.6±5.9 Ma, K-Ar, hornblende (Smith and others, 1971) (Cretaceous).

Rocks intruded: Triassic and Jurassic shale, mudstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Plutonic rocks having a maximum areal extent of about 150 km².

Mining activity: Gold, diatomite, and lightweight aggregate and perlite have been mined along the Trinity Range.

Selected reference: Smith and others, 1971.

P-6. Haystack Butte

General location: Antelope Range and Majuba Mountain area.

Coordinates: lat 40°46' N., long 118°26' W.

Land classification: Public domain and private land.

Area: 26 km².

Accessibility: Main outcrop is 22 km northwest of U.S. Highways 95, 80, and 40; 21 km northwest of Southern Pacific Railroad; and 3 km north of State Highway 49.

Composition: Granodiorite.

Age: 92.0±3.9 Ma, K-Ar, hornblende; and 95.2±6.3 Ma, K-Ar, hornblende (Smith and others, 1971) (Cretaceous).

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: High (high-amplitude) associated with northern exposure. High (low-amplitude) associated with southern exposure.

Inferred source: The subsurface plutonic rocks of the northern exposure may be about 25 km² in areal extent.

Mining activity: Gold has been mined in the south end of Majuba Mountain near pluton.

Selected reference: Smith and others, 1971.

P-7. Eugene Mountains

General location: Eugene Mountains, north-central part of the county near Humboldt County line.

Coordinates: lat 40°42' N., long 118°14' W.

Land classification: Public domain and private land.

Area: 10 km².

Accessibility: Southwesternmost outcrop is 6 km northwest of Southern Pacific Railroad and 7 km northwest of U.S. Highways 95, 80, and 40. State Highway 49 intersects main outcrop.

Composition: Granodiorite.

Age: 90.0±2.7 Ma, K-Ar, biotite (Krueger and Schilling, 1971). Ages range from 66.5 to 88.9 Ma, (Tingley, 1975) (Cretaceous).

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude).

Inferred source: Plutonic rocks having a cumulative areal extent of about 35 km².

Mining activity: Tungsten has been mined in the central and southwestern part of the Eugene Mountains near the pluton.

Selected references: Krueger and Schilling, 1971; Tingley, 1975.

P-8. Humboldt Range

General location: Scattered outcrops throughout the Humboldt Range.

Coordinates: lat 40°16' N., long 118°08' W.

Land classification: Public domain, private land, and patented mining claims.

Area: 20 km².

Accessibility: Southern exposures, 18 km east of U.S. Highways 95, 80, and 40 and 19 km east of the Southern Pacific Railroad; northern exposures, 5 km east of U.S. Highways 95, 80, and 40 and 6 km east of the Southern Pacific Railroad.

Composition: Leucogranite.

Age: Triassic.

Rocks intruded: Koipato Group (Triassic—volcanic rocks) and Triassic limestone, dolomite, shale, sandstone, and conglomerate.

Aeromagnetic expression:

Anomaly: Highs (high-amplitude) in regional north-trending belt.

Inferred source: Plutonic rocks having a cumulative areal extent as great as 250 to 300 km².

Mining activity: Gold has been mined in the southwestern part of the Humboldt Range.

Selected references: Johnson, 1977; Tatlock, 1969.

P-9. Rocky Canyon Stock

General location: West flank of the Humboldt Range.

Coordinates: lat 40°24' N., long 118°13' W.

Land classification: Public domain and private land.

Area: 8 km².

Accessibility: 3 km east of the Southern Pacific Railroad and U.S. Highways 95, 80, and 40 and 8 km southeast of Rye Patch Reservoir.

Composition: Granodiorite.

Age: 73.1±3 Ma, K-Ar, biotite, and 125±15 Ma, lead-alpha, zircon (Marvin and Dobson, 1979) (Cretaceous).

Rocks intruded: Koipato Group (Triassic—volcanic rocks) and Triassic limestone, dolomite, shale, and sandstone.

Aeromagnetic expression:

Anomaly: High.

Inferred source: Plutonic rocks that appear to be connected in the subsurface to the Humboldt Range pluton (P-8).

Mining activity: None.

Selected reference: Marvin and Dobson, 1979.

P-10. West Humboldt

General location: West flank of the southern part of the West Humboldt Range.

