An addendum to "K-Ar results for silicic volcanics from the Medicine Lake Highland, northeastern California —a summary"

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AN ADDENDUM TO "K-Ar RESULTS FOR SILICIC VOLCANICS FROM THE MEDICINE LAKE HIGHLAND, NORTHEASTERN CALIFORNIA—A SUMMARY"

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These four samples were not included in the purported "summary" article published in Isochron/West, No. 34, August 1982. The deficiency is hereby remedied.

COMMENTS

The analytical procedures described in Mertzman (1982) are also appropriate for this work. The K-Ar data are reported in the section of this article on Sample Descriptions; the whole-rock chemical analyses for the four dated samples can be found in table 1, and the sample locations are depicted in figure 1. The samples are numbered 15 through 18 to be consistent with the previously reported data.

Sample KT-80-57 (map no. 15) is the oldest silicic volcanic rock in the Mount Shasta–Medicine Lake region. There are certainly time-correlative extrusives in this extensive area, but all samples which have heretofore been age dated are of a substantially more mafic character. The petrography of KT-80-57 is unique among the 18 samples for which data is reported. Two to three percent modal quartz occurs in rounded to egg-shaped phenocrysts with no observable reaction rims. As is typical for the lavas of this region the only modal feldspar is plagioclase; phenocrysts have strongly developed oscillatory zoning and are rounded at the corners as well. Plagioclase and quartz are seen with common grain boundaries, suggesting an equilibrium mineral assemblage. The mafic minerals include nearly equal amounts of hornblende and biotite, minor amounts of both orthopyroxene and clinopyroxene, and an accessory amount of olivine which has coronas of orthopyroxene. This latter characteristic suggests that perhaps a compositionally stratified magma chamber existed prior to the extrusion of this magma. Two points are worth noting when comparisons are drawn with the younger silicic samples: petrographically, the older extrusives are strikingly porphyritic with a significant amount of modal quartz while the younger volcanics are much more aphyric and completely devoid of quartz; chemically, the older extrusives are considerably lower in K_2O (~0.75–1.0 wt %) at 68% SiO_2. This latter facet may indicate that Pliocene silicic volcanism was more tholeiitic in character than the subsequent mid-Pleistocene to Recent activity which is of calc-alkaline affinity. The approximate two-million-year hiatus in silicic volcanism may prove to be real, as I have essentially no chemically analyzed sample whose SiO_2 content is in excess of 67 weight percent that hasn't been dated through K-Ar geochronology.

The rhyolite and dacite samples (map nos. 16 and 17, respectively) are from the east-northeast side of the Medicine Lake volcano and geomorphologically would be termed "kipukas." The age of the rhyolite indicates it is

TABLE 1. Major element chemistry in weight percent together with C.I.P.W. norms.*

Sample no.	KT-80-57	82-18	82-19	82-Anhy
Map no.	15	16	17	18
SiO_2	68.29	75.94	68.72	70.62
Al_2O_3	16.73	13.01	15.52	14.83
FeO	1.80	0.18	2.18	1.76
Fe_2O_3	1.25	1.12	1.17	0.89
TiO_2	0.39	0.08	0.63	0.50
MnO	0.07	0.04	0.06	0.05
MgO	1.04	0.00	0.94	0.62
CaO	3.26	0.47	2.43	1.93
Na_2O	4.05	3.94	4.61	3.76
K_2O	2.40	4.84	3.74	4.46
P_2O_5	0.07	0.01	0.12	0.11
L.O.I.	0.83	1.05	0.28	0.35
TOTAL	100.18	100.68	100.40	99.88
FeO^T	2.93	1.19	3.23	2.56
Qz	26.58	32.31	20.48	26.25
Or	14.28	27.40	22.08	26.48
Ab	34.49	37.53	38.96	31.97
An	15.82	0.58	10.60	8.91
C	1.72	0.00	0.00	0.57
Di	0.00	1.42	0.55	0.00
Hy	4.38	0.00	4.17	3.32
Mt	1.82	0.93	1.69	1.30
Ilm	0.75	[illegible]	1.20	0.95
Hm	0.00	[illegible]	0.00	0.00
Ap	0.16	[illegible]	0.28	0.26

*The analyses were determined by XRF techn[illegible]d in Mertzman (1977); L.O.I. = loss on ignition.

