145. CORRELATION OF GRANITIC PLUTONS ACROSS FAULTED OWENS VALLEY, CALIFORNIA

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This article presents evidence for the correlation of the Santa Rita Flat pluton in the Inyo Mountains with the Tinemaha Granodiorite, of Cretaceous age, in the Sierra Nevada (Bateman, 1961). Such a correlation places a limit on the amount of lateral movement along the faults that bound or lie beneath Owens Valley.

Geologic mapping in the east-central Sierra Nevada during the past several years has focused attention on correlating areally separate granitic masses within the composite Sierra Nevada batholith. The most recent product of this work is a report by Bateman (1961) in which he established several formal granitic formations in the Bishop area.

Bedrock in the Inyo Mountains, across Owens Valley from the Sierra, consists predominantly of Paleozoic sedimentary rocks into which are intruded granitic plutons, some of batholithic proportions. In the Independence quadrangle, D. C. Ross, F. K. Miller, and R. J. Pickering have delineated several large plutons, one of which, the Santa Rita Flat pluton, bears a close resemblance to the Tinemaha Granodiorite of the Sierra Nevada (fig. 145.1). Examination of these two masses in the field and comparison of modal and chemical data suggest that they are correlative. This is the first time that a single lithologic unit has been correlated across Owens Valley, although broad correlations based on the regional pattern have been proposed (Bateman and others, 1962). Folded Paleozoic sedimentary and Mesozoic volcanic strata of the Inyo Mountains strike obliquely across Owens Valley toward the Sierra Nevada and may be correlative with metamorphosed remnants of grossly similar lithologies in the Sierra Nevada. Moore and Hopson (1961) have also suggested that a swarm of mafic dikes in the eastern Sierra is correlative across Owens Valley with similar dikes on strike in the southern Inyo Mountains.

The criteria for correlating areally separated granitic plutons are: (1) similarity of appearance—in particular similarity of textures and structures; (2) similarity of composition; and (3) compatible intrusive relations, and hence similar age.

The textural and mineralogical similarity of the Santa Rita Flat pluton and the Tinemaha Granodiorite is striking. Both masses have about the same percentage of dark minerals and a range in grain size of 2 to 5mm. Both contain widespread tabular to equant phenocrysts of K-feldspar as long as 2 cm, which have irregular borders and are commonly studded with dark minerals. Scattered relatively well formed hornblende crystals that are generally 1 to 2 cm long are characteristic of the Santa Rita Flat pluton, and were also observed in outcrops of the Tinemaha Granodiorite. Lenticular mafic inclusions in the Tinemaha Granodiorite, described by Bateman (1961) as numerous and defining a foliation, are widespread in the Santa Rita Flat pluton, but they are rarely abundant and only locally define a foliation.

The compositional similarity and the similar average specific gravity of these two masses also suggest

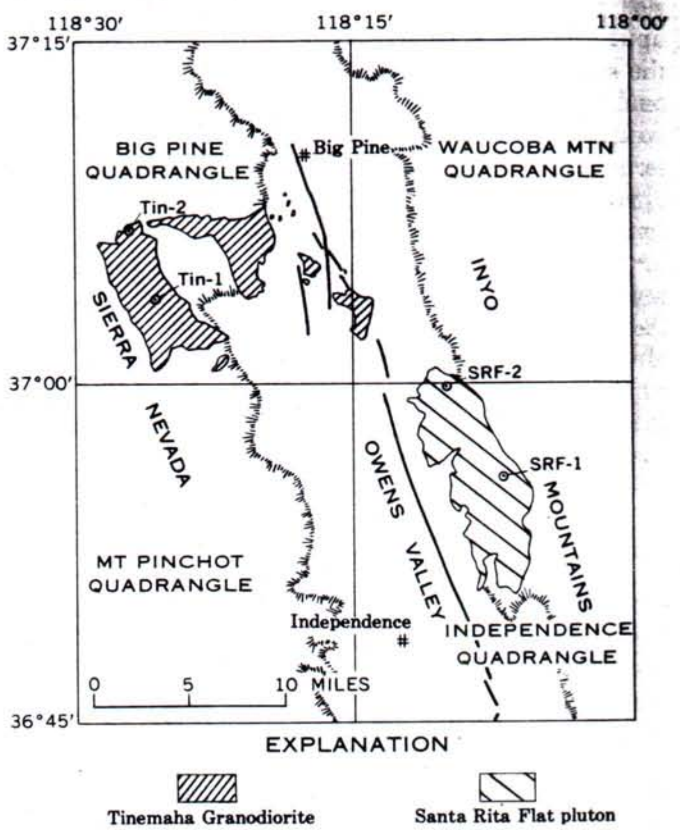

Figure 145.1.—Map showing outcrop area of Santa Rita Flat pluton and Tinemaha Granodiorite. Faults along which there was movement in the 1872 earthquake in Owens Valley are shown as heavy black lines. Location of chemically analyzed samples is shown by small circled dots.