Coordinates: lat 40°04' N., long 118°25' W.

Land classification: Public domain and private land.

Area: 9 km².

Accessibility: 6 km southeast of State Highway 59.

Composition: Granodiorite.

Age: 104±4 Ma, K-Ar, biotite (Smith and others, 1971) (Cretaceous).

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: High (low-amplitude flexure).

Inferred source: Plutonic rocks that may be connected to the Trinity Range pluton (P-5).

Mining activity: None.

Selected reference: Smith and others, 1971.

P-11. New York Canyon

General location: West flank of the Stillwater Range.

Coordinates: lat 40°03' N., long 118°01' W.

Land classification: Public domain.

Area: 4 km².

Accessibility: 38 km southeast of U.S. Highways 95, 80, and 40 and the Southern Pacific Railroad; 5 km south of an improved-surface road.

Composition: Quartz monzonite.

Age: 69±3 Ma, K-Ar, biotite (Speed and Armstrong, 1971) (Cretaceous).

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonates.

Aeromagnetic expression: None.

Mining activity: Clay has been mined in the northwestern part of the Stillwater Range.

Selected reference: Speed and Armstrong, 1971.

P-12. Stillwater

General location: East flank of the Stillwater Range.

Coordinates: lat 40°04' N., long 117°49' W.

Land classification: Public domain.

Area: 2 km².

Accessibility: 52 km southeast of U.S. Highways 95, 80, and 40 and the Southern Pacific Railroad; 4 km west of an improved-surface road.

Composition: Leucogranite.

Age: Triassic.

Rocks intruded: Koipato Group.

Aeromagnetic expression:

Anomaly: High (high-amplitude, northeast-trending).

Inferred source: Plutonic rocks having a maximum areal extent of about 50 km².

Mining activity: None.

Selected references: Johnson, 1977; Tatlock, 1969.

P-13. Granite Mountain Stock

General location: Southern part of the East Range at Granite Mountain.

Coordinates: lat 40°17' N., long 117°49' W.

Land classification: Public domain, private land, patented mining claims, and Bureau of Reclamation withdrawals.

Area: 78 km².

Accessibility: 37 km east of U.S. Highways 95, 80, and 40 and the Southern Pacific Railroad; 5 km west of an improved-surface road. A major improved-surface road also intersects the pluton.

Composition: Leucogranite and quartz monzonite.

Age: 29±1 and 30.3±2.6 Ma, K-Ar, biotite-quartz monzonite; 30±10 Ma, lead-alpha, zircon-quartz monzonite; and 180±30 Ma, lead-alpha, hornblende-leucogranite (Marvin and Dobson, 1979) (Jurassic and Tertiary).

Rocks intruded: Quartz monzonite intrudes the older leucogranite, Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics) and Havallah Formation (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone), and Koipato Group (Triassic—volcanic rocks). The leucogranite intrudes the Pumpernickel and Havallah Formations; Koipato Group; and shale, mudstone, sandstone, and carbonate of Triassic and Jurassic age.

Aeromagnetic expression:

Anomaly: High (high-amplitude, west-trending, elliptical).

Inferred source: Plutonic rocks having an areal extent about the same as that of exposures.

Mining activity: None.

Selected reference: Marvin and Dobson, 1979.

P-14. Home Creek

General location: East flank of the East Range.

Coordinates: lat 40°31' N., long 117°40' W.

Land classification: Public domain.

Area: 6 km².

Accessibility: 32 km east of State Highway 50 and 2 km west of an improved-surface road.

Composition: Leucogranite.

Age: Triassic.

Rocks intruded: Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics) and Havallah Formation (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone).

Aeromagnetic expression: None.

Mining activity: None.

Selected references: Johnson, 1977; Tatlock, 1969.

P-15. Lee Peak Stock

General location: Central part of the East Humboldt Range at Lee Peak.

Coordinates: lat 40°35' N., long 117°52' W.

Land classification: Public domain and private land.

Area: 17 km².

Accessibility: Easternmost part of the main outcrop is 13 km east of State Highway 50; 18 km southeast of U.S. Highways 95, 80, and 40; and 15 km west of an improved-surface road.

Composition: Quartz monzonite.

