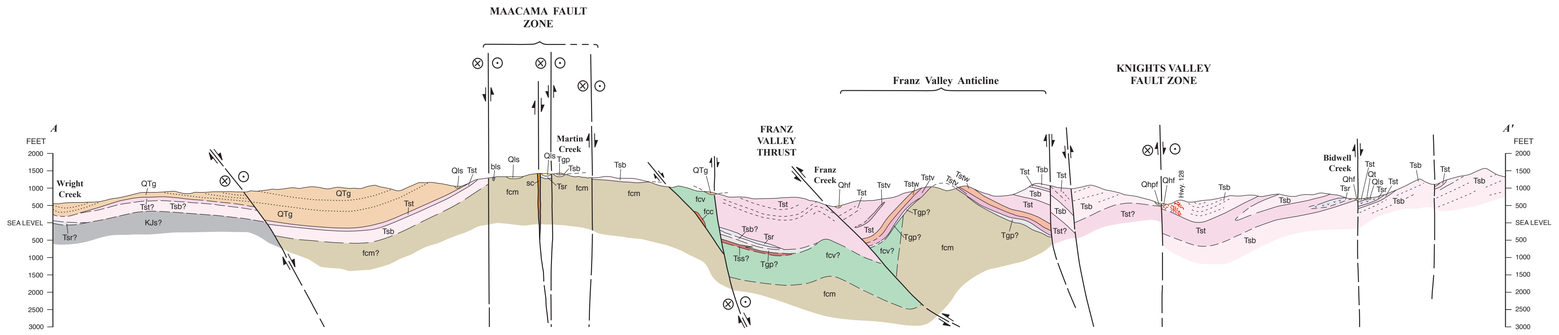
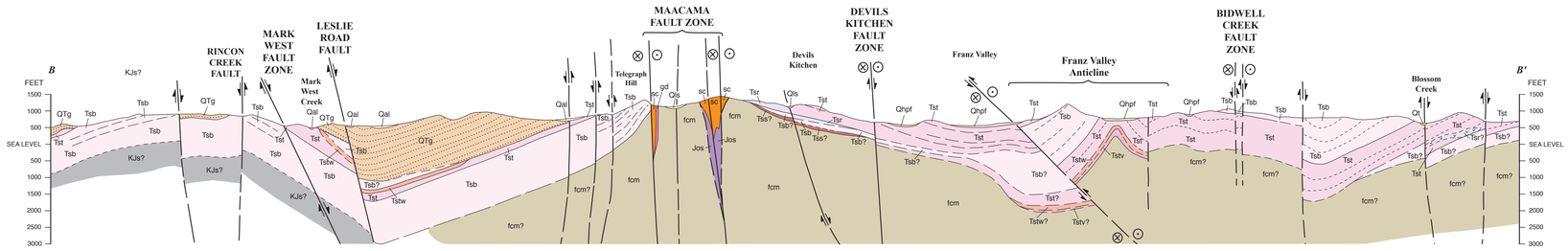
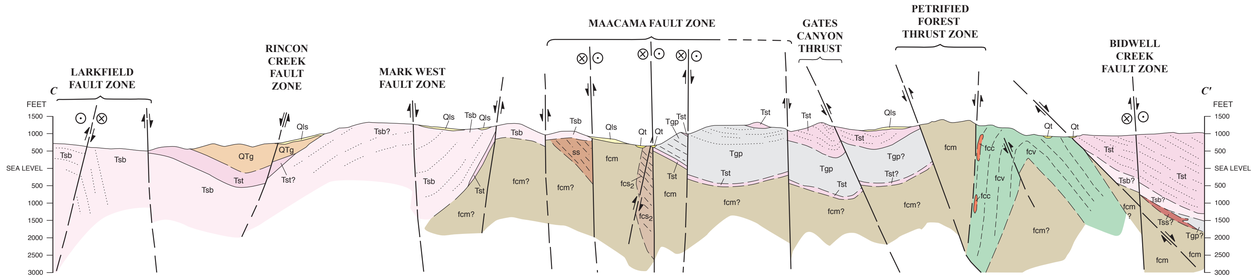
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

