Rb-Sr Whole-Rock and Mineral Ages, K-Ar, $^{40}Ar/^{39}Ar$, and U-Pb Mineral ages, and Strontium, Lead, Neodymium, and Oxygen Isotopic Compositions for Granitic Rocks from the Salinian Composite Terrane, California

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RB-SR WHOLE-ROCK AND MINERAL AGES, K-AR, $^{40}AR/^{39}AR$, AND U-PB MINERAL AGES, AND STRONTIUM, LEAD, NEODYMIUM, AND OXYGEN ISOTOPIC COMPOSITIONS FOR GRANITIC ROCKS FROM THE SALINIAN COMPOSITE TERRANE, CALIFORNIA

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ABSTRACT

This report summarizes new and published age and isotopic data for whole-rocks and minerals from granitic rocks in the Salinian composite terrane, California. Rubidium-strontium whole-rock ages of plutons are in two groups, Early Cretaceous (122 to 100 Ma) and Late Cretaceous (95 to 82 Ma). Early Cretaceous plutons occur in all granitic rock exposures from Bodega Head in the north to those from the Santa Lucia and Gabilan Ranges in the central part of the terrane. Late Cretaceous plutons have been identified in the Point Reyes Peninsula, the Santa Lucia and the Gabilan Ranges, and in the La Panza Range in the southern part of the terrane. Ranges of initial values of isotopic compositions are $^{87}Sr/^{86}Sr$, 0.7046-0.7147, $\delta^{18}O$, +8.5 to +12.5 per mil, $^{206}Pb/^{204}Pb$, 18.901-19.860, $^{207}Pb/^{204}Pb$, 15.618-15.814, $^{208}Pb/^{204}Pb$, 38.569-39.493, and εNd, +0.9 to -8.6.

The initial $^{87}Sr/^{86}Sr$=0.706 isopleth is identified in the northern Gabilan Range and in the Ben Lomond area of the Santa Cruz Mountains, in Montara Mountain, in Bodega Head, and to the west of the Farallon Islands on the Cordell Bank. This isotopic boundary is offset about 95 miles (160km) by right-lateral displacements along the San Gregorio-Hosgri and San Andreas fault systems.

INTRODUCTION

The Salinian block or Salinian composite terrane is a part of the California Coast Ranges bounded on the northeast by the San Andreas fault zone and on the southwest by the Sur-Nacimiento fault zone (Figure 1). The bounding faults separate, on both sides, a basement of Mesozoic granitic rocks that intruded platform type sedimentary rocks metamorphosed to upper amphibolite facies and locally granulite facies (Compton, 1966) in the Salinian composite terrane from rocks of the Franciscan assemblage. The mechanisms and timing that juxtaposed these grossly different lithotectonic assemblages are some of the major problems of California geology.

The first isotopic study of granitic plutons of the Salinian composite terrane was by potassium-argon age determinations on biotites (Curtis and others, 1958). Hutton (1959) reported a non-isotopic Th-Pb age for a granitic rock monazite separated from beach sand on the Monterey Peninsula. Compton (1966) reported additional K-Ar dates on biotite and hornblende, and more K-Ar dates and a Rb-Sr whole-rock isochron age were given by Evernden and Kistler (1970). As a test of suggested offsets along the San Andreas fault zone, Kistler and others (1973) determined initial $^{87}Sr/^{86}Sr$ values of Salinian terrane plutons. These reports were followed by dating of plutons by fission-track ages of sphene and apatite (Naeser and Ross, 1976) and by U-Pb dates of zircon, apatite, and sphene (Mattinson, 1978). Masi and others (1981) reported $\delta^{18}O$ and δD values, and H_2O concentrations for splits of the same rocks investigated for Sr isotopes by Kistler and others (1973). Mattinson (1990, 1994), James (1992), and James and others (1993) published additional isotopic results for Salinian plutons including more U-Pb zircon, sphene, and apatite dates and initial Sr and Pb isotopic data. Schott and Johnson (1998) reported U-Pb zircon ages and initial Sr and Pb isotopic compositions of granitic and gabbroic clasts from Late Cretaceous and Eocene conglomerates from the Gualala Basin at the northernmost exposures of the Salinian composite terrane.

In 1987 we began a study of Salinian plutons with the intent to date and isotopically characterize them with Rb-Sr whole-rock and mineral analyses. As this work progressed, we added oxygen and common Pb isotopes, $^{40}Ar/^{39}Ar$ incremental heating ages of biotite and hornblende, and conventional U-Pb dating of zircon and sphene and SHRIMP U-Pb zircon dating to the pluton characterizations. We reported the progress of these investigations in a series of abstracts: Champion (1989), Kistler and Champion (1991, 1997), Champion and Kistler (1991), Kistler and Wooden (1994), Stakes and others (1998,1999). This report summarizes in five tables the unpublished data gathered in our investigations along with published data by investigators referred to above (Table 1, Table 2, Table 3, Table 4, and Table 5).