Age: 131±3 Ma, K-Ar, biotite; and 149±3 Ma, K-Ar, hornblende (Silberman and McKee, 1971) (Jurassic and Cretaceous).

Rocks intruded: Harmony Formation (Cambrian/sandstone, shale, limestone, and chert); Ordovician volcanic rocks; Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and

pyroclastics); Havallah Formation (Pennsylvanian and Permian—limestone, sandstone, shale, and quartzite); Triassic limestone, shale, and sandstone; and Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: High (high-amplitude, northwest-trending).

Inferred source: About 15 km north of exposures and having a maximum areal extent of about 50 km².

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

P-16. Dun Glen Peak

General location: Northern part of the East Range, near Dun Glen Peak.

Coordinates: lat 40°51' N., long 117°53' W.

Land classification: Public domain and private land.

Area: 1 km².

Accessibility: 5 km east of Interstate Highway 80 and 6 km east of Southern Pacific Railroad.

Composition: Granite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic shale, mudstone, siltstone, sandstone, and carbonate.

Aeromagnetic expression:

Anomaly: High (elongate).

Inferred source: Plutonic rocks that may extend in subsurface northward from the Lee Peak pluton (P-15).

Mining activity: Gold has been mined in the northern part of the East Range.

Selected references: Johnson, 1977; Tatlock, 1969.

P-17. Grand Trunk Canyon

General location: West flank of the Sonoma Range.

Coordinates: lat 40°41' N., long 117°38' W.

Land classification: Public domain and private land.

Area: 10 km².

Accessibility: Main outcrop is 4 km east of an improved-surface road and 35 km east of Interstate Highway 80.

Composition: Granite.

Age: Jurassic-Tertiary.

Rocks intruded: Pumpernickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics) and Havallah Formation (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone).

Aeromagnetic expression: None.

Mining activity: None.

Selected reference: Johnson, 1977, Tatlock, 1969.

P-18. Tobin

General location: Three exposures—one at the central part of the Tobin Range; the second exposure near Needle Peak, Tobin Range; and the third at Fish Creek Mountain.

Coordinates: Northernmost exposure at lat 40°28' N., long 117°30' W.

Land classification: Public domain.

Area: 5 km².

Accessibility: 48 km east of State Highway 50 and 8 km east of an improved-surface road.

Composition: Granite.

Age: 153±3 Ma, K-Ar, biotite (Silberman and McKee, 1971) (Jurassic).

Rocks intruded: Pumpnickel Formation (Pennsylvanian and Permian—chert, siltstone, and pyroclastics) and Havallah Formation (Pennsylvanian and Permian—sandstone, shale, quartzite, and limestone).

Aeromagnetic expression:

Anomaly: High (short-wavelength, elliptical).

Inferred source: Plutonic rocks having a maximum areal extent of about 1 km².

Mining activity: None.

Selected reference: Silberman and McKee, 1971.

WASHOE, STOREY, AND DOUGLAS COUNTIES AND CARSON CITY (INDEPENDENT CITY)

Geology

Washoe, Storey, and Douglas Counties and Carson City (independent city, formerly Ormsby County; fig. 18) are located along the northwest border of the State of Nevada. The three counties and Carson City have been grouped mainly because they are all situated along a transition zone between the Sierra Nevada and the Basin and Range provinces. Also, a few granitic exposures of batholithic dimensions, in adjoining counties, extend into these three counties. An example is the Carson Range, where a continuous granite mass is exposed in three counties.

Igneous, metamorphic, and sedimentary rocks, ranging in age from Permian(?) to Quaternary, are exposed within the area. The oldest rocks consist of metamorphosed volcanic and sedimentary strata that have been intruded by bodies of granitic rocks of late Mesozoic age. The Mesozoic metasediments commonly consist of slate, phyllite, metatuff, argillite, quartzite, recrystallized limestone, and hornfels. Metavolcanics include regionally and thermally metamorphosed lava

flows, breccia, and pyroclastics ranging from basalt to rhyolite in composition. Extensive areas throughout the counties are covered by Tertiary rocks, chiefly basaltic, andesitic, and rhyolitic lava flows, breccia, and pyroclastics with intercalated lenses of sedimentary rocks.