SCIENTIFIC INVESTIGATIONS MAP 2858
SHEET 2 of 2
Pamphlet accompanies map







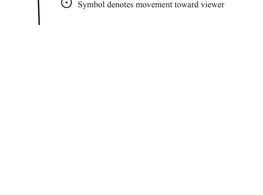


Table 1. *$^{40}Ar/^{39}Ar$ ages of volcanic rocks in the Mark West Springs 7.5' quadrangle.*

[Localities arranged in numerical order, with northernmost locality first, southernmost locality last. All ages were determined in the U.S. Geological Survey radiometric dating laboratory, Menlo Park, Calif. by R.J. Fleck. Samples were irradiated in the U.S. Geological Survey TRIGA Reactor Facility in Denver, Colo.]

Map No.	Sample name	Rock Unit	Rock type	Material analyzed	West Longitude (°)	North Latitude (°)	$^{40}Ar/^{39}Ar$ (Ma±1σ)
10	MRM00-8	vitric tuff of High Ridge Ranch	vitric tuff	Plagioclase	122.67027	38.59808	3.19±0.04
19	015-18A	ash-flow tuff of Franz Valley School Road	tuff	Plagioclase	122.64738	38.58157	2.85±0.02
27	MRM6-99 (995-25A)	ash-flow tuff of Pepperwood Ranch	tuff	Plagioclase	122.69986	38.57933	3.19±0.02
31	995-25C	basalt of Telegraph Hill	basalt	whole rock	122.70236	38.57242	5.40±0.20
44	015-17A	ash-flow tuff of Leslie Road	tuff	Plagioclase	122.72000	38.54982	5.02±0.20
45	015-17B	basalt of Leslie Road	basalt	whole rock	122.72000	38.54982	4.85±0.03
62	MRM4-97 (HRC-4A)	ash-flow tuff of Riebli Road	tuff	Plagioclase	122.70250	38.50567	3.12±0.03
63	995-25D	basalt of Larkfield	basalt	whole rock	122.73286	38.50447	4.60±0.05

Table 2. *Tephrochronologic data for the Mark West Springs 7.5' quadrangle.*

[All tephra unit names listed are informal names, with the exception of the Putah Tuff and the Lawlor Tuff (Sarna-Wojcicki, 1976). Localities are arranged by age and by compositional similarity.]