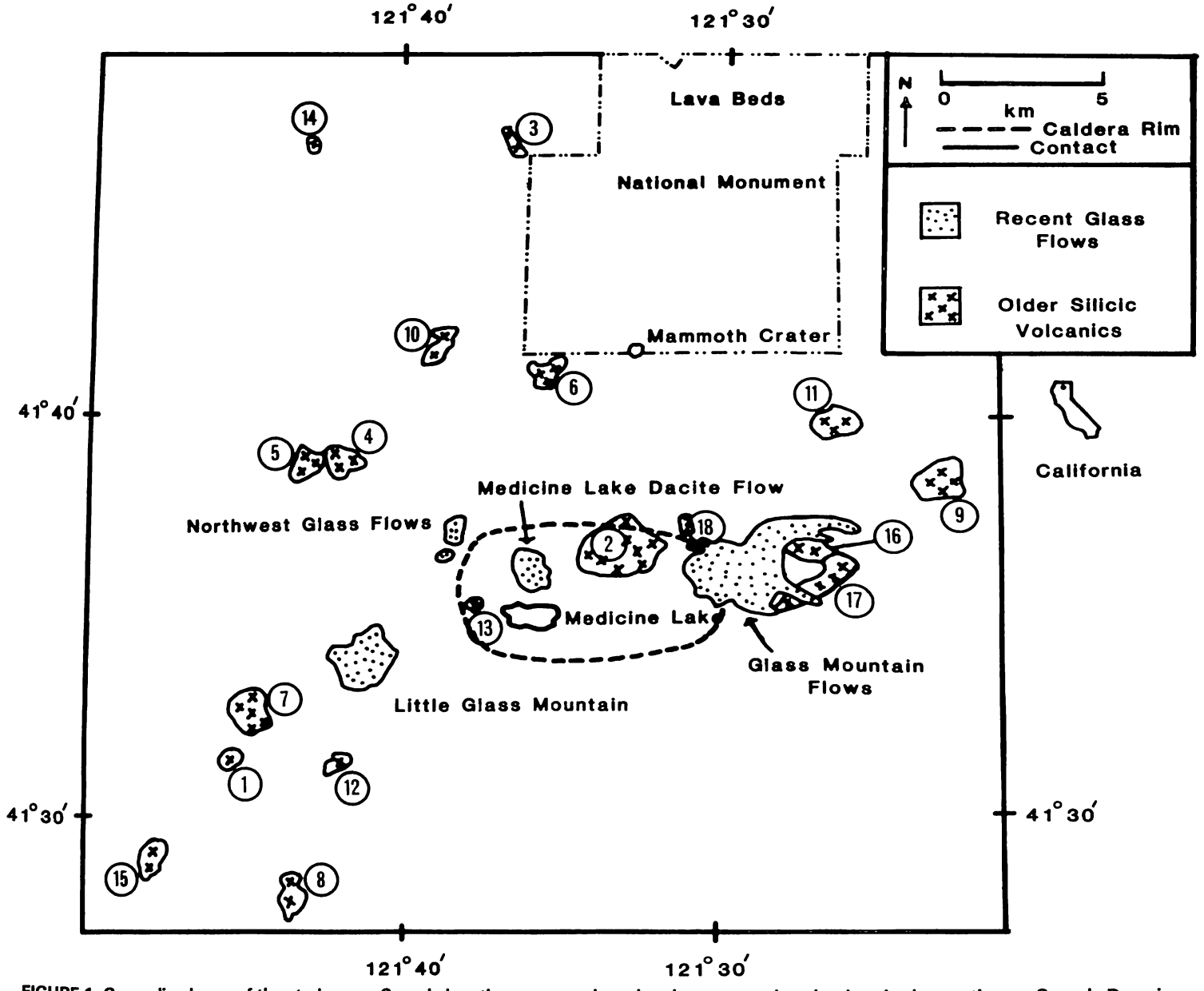

FIGURE 1. Generalized map of the study area. Sample locations are numbered and correspond to the data in the section on Sample Descriptions and table 1.

essentially coeval with the Cougar Butte rhyolite (see map no. 11 on fig. 1), whole nearest outcrop is located approximately 4 miles to the north. Petrographic and chemical similarities suggest these two rhyolites could have been derived from the same magma reservoir. Perhaps these two silicic dome-lava flow associations had their vents connected to the same plumbing system at depth or are remnants of a more areally extensive extrusive mass that was largely covered by subsequent, more mafic lava flows. The dacite provides a particularly good time-stratigraphic marker since it is overlain by aphyric basaltic andesite lavas which constitute part of the shield-forming extrusives of the Medicine Lake volcano and, therefore, in this area must be less than 10^5 years old, as the age of the dacite is 0.10 ± 0.01. This chronology is congruent with data from other parts of the Medicine Lake Highland.