Granodiorite and quartz monzonite are the most abundant types of granitic rocks, although alaskite and granite porphyry are also present. Several quartz monzonite and granodiorite intrusions of Miocene and (or) Pliocene age are present in southern Washoe and Storey Counties. These Tertiary plutons commonly exhibit weak to intense hydrothermal alteration.

Geologic evidence indicates two main deformational episodes. The first episode began in late Mesozoic time and the second commenced in the late Tertiary, and continued into the Quaternary. Late Mesozoic structure is represented by folds, faults, and low-grade regional metamorphism prior to intrusion of granitic plutons in the Cretaceous(?) Period.

A late period of deformation probably began in the middle to late Tertiary and has continued into the Quaternary. Structural features associated with this episode include normal faults, strike-slip displacement, and folds related to strike-slip movement. The Walker Lane fault zone is the dominant Cenozoic structural element in Washoe and Storey Counties, although movement along it may have begun in Early Jurassic time. This zone of strike-slip faults extends northward through Washoe County from the vicinity of Wadsworth to Honey Lake Valley near Flanigan. The latest detectable displacement along the fault occurred in the late Pleistocene (Bonham, 1969).

Most of the geologic data summarized herein have been abstracted from Bonham (1969) and Moore (1969).

Plutons

WS-1. Granite Range

General location: North of Gerlach.

Coordinates: lat 40°46' N., long 119°23' W.

Land classification: Public and private land.

Area: 154 km².

Accessibility: State Highways 81 and 34 pass along the west and east flanks of the range, respectively. Highway 34 extends southward and connects with Interstate 80. The Western Pacific Railroad passes along the south margin.

Composition: Granodiorite.

Age: 88.8 Ma, K-Ar, biotite (Krueger and Schilling, 1971) and 91.9±6.1 Ma, K-Ar, biotite (Smith and others, 1971) (Cretaceous).