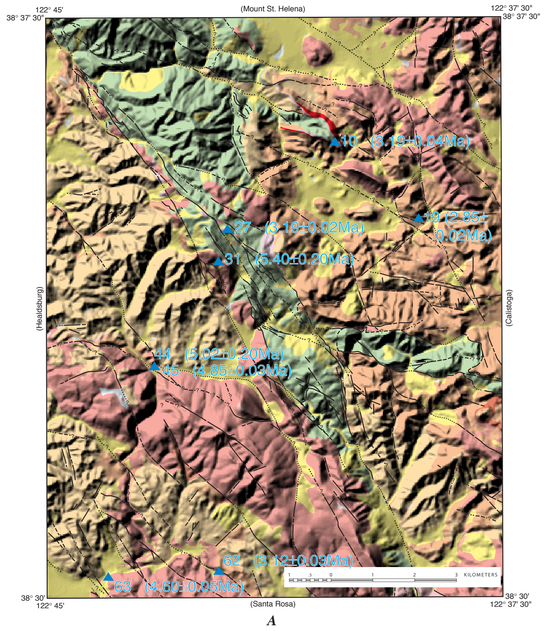
Map No.	Sample name	West Longitude (°)	North Latitude (°)	Tephra unit	Interpolated age from correlation to dated locations (Ma±1σ)	Tephra locality (fig. 3*B*)
15	MRM00-35	122.68147	38.59075	Franz Valley 2	2.85±0.02	
21	015-18B	122.64738	38.58157	Franz Valley 2	2.85±0.02	
22	015-18C, D	122.64750	38.58132	Franz Valley 2	2.85±0.02	
13	MRM00-34	122.68200	38.59250	Franz Valley 1	>2.85, <3.34?	
23	MRM87-99B	122.67563	38.58118	Franz Valley 3	Indeterminate; heterogeneous shard population	
6	MRM57-99	122.74042	38.60447	Shilo Valley	Indeterminate; most like Franz Valley 3	
54	MRM77-99	122.73661	38.52869	Shilo Valley	Indeterminate; most like Franz Valley 3	
58	MRM13-97	122.71150	38.51750	Indeterminate	Stratigraphically above Riebli Road (No. 62)	
60	MRM10-97	122.71183	38.51467	Mixed population (includes Riebli Road)	Indeterminate; but must be ≤3.12	
61	MRM22-97	122.70400	38.51133	Mixed population (includes Riebli Road, Roblar, Petrified Forest)	Indeterminate; but must be ≤3.12	
62	MRM4-97 (HRC-4A)	122.70250	38.50567	Riebli Road	3.12 ±0.03	
1	MRM96-01	122.63850	38.61833	Bidwell Creek	Indeterminate; most like Riebli Road (No. 62)	
3	MRM51-99	122.73964	38.61103	Bidwell Creek	Indeterminate; most like Riebli Road (No. 62)	
26	995-25B	122.69986	38.57933	Pepperwood	3.19±0.02	
42	MRM85-99A	122.63892	38.55633	Pepperwood	3.19±0.02	
33	MRM9-01B	122.65450	38.56967	Pepperwood?	3.19±0.02 (?)	
34	MRM9-01C	122.65450	38.56967	Pepperwood?	3.19±0.02 (?)	
38	MRM85-99F	122.64268	38.55824	Petrified Forest	≥3.19, ≤3.34	
40	MRM85-99D	122.63839	38.55711	Petrified Forest	≥3.19, ≤3.34	
55	MRM78-99	122.73228	38.52636	Petrified Forest?	≥3.19, ≤3.34 (?)	
28	MRM00-30	122.68392	38.57511	Jordan Vineyards	>3.19, <5.04	
30	MRM-22-01	122.65633	38.57333	Jordan Vineyards?	>3.19, <5.04 (?)	
32	MRM9-01A	122.65450	38.56967	Jordan Vineyards?	>3.19, <5.04 (?)	
29	MRM26-01	122.65167	38.57383	Devils Kitchen	>3.22, <3.34	
35	MRM00-26	122.68464	38.56947	Devils Kitchen	>3.22, <3.34	
36	MRM10-01	122.65307	38.56892	Devils Kitchen?	>3.22, <3.34 (?)	
50	MRM61-01	122.66400	38.54400	Camp Neuman	Indeterminate; similar to Devils Kitchen (No. 35)	
48	MRM22-00	122.65178	38.54758	Putah	3.34	
46	015-17C	122.72000	38.54982	Lawlor	4.83	
47	MRM28-99	122.72122	38.54961	Mark West	>4.83, <5.0	
51	MRM40-97	122.72458	38.53256	Mark West	>4.83, <5.0	

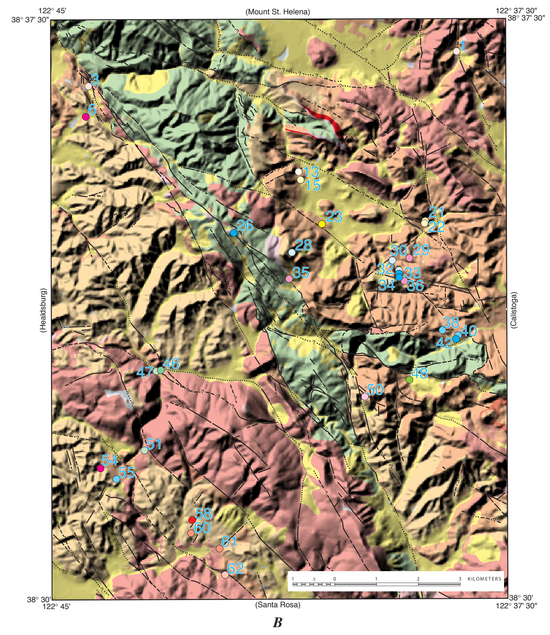
Table 3. *Chemical compositions of volcanic glass in pyroclastic units in the Mark West Springs 7.5' quadrangle.*