The last sample to be discussed, 82-Anhy (map no. 18), is somewhat unusual in that it does not outcrop in any manner other than as scattered fragments ranging from 2–3 cm to 2–3 m in maximum dimension. This debris is found scattered about a sequence of explosion craters that trend along a line striking N20°–25°W through Glass Mountain. Each of the explosion craters has within its upheaved outer rim a rhyolite dome. In the crater walls explosion breccia is exposed which contains, among many other rock types, clasts of a rather dense, black, totally aphyric, dully vitreous, nonvesicular, glassy igneous rock identical to the fragments which litter the nearby countryside. The heft of the sample is immediately suggestive of andesite; yet, the whole-rock chemistry clearly indicates its rhyolitic nature. The texture unequivocally resulted from crystallization at the surface of the earth. Subsequent to its extrusion 50,000 years ago, it was covered to a shallow depth, probably no more than a few tens of meters, by younger volcanic material before being intruded and caught up in the vent system of a new pulse of silicic volcanism.

Figure 2 provides a useful summary of the age data presented herein and in Mertzman (1982). With the under-

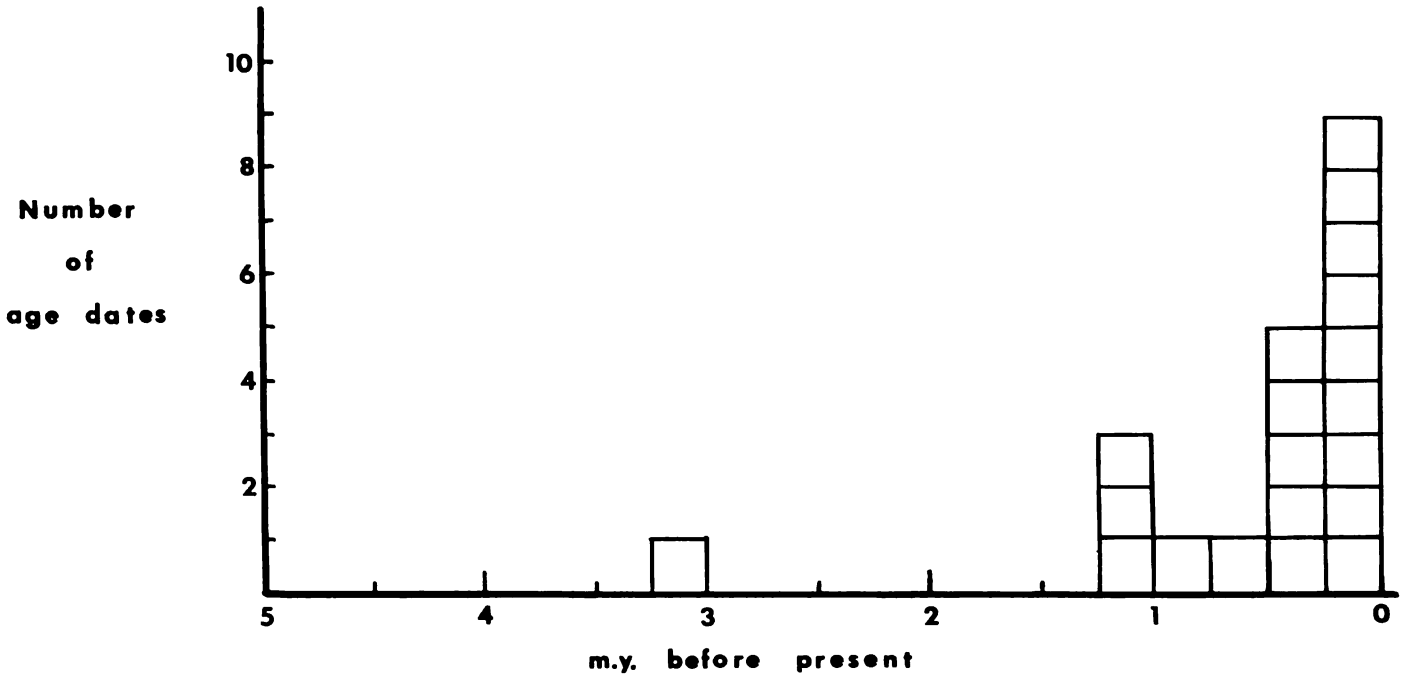

FIGURE 2. A histogram summarizing the K-Ar chronology of the silicic rocks (>67% SiO_2) in the Mount Shasta–Medicine Lake region of northern California. Four additional squares have been added to the 0.25–0.0 segment to represent each of the following: Medicine Lake dacite flow, Glass Mountain complex, Little Glass Mountain, and the Northwest Glass flows; each is considerably too young to date through K-Ar methods.