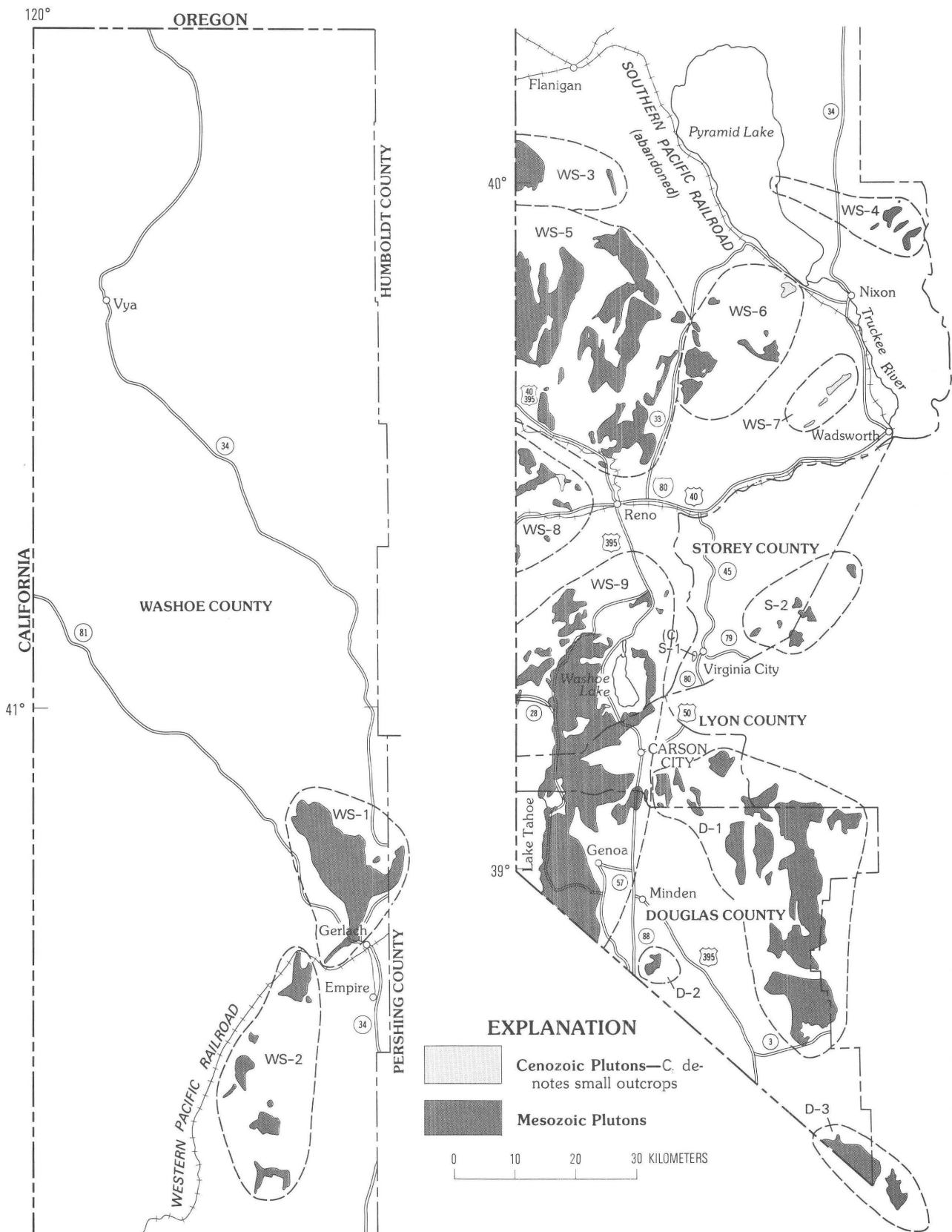


Figure 18. Locations of plutons in Washoe, Storey, and Douglas Counties and Carson City (independent city). A, north half of map area; B, south half of map area.

Rocks intruded: Permian(?) and Triassic lava flows, pyroclastics, metabasalt, metaandesite flows, and limestone.

Aeromagnetic expression:

Anomaly: High (high-amplitude, long-wavelength).

Inferred source: Pluton; an additional plutonic rock mass, having a maximum areal extent of about 50 km², is inferred to occur northeast of the mapped pluton.

Mining activity: None.

Selected references: Krueger and Schilling, 1971; Smith and others, 1971.

WS-2. Fox Range

General location: Southwest of Gerlach.

Coordinates: lat 40°34' N., long 119°33' W.

Land classification: Public domain. The southernmost exposure is on the Pyramid Lake Indian Reservation.

Area: 79 km².

Accessibility: State Highway 34 passes 13 km east of the westernmost exposure. The Western Pacific Railroad passes along the west flank of the range within 4 km of the western outcrops and adjacent to the northernmost exposure.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Nightingale sequence (Triassic and Jurassic—slate, phyllite, hornfels, limestone, and dolomite).

Aeromagnetic expression:

Anomaly: High (high-amplitude) associated with northernmost exposure.

Inferred source: Unknown.

Mining activity: None.

Selected references: Bonham, 1969; Moore, 1969.

WS-3. Fort Sage Mountains

General location: West of Pyramid Lake, along California State line.

Coordinates: lat 40°01' N., long 119°57' W.

Land classification: Public domain and private land.

Area: 31 km².

Accessibility: The main exposure is 30 km northwest of State Highway 33 and 10 km south of the Western Pacific Railroad.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Overlain by Pyramid sequence (Tertiary—volcanics) and Santiago Canyon Tuff (Tertiary).

Aeromagnetic expression:

Anomaly: High (high-amplitude, northwest-trending).

Inferred source: Intrusive and extrusive rocks.

Mining activity: None.

Selected reference: Gianella, 1957.

WS-4. Nightingale District (Truckee Range)

General location: East of Pyramid Lake (includes isolated exposure along the east shoreline of Pyramid Lake).

Coordinates: lat 39°56' N., long 119°16' W.

Land classification: Public domain and private land. Westernmost outcrop lies on the Pyramid Lake Indian Reservation.

Area: 12 km².

Accessibility: State Highway 34 is 7.5 km west of the main eastern exposure and the Southern Pacific Railroad is 15 km southwest of the southern outcrop.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Nightingale sequence (Triassic and Jurassic—slate, phyllite, hornfels, limestone, and dolomite).

Aeromagnetic expression:

Anomaly: High (short-wavelength) associated with northern exposures.

Inferred source: Intrusive and extrusive rocks.

Mining activity: None.

Selected references: Bonham, 1969; Moore, 1969.

WS-5. Stateline Peak District

General location: North of Reno, along the Nevada-California border.