[Values given are weight percent oxide normalized to a 100 percent fluid-free basis to correct for variations in water content of the glasses. Values reported here as Fe_2O_3 are converted and recalculated to 100 percent from analyses originally reported as FeO. The values for a homogenous obsidian used as an internal standard, RLS-132, are given below to provide an approximation of the analytical error in the electron-microprobe analysis. All tephra unit names listed are informal names, with the exception of the Putah Tuff and the Lawlor Tuff. Localities are arranged by age and compositional similarity.]

Map No.	Tephra unit	Sample Name, Lab No.	Interpolated age from correlation to dated locations (Ma±1σ)	Weight percent oxide								
				SiO_2	Al_2O_3	Fe_2O_3	MgO	MnO	CaO	TiO_2	Na_2O	K_2O	Total
15	Franz Valley 2	MRM00-35, T465-4(rec.)	2.85±0.02	76.04	12.55	2.30	0.02	0.05	0.43	0.16	4.13	4.31	99.99
21	Franz Valley 2	015-18B1, T477-6	2.85±0.02	76.33	12.68	2.25	0.02	0.06	0.43	0.17	3.23	4.84	100.01
21	Franz Valley 2	015-18B2, T477-7	2.85±0.02	75.83	12.65	2.39	0.02	0.09	0.44	0.15	4.36	4.07	100.00
22	Franz Valley 2	015-18C, T477-8	2.85±0.02	76.07	12.68	2.35	0.01	0.05	0.47	0.13	4.20	4.04	100.00
22	Franz Valley 2	015-18D, T477-9	2.85±0.02	75.75	12.60	2.36	0.02	0.08	0.44	0.15	4.82	3.77	99.99
13	Franz Valley 1	MRM00-34, T465-3	>2.85, <3.34?	73.52	13.64	3.39	0.02	0.07	1.42	0.23	3.93	3.78	100.00
23	Franz Valley 3	MRM87-99B(All), T435-8	undetermined	76.86	13.07	1.18	0.05	0.03	0.44	0.10	3.53	4.73	99.99
23	Franz Valley 3	MRM87-99B(pop1), T435-8	undetermined	77.45	13.08	0.84	0.03	0.03	0.41	0.09	3.37	4.70	100.00
23	Franz Valley 3	MRM87-99B(pop2), T435-8	undetermined, most like Shilo Valley	76.55	13.07	1.36	0.06	0.03	0.46	0.11	3.61	4.75	100.00
6	Shilo Valley	MRM57-99, T435-6	undetermined, most like Franz Valley 3	76.46	13.08	1.37	0.06	0.02	0.53	0.10	3.00	5.39	100.01
54	Shilo Valley	MRM77-99, T436-2	undetermined, most like Franz Valley 3	75.93	13.17	1.38	0.05	0.03	0.53	0.11	3.48	5.32	100.00
58	Indeterminate	MRM-13-97, T395-4	undetermined, stratigraphically above Riebli Road (No. 62)	77.29	12.61	0.97	0.05	0.02	0.46	0.07	3.62	4.91	100.00
60	mixed population, includes Riebli Road	MRM-10-97, T393-9	undetermined, but must be ≤ 3.12	77.92	12.18	0.71	0.05	0.02	0.50	0.12	2.77	5.74	100.00
61	mixed population, includes Riebli Road	MRM-22-97, T394	undetermined, but must be ≤ 3.12	73.13	13.98	2.93	0.16	0.06	1.02	0.24	5.12	3.36	100.00
62	Riebli Road	MRM4-97(HRC-4A), T377	3.12±0.03	72.50	13.90	3.39	0.24	0.07	1.19	0.34	4.93	3.43	99.99