standing that perhaps significant amounts of 3-m.y.-old silicic volcanics lie buried under a blanket of younger extrusives, it appears that either silicic volcanism has peaked in Late Pleistocene to Holocene times or this region can expect an even greater number of silicic volcanic eruptions over the next several hundred thousand years as this latest phase of activity reaches its zenith.

Constants used in the age calculation include: λ_ϵ = 0.581×10^{-10} yr^{-1}; $\lambda\beta$ = 4.962×10^{-10} yr^{-1}; $^{40}K/K$ = 1.167×10^{-4} mol/mol.

SAMPLE DESCRIPTIONS

15. *KT-80-57* K-Ar
Dacite (SE1/4 NW1/4 S18,T42N,R2E; SE portion of Nine Buck Butte, Bartle quad., CA). Gray- to buff-colored lava, often pumiceous; plagioclase (An_{30-50}), biotite, orthopyroxene, hornblende, quartz, olivine, and titanomagnetite phenocrysts set in a pilotaxitic microcrystalline groundmass dominated by plagioclase microlites. Mode: 27.8% plag, 1.6% qtz, 0.6% bio, 0.4% hbl, 0.2% opx, 0.3% ol, 0.1% cpx, 0.1% Ti-mt, 68.9% groundmass. *Analytical data:* Sample weight = 3.1438 gm.; K_2O = 2.40 (wt)%; $*Ar^{40}$ = 1.108×10^{-11} moles/gm.; $*Ar^{40}$ = 59.59%.
(whole rock) 3.20 ± 0.16 m.y.

16. *82-18* K-Ar
Rhyolite (NW1/4 SW1/4 S36,T44N,R4E; from pumice pit immediately E of Recent Glass Mountain obsidian flow, Timber Mountain quad., CA). Cream- to buff- to pink-colored lava, often pumiceous, with patches of spherulites well developed; infrequent small (<1 mm) phenocrysts of plagioclase (An_{30-40}) set in a cryptocrystalline felsitic aggregate containing randomly oriented feldspar microlites. Mode: 0.4% plag., 99.6% groundmass. *Analytical data:* Sample weight = 2.5965 gm.; K_2O = 4.84 (wt)%; $*Ar^{40}$ = 3.320×10^{-12} moles/gm.; $*Ar^{40}$ = 7.68%.
(whole rock) 0.48 ± 0.06 m.y.

17. *82-19* K-Ar
Dacite (NW1/4 NW1/4 S6,T43N,R5E; Timber Mountain quad., CA). Black glassy rock on fresh surfaces, dull black to dark gray on perlitic surfaces; plagioclase (An_{30-50}), orthopyroxene, and titanomagnetite phenocrysts (0.3–1 mm) set in a hyalotrachytic groundmass consisting of numerous feldspar microlites set in clear fresh glass. Mode: 8.7% plag, 2.0% opx, 0.2% Ti-mt, 89.1% groundmass. *Analytical data:* Sample weight = 2.7399 gm.; K_2O = 3.74 (wt)%; $*Ar^{40}$ = 5.234×10^{-13} moles/gm.; $*Ar^{40}$ = 13.15%.
(whole rock) 0.10 ± 0.01 m.y.

18. *82-Anhy* K-Ar
Rhyolite (NW1/4 NW1/4 S33,T44N,R4E; Medicine Lake quad., CA). Dense black glassy rock which is totally devoid of phenocrysts. Groundmass is hyalopilitic, randomly oriented feldspar microlites set in fresh clear glass. Mode: 100% groundmass. *Analytical data:* Sample weight = 3.0817 gm.; K_2O = 4.46 (wt)%; $*Ar^{40}$ = 3.146×10^{-13} moles/gm.; $*Ar^{40}$ = 4.70%.
(whole rock) 0.05 ± 0.01 m.y.

REFERENCE

...an, S. A. (1982) K-Ar results for silicic volcanics ...he Medicine Lake Highland, northeastern California—a ...v: Isochron/West, no. 34, p. 3–7.