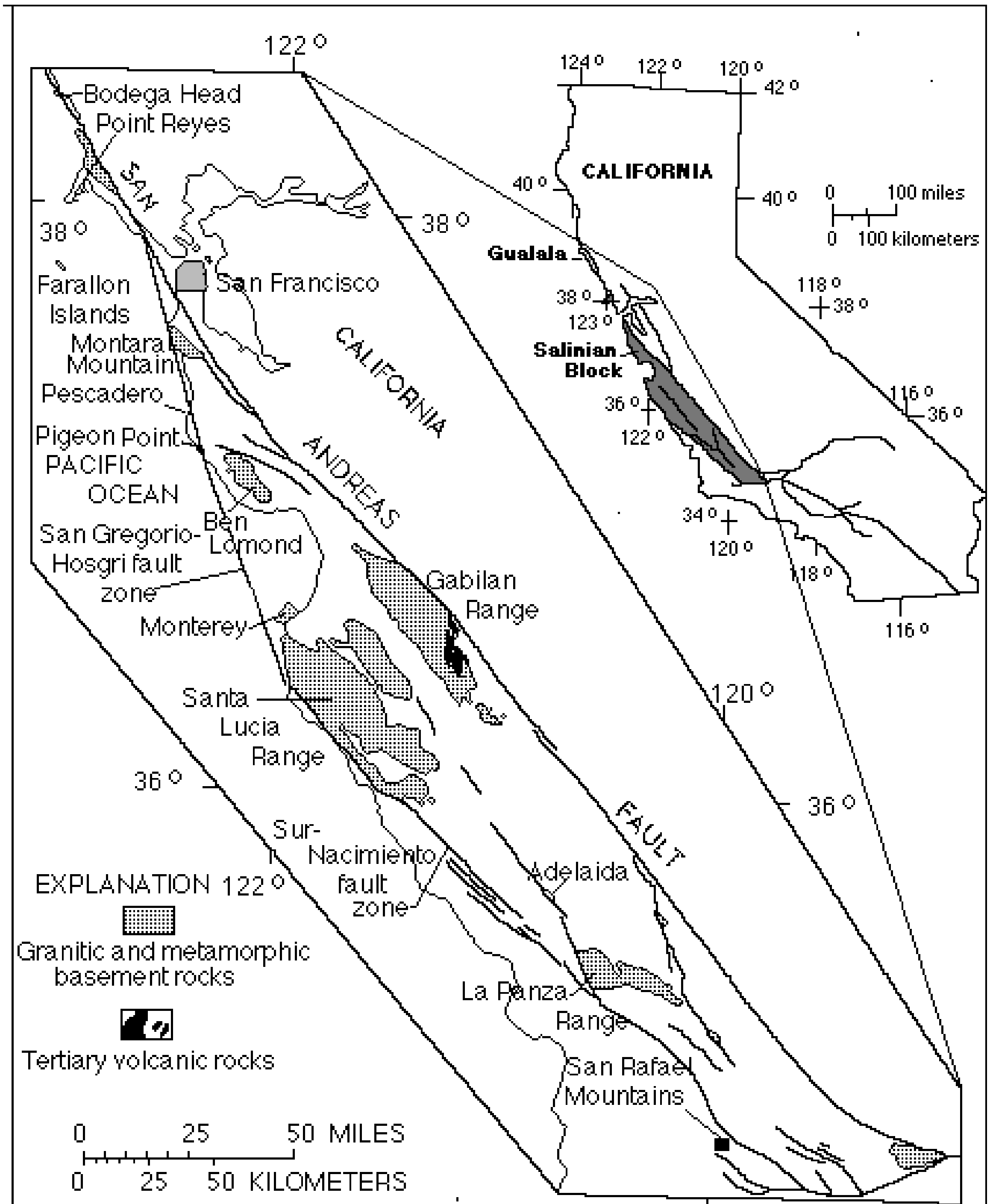

FIGURE 1

MAP SHOWING BASEMENT ROCK EXPOSURES IN THE SALINIAN BLOCK, CALIFORNIA COAST RANGES

ANALYTICAL METHODS

The rubidium and strontium concentration and Sr isotopic data reported in Table 1 were gathered in the Sr isotope laboratory at the USGS in Menlo Park, California. Results are presented for whole-rock and mineral powders milled to less than 200 mesh. Minerals were isolated by standard techniques of magnetic separation and by gravity in heavy liquids. Rubidium and strontium abundances of whole-rock powders were determined by energy dispersive X-ray fluorescence methods, whereas standard isotope dilution techniques were used to determine these elemental abundances in K-feldspar, plagioclase, hornblende and biotite. Concentrations of Rb and Sr by X-ray fluorescence are ± 3%, whereas they are ± 1% by isotope dilution. Strontium isotope ratios were determined using a MAT 261, 90° sector mass spectrometer, using the double rhenium filament mode of ionization. Strontium isotopic compositions are normalized to $^{86}Sr/^{88}Sr=0.1194$. Measurements of NBS strontium carbonate standard SRM 987 yield a mean $^{87}Sr/^{86}Sr$ of 0.710239±0.000015 over the period of this study. Analytical uncertainties in $^{87}Sr/^{86}Sr$ values are about ±0.008%. The initial $^{87}Sr/^{86}Sr$ values reported for whole-rocks, and whole rock- mineral isochron ages in Table 1 were calculated using the decay constant for rubidium from Steiger and Jager (1977) and the ISOPLOT program of Ludwig (1999), respectively.