1	Bidwell Creek	MRM96-01, T486-10	undetermined, most like Riebli Road	72.33	14.37	3.49	0.19	0.09	1.29	0.30	5.00	2.95	100.01
3	Bidwell Creek	MRM51-99, T435-10	undetermined, most like Riebli Road	72.10	14.44	3.43	0.18	0.08	1.27	0.30	4.71	3.48	99.99
26	Pepperwood	995-25B, T434-10	3.19±0.02	73.60	14.40	2.79	0.22	0.06	1.06	0.30	2.76	4.81	100.00
42	Pepperwood	MRM85-99A, T433-3	3.19±0.02	73.90	14.22	2.60	0.22	0.04	1.05	0.31	2.85	4.82	100.01
33	Pepperwood?	MRM9-01B, T484-1	3.19±0.02?	74.47	14.37	2.87	0.22	0.05	1.14	0.25	2.42	4.22	100.01
34	Pepperwood?	MRM9-01C, T484-2	3.19±0.02?	73.17	14.31	2.91	0.24	0.07	1.22	0.28	4.33	3.47	100.00
38	Petrified Forest	MRM85-99F, T435-5	≥3.19, ≤3.34	75.88	13.83	2.39	0.15	0.03	1.07	0.23	1.54	4.88	100.00
40	Petrified Forest	MRM85-99D, T435-4	≥3.19, ≤3.34	75.71	13.84	2.39	0.15	0.04	1.06	0.24	1.83	4.75	100.01
55	Petrified Forest?	MRM78-99, T436-3	≥3.19, ≤3.34?	73.91	13.89	2.40	0.16	0.05	0.92	0.23	4.11	4.33	100.00
28	Jordan Vinyards	MRM00-30, T465-2	>3.19, <5.04	72.41	13.82	3.28	0.17	0.09	1.12	0.28	4.89	3.94	100.00
30	Jordan Vinyards?	MRM22-01, T480-4	>3.19, <5.04	72.41	13.94	3.37	0.17	0.10	1.14	0.29	4.34	4.25	100.01
32	Jordan Vinyards?	MRM9-01A, T484-3	>3.19, <5.04	72.93	14.10	3.40	0.18	0.10	1.14	0.23	4.34	3.58	100.00
29	Devils Kitchen	MRM26-01, T486-1	>3.22, <3.34	73.86	14.67	3.56	0.27	0.07	1.39	0.32	1.76	4.10	100.00
35	Devils Kitchen	MRM00-26, T465-1	>3.22, <3.34?	74.12	14.70	3.31	0.28	0.08	1.32	0.38	1.41	4.37	99.97
36	Devils Kitchen?	MRM10-01, T486-5	>3.22, <3.34	73.83	14.67	3.56	0.27	0.08	1.41	0.34	2.01	3.83	100.00
50	Camp Neuman	MRM61-01, T486-9	Indeterminate; similar to Devils Kitchen (No 35)	71.22	14.68	3.53	0.35	0.06	1.53	0.36	4.25	4.02	100.00
48	Putah	MRM00-22, T444-6	3.34	77.10	13.14	1.77	0.08	0.02	0.62	0.17	2.93	4.17	100.00
46	Lawlor	015-17C, T477-1	4.83	74.42	13.74	2.14	0.09	0.04	0.89	0.18	4.09	4.41	100.00
47	Mark West	MRM28-99, T435-9	>4.83, <5.0	75.13	13.88	1.65	0.04	0.03	0.78	0.09	3.33	5.06	99.99
51	Mark West	MRM40-97, T435-2	>4.83, <5.0	75.11	13.78	1.62	0.04	0.03	0.76	0.11	3.82	4.71	99.98
			RLS-132, obsidian standard	74.05	11.36	4.66	0.05	0.15	0.10	0.19	5.09	4.37	100.02
			Standard Deviation	0.65	0.10	0.04	0.01	0.01	0.01	0.01	0.16	0.05	0.65
			No. of runs (~20 shards/run)	83	83	83	83	83	83	83	83	83	83

Figure 3. Maps showing locations of radiometrically dated ($^{40}Ar/^{39}Ar$) volcanic rocks (A) and tephra collected for geochemical correlation (B). Locality numbers refer to tables 1-3 and the map and increase from north to south by latitude.