TABLE 145.1.—*Modal data of Santa Rita Flat pluton and Tinemaha Granodiorite*

	Average modes [1]	
	Santa Rita Flat pluton	Tinemaha Granodiorite [2]
Plagioclase	36	42.3
K-feldspar	31	24.5
Quartz	20	19.2
Biotite	4	4.6
Hornblende	6	6.0
Other	3	3.4
Average specific gravity	2.70	2.72
Hornblende: biotite	1.5:1	1.3:1
Dark-mineral content (color index)	13	14

[1] In volume percent.
[2] Data on average mode from Bateman (1961).

correlation. Abundant modal data show that the two bodies have similar percentages of quartz, biotite, and hornblende, but somewhat different percentages of plagioclase and K-feldspar (table 145.1). Hornblende in excess of biotite, which is characteristic of both bodies but quite unusual in rocks of the central Sierra Nevada, is a key factor in the suggested correlation.

The triangular plots of individual modes on figure 145.2 (points show quartz, plagioclase, and K-feldspar computed to 100 percent) show that although the Santa Rita Flat pluton has a more restricted compositional range and relatively more K-feldspar than the Tinemaha Granodiorite, the modal field of the Santa Rita Flat pluton encloses nearly two-thirds of the modal plots of the Tinemaha Granodiorite specimens.

Chemical data (table 145.2 and fig. 145.3) are limited to only two analyses from each mass, and these analyses are not of average specimens in the sense of having modes near the centers of their respective modal fields. Caution must be observed therefore in using the limited chemical data to draw conclusions about these granitic masses whose modal, and hence compositional, range is great. It seems reasonable to conclude, however, that though the chemical data neither confirm nor deny correlation, they are compatible with the correlation of these masses.

The intrusive relations, and hence the age relations of these masses, cannot be compared because the Santa Rita Flat pluton is not in contact with other granitic plutons. Both masses, however, are cut by abundant dark-colored dikes of the type described by Moore and Hopson (1961).

In summary, each of the two masses discussed here has persistent mappable characteristics. Further, the similarity of the masses suggests that both are part of an originally continuous granitic intrusive, though the

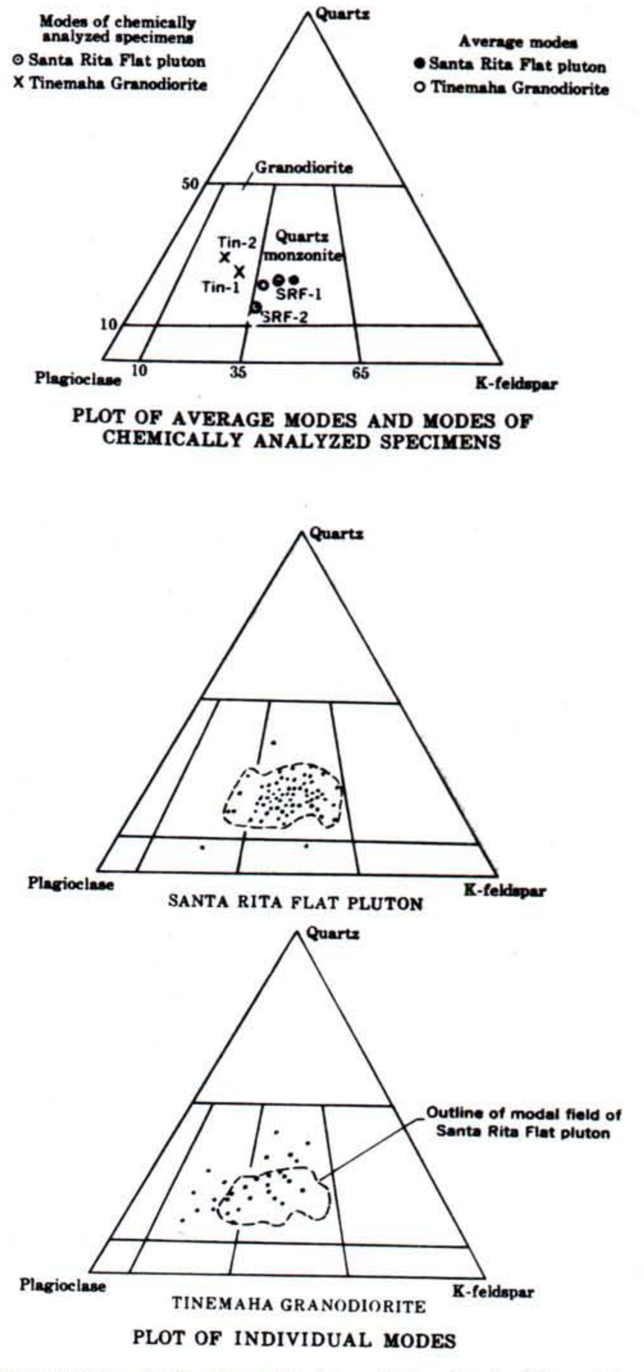

FIGURE 145.2.—Plots of model data of the Santa Rita pluton and Tinemaha Granodiorite. Data on individual modes are from Bateman (written communication, 1962).