Coordinates: lat 39°40' N., long 119°52' W.

Land classification: Public domain and private land.

Area: 341 km².

Accessibility: State Highway 33 extends along the east edges of three exposures. An abandoned branch of the Southern Pacific Railroad passes about 14 km northeast of the northeastern exposure. U.S. Highway 40 (Interstate 80) and a branch of the Southern Pacific Railroad pass along the southern outcrops.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Overlain by Santiago Canyon Tuff (Tertiary).

Aeromagnetic expression:

Anomaly: Highs (high-amplitude, northwest-trending).

Inferred source: Unknown.

Mining activity: None.

Selected references: Bonham, 1969; Moore, 1969.

WS-6. Pah Rah Range

General location: South of Pyramid Lake.
Coordinates: lat 39°44' N., long 119°34' W.
Land classification: Private land and Pyramid Lake Indian Reservation.
Area: 44 km².
Accessibility: State Highway 33 extends along the west edge of the exposures, and an abandoned branch of the Southern Pacific Railroad passes along the northeast edge of the northernmost outcrop. U.S. Highway 40 (Interstate Highway 80) passes 17 km south of the southernmost exposure.
Composition: Granodiorite and quartz monzonite.
Age: Cretaceous(?)–Tertiary.
Rocks intruded: Lava flows, breccia, and pyroclastic rocks of Tertiary(?) age.
Aeromagnetic expression:
Anomaly: High.
Inferred source: Extrusive and intrusive rocks.
Mining activity: None.
Selected reference: Carlson and others, 1975.

WS-7. Olinghouse District

General location: Northeast of Reno.
Coordinates: lat 39°42' N., long 119°24' W.
Land classification: Public domain, private land, and a few local mining claims.
Area: 6 km².
Accessibility: The largest outcrop occurs 2.5 km west of State Highway 34 and 3 km west of an abandoned branch of the Southern Pacific Railroad. U.S. Highway 40 (Interstate Highway 80) lies 10 km to the south.
Composition: Granodiorite.
Age: Tertiary.
Rocks intruded: Santiago Canyon Tuff and Chloropagus Formation of Axelrod (1956).
Aeromagnetic expression: None.
Mining activity: None.
Selected reference: Axelrod, 1956.

WS-8. Peavine District

General location: West of Reno, along the California State boundary.
Coordinates: lat 39°34' N., long 119°55' W.
Land classification: Private land.
Area: 29 km².
Accessibility: U.S. Highway 40 (Interstate 80) passes along the south edge of the larger exposures and U.S. Highway 395 (alternate U.S. Highway 40) passes 5 km north of the northernmost exposures.
Composition: Granodiorite.
Age: Cretaceous(?)–Tertiary.

Rocks intruded: Peavine sequence (Triassic and Jurassic—metavolcanic and metasedimentary rocks); Tertiary granodiorite intrudes older, Cretaceous(?) granodiorite.

Aeromagnetic expression:

Anomaly: High (short-wavelength, elliptical, northwest-trending).

Inferred source: Diverse magnetic lithologies.

Mining activity: None.

Selected references: Bonham, 1969; Moore, 1969.

WS-9. Carson Range

General location: North and east of Lake Tahoe.
Coordinates: lat 39°10' N., long 119°53' W.
Land classification: Private land, national forest, and State lands.
Area: 453 km².
Accessibility: U.S. Highway 395 extends southward from Reno along the east edge of the Carson range and State Highway 28 passes along the east edge of Lake Tahoe.
Composition: Granodiorite and quartz monzonite.
Age: 77.7±1.0 Ma, K-Ar, biotite-granodiorite (Marvin and Cole, 1978) (Cretaceous).
Rocks intruded: Triassic metasedimentary and meta-volcanic rocks.
Aeromagnetic expression:
Anomaly: Highs (north-trending).
Inferred source: Plutonic rocks.
Mining activity: None.
Selected references: Thompson and White, 1964; Gar-side, 1974; Marvin and Cole, 1978; Evernden and Kistler, 1970.