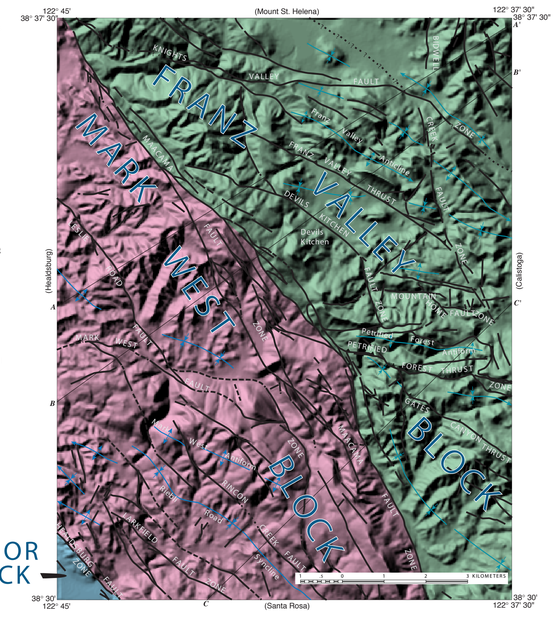


Figure 4. Map showing principal structural elements in Mark West Springs 7.5' quadrangle. Map area is traversed by the active northwest-trending Healdsburg and Maacama Faults, which, from southwest to northeast, juxtapose the Windsor, Mark West, and Franz Valley structural blocks.

Only a small part of the Windsor block is present in Mark West Springs quadrangle, and it is covered largely by Holocene and Pleistocene alluvium. The Mark West and Franz Valley blocks, which occupy the remainder of the map area, are internally deformed by folding and faulting into a number of subsidiary blocks separated by faults having smaller displacements than the Healdsburg and Maacama Fault Zones. In the Mark West block these faults include the Larkfield Fault Zone, Rincon Creek Fault, Mark West Fault Zone, and Leslie Road Fault. The Franz Valley block includes several west-northwest-trending faults with conspicuous reverse- and normal-components of slip (Knights Valley Fault Zone, Franz Valley Thrust, Devils Kitchen Fault Zone, Mountain Home Fault Zone, Petrified Forest Thrust Zone, and Gates Canyon Thrust) as well as a north-northwest-trending zone of young strike-slip faulting (Bidwell Creek Fault Zone).

The Mark West and Franz Valley blocks are, in turn, deformed by folds in the Neogene rocks that trend west-northwest and plunge either northwest or southeast and locally form horst-like, fault-bounded antiforms (Mark West and Petrified Forest Antiforms). Some south-southwest-vergent anticlinal folds (Franz Valley Anticline) and antiforms (Petrified Fee st Antiform) are clearly related to compression in the hanging walls of thrust and reverse faults. Some synclinal folds are associated with young basins (Franz Valley).

The west-northwest-trending folds and southwest-vergent thrust faults are younger than 2.8 Ma folded volcanic rocks that are offset by the thrusts. The Petrified Forest thrust zone and associated antiform appear to be truncated by the Maacama Fault Zone.

Fault—Dashed where approximately located or inferred; dotted where concealed; queried where uncertain

Thrust fault—Sawteeth on upper plate

Fold—Showing plunge direction where known; dashed where approximately located; dotted where concealed; queried where uncertain

Anticline

Syncline

A——*A'* **Cross section**—Shown on map

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Geology, Tephrochronology, Radiometric Ages, and Cross Sections of the Mark West Springs 7.5' Quadrangle, Sonoma and Napa Counties, California

By

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