connection may be at some depth. The overall northwest trend of the two plutons (fig. 145.1), parallel to the regional trend of many granitic masses in the central Sierra, suggests a present-day connection beneath the Cenozoic deposits of Owens Valley. However, the several-mile gap between the easternmost outcrops of Tinemaha Granodiorite and the Santa Rita Flat pluton precludes more than speculation on

TABLE 145.2.—*Chemical analyses and norms of Santa Rita Flat pluton and Tinemaha Granodiorite*

	SRF-1 [1]	SRF-2 [1]	Tin-1 [2]	Tin-2 [3]
CHEMICAL ANALYSES				
SiO_2	66. 4	61. 3	62. 82	65. 77
Al_2O_3	14. 9	15. 9	15. 44	14. 34
Fe_2O_3	2. 6	3. 1	2. 59	2. 10
FeO	2. 0	3. 0	3. 17	2. 62
MgO	1. 6	2. 2	2. 35	2. 02
CaO	3. 9	5. 3	5. 04	4. 24
Na_2O	3. 0	3. 3	3. 15	3. 18
K_2O	4. 1	3. 4	3. 72	3. 76
H_2O	. 73	. 85	. 65	. 56
TiO_2	. 48	. 64	. 64	. 60
P_2O_5	. 26	. 36	. 30	. 24
MnO	. 08	. 10	. 11	. 10
CO_2	. 05	. 05	. 01	. 08
NORMS				
Q	23. 5	15. 7	16. 69	21. 42
or	24. 5	20. 0	22. 20	22. 24
ab	25. 2	27. 8	26. 71	27. 25
an	15. 0	18. 6	16. 68	13. 34
di	2. 0	4. 0	5. 16	5. 66
hy	3. 9	5. 6	6. 18	4. 32
mt	3. 7	4. 4	3. 74	3. 02
il	. 9	1. 2	1. 22	1. 22
ap	. 7	1. 0	. 69	. 34
Total	99. 4	98. 5	99. 27	98. 81
Normative plagioclase	An_{37}	An_{40}	An_{38}	An_{33}

[1] Rapid rock analysis. Analysts: P. L. D. Elmore, I. H. Barlow, S. D. Botts, G. Chloe.
[2] Standard rock analysis (Bateman 1961, p. 1525–1526.)
[3] Standard rock analysis (Bateman, written communication 1962).

this point. Also, at least minor disruption of the postulated originally continuous body must have occurred along the trend of the 1872 earthquake faults.

The correlation of these plutons across Owens Valley affects interpretations of the structural history of the region. Hill (1954, p. 10) suggests that Owens Valley may be the course of a major strike-slip fault. More recently Pakiser (1960) invokes strike-slip movement to help account for the origin and distribution of Cenozoic volcanic rocks in Owens Valley. Strike-slip faulting undoubtedly took place along some of the faults shown on figure 145.1 during the Owens Valley earthquake of 1872; however, Bateman (1961, p. 493) suggests that strike-slip movement was subordinate to dip-slip movement in the Cenozoic structural development of the region. Moore and Hopson (1961, p. 258) suggest a limitation on strike-slip movement in Owens Valley of a few miles at most since Cretaceous time, based on the strike continuation of a swarm of mafic dikes across the valley. The correlation of the Santa Rita Flat pluton with the Tinemaha Granodiorite supports the view that strike-slip movement along the present course of Owens Valley is limited to a few miles at most since the emplacement of the Sierra Nevada batholith.

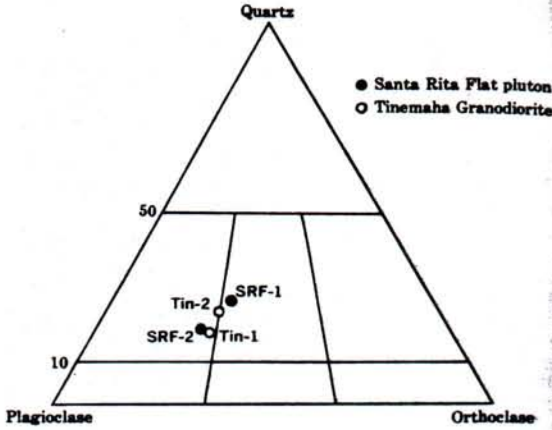

FIGURE 145.3.—Plot of normative quartz, orthoclase, and feldspar.

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