D-1. Pine Nut Mountains

General location: Northeastern part of Douglas County.
Coordinates: lat 38°59' N., long 119°27' W.
Land classification: Public domain, private land, and Indian Trust Allotments.
Area: 310 km².
Accessibility: The northwestern outcrops are within 5 km of U.S. Highway 50. West-central exposures are 10–15 km east of U.S. Highway 395. The southern extent of the mountains is less than 1 km north of State Highway 3.
Composition: Quartz monzonite.

Age: 81 Ma, K-Ar, biotite, and 106 Ma, K-Ar, hornblende (Noble and others, 1973); 146 Ma, K-Ar, hornblende (Krueger and Schilling, 1971); and 145 Ma, K-Ar, biotite and 180 Ma, K-Ar, hornblende (Caster and McKee, 1975) (Jurassic and Cretaceous).

Rocks intruded: Triassic and Jurassic shale, slate, tuffaceous sandstone, sandstone, graywacke, andesitic tuff, and lava flows.

Aeromagnetic expression:

Anomaly: Highs (northwest-trending).

Inferred source: Unknown.

Mining activity: Gold has been mined along the southeast flank of the Pine Nut mountains.

Selected references: Krueger and Schilling, 1971; Noble and others, 1973; Caster and McKee, 1975.

D-2. Dresslerville

General location: Western part of Douglas County near the Nevada-California State border.

Coordinates: lat 38°52' N., long 119°44' W.

Land classification: Private land and Bureau of Reclamation withdrawals.

Area: 6 km².

Accessibility: U.S. Highway 395 passes 3.5 km northeast and State Highway 88 is 2 km west of the exposure.

Composition: Quartz monzonite and granodiorite.

Age: Cretaceous.

Rocks intruded: Triassic and Jurassic andesite breccia, tuff, basalt, and rhyolitic lava flows.

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength).

Inferred source: Granitic rocks; that part within Nevada is inferred to have a maximum areal extent of from 1 to 5 km².

Mining activity: None.

Selected references: Bonham, 1969; Moore, 1969.

D-3. Northern Sweetwater Mountains

General location: Southeastern part of Douglas County along Nevada-California border.

Coordinates: lat 38°34' N., long 119°21' W.

Land classification: Toiyabe National Forest.

Area: 42 km².

Accessibility: U.S. Highway 395 passes within 9 km of the Nevada segment of the plutonic mass. State Highway 22, in Lyon County, passes along the eastern slope of the northern Sweetwater Mountains, about 8 km east of the exposures.

Composition: Granodiorite and quartz monzonite.

Age: Jurassic and Cretaceous.

Rocks intruded: Triassic and Jurassic metasedimentary and metavolcanic rocks.

Aeromagnetic expression: None.

Mining activity: None.

Selected references: Bonham, 1969; Moore 1969.

S-1. Comstock Lode

General location: West of Virginia City.

Coordinates: lat 39°18' N., long 119°39' W.

Land classification: Private land, public domain, and patented mining claims.

Area: 1 km².

Accessibility: The outcrop is about 1 km southwest of State Highway 45.

Composition: Granite.

Age: 15 Ma, K-Ar, plagioclase (Carlson and others, 1975) (Tertiary).

Rocks intruded: Alta Formation (Tertiary—volcanics).

Aeromagnetic expression: None.

Mining activity: Lightweight aggregate and perlite have been mined along the west flank of the Virginia Range.

Selected references: Thompson, 1956; Carlson and others, 1975.

S-2. Flowery Range (Virginia Range)

General location: Southeast part of Storey County.

Coordinates: lat 39°21' N., long 119°30' W.

Land classification: Private land, public domain, and patented mining claims.

Area: 15 km².

Accessibility: U.S. Highway 50 crosses the southernmost outcrop in Lyon County. State Highway 79 passes 4 km southwest of the westernmost outcrop.

Composition: Granodiorite.

Age: Cretaceous(?).

Rocks intruded: Peavine sequence (Triassic and Jurassic—slate, phyllite, argillite, quartzite, greywacke, and limestone).

Aeromagnetic expression:

Anomaly: High (high-amplitude, short-wavelength, north-trending).

Inferred source: Plutonic rocks having a maximum areal extent of from 1 to 5 km².

Mining activities: Gold has been mined approximately 4 km south of the westernmost exposure. Lightweight aggregate and perlite have also been mined within the area.

Selected references: Bonham, 1969; Moore, 1969.

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