Oxygen was extracted from whole-rock samples by the BrF_5 method (Clayton and Mayeda, 1963) or by the ClF_3 method (Bothwick and Harmon (1982) in nickel bombs at 550^{o}C and converted to CO_2 by reaction with hot carbon. The CO_2 was analyzed on a MAT-250 isotope ratio mass spectrometer. Extractions and analyses of oxygen were done in the stable isotope laboratory in Menlo Park, California (Masi and others, 1981, this report). All of the δ-values reported in Table 4 are given in per mil relative to the SMOW standard. All samples were analyzed in duplicate with reproducibility of $\delta^{18}O$ of ± 0.15 per mil or better.

The Pb isotope data (Table 2) determined in the laboratory at the U.S. Geological Survey in Menlo Park were obtained on feldspar separates made from whole-rock crushes by conventional magnetic and heavy-liquid separation techniques. Sodium and particularly K-rich feldspars from granitoid rocks have relatively high concentrations of Pb and very low concentrations of U and Th and their measured Pb isotopic ratios are essentially initial values for their host rocks. Pb was separated from feldspar using standard anion exchange resin processes that utilize HBr and HCl. All feldspar mineral separates were leached with HCl, HNO_3, and weak HF to remove labile Pb before dissolution. Pb isotopic compositions were determined in static-collection mode on a MAT 262 mass spectrometer. Thermal fractionation was monitored by running NBS-981 and -982. The empirically determined fractionation correction factor is 0.0011 per mass unit and its uncertainty is the largest contribution to the total analytical uncertainty of about ±0.1% associated with the Pb isotopic ratios.

Initial $^{143}Nd/^{144}Nd$ values of selected plutons (Table 2) are reported in ε notation (DePaolo and Wasserburg, 1976) as deviations in parts in 10^4 from the reference mantle reservoir where $\varepsilon Nd=\{(^{143}Nd/^{144}Nd)T_{INIT}/(^{143}Nd/^{144}Nd)T_{CHUR}-1\}\ x10^4$. Values for plutons at Bodega Head, Point Reyes, Montara Mountain, and Ben Lomond Mountain-Santa Cruz area are from this report, whereas all other values are from Mattinson (1990). At the USGS, all isotopic neodymium determinations were with the MAT 261 mass spectrometer using double rhenium filament mode of ionization, double collection, and automated operation and data reduction. Analysis of USGS rock standard BCR-1 gives a $^{143}Nd/^{144}Nd$ value of 0.512642±2 after isotopic ratios are normalized to a $^{146}Nd/^{144}Nd$ value of 0.7219. The decay constant of ^{147}Sm used is 6.54 x 10^{-12} yr^{-1}. Sm and Nd concentrations are by INAA from Ross (1982).

The $^{40}Ar/^{39}Ar$ isotopic measurements (Table 3) were made in the USGS K-Ar laboratory on argon extracted from biotites and hornblendes that were heated incrementally to fusion in a resistance heater. The argon increments were purified in a conventional argon extraction system and then measured either in an on-line, 6-inch radius 60° sector, Nier-type, single-collector mass spectrometer or a MAP 216 with a Bauer-Signer source, high-sensitivity mass spectrometer with electron multiplier. Samples were irradiated in the core of the U.S. Geological Survey TRIGA reactor at a 1-MW power level. The reactor neutron flux constant, J, was calculated using biotite and sanidine monitor minerals distributed both vertically and horizontally around the samples. The potassium and argon isotopic abundances and the ^{40}K decay constants used in the age calculations are those recommended by Steiger and Jager (1977). Uncertainties in $^{40}Ar/^{39}Ar$ ratios of irradiated samples are generally between 0.2 and 0.4%. Corrections for atmospheric and neutron-induced interferences were made as appropriate and the error estimates quoted for ages reported include propagations of these uncertainties (Dalrymple and Duffield, 1988).

Table 5 summarizes U-Pb, Rb-Sr, ^{40}Ar-^{39}Ar, K-Ar, and published fission-track ages of minerals from granitic rocks in the Salinian composite terrane, California.

DISCUSSION OF RESULTS

Bodega Head and Point Reyes Peninsula

In the northern Salinian block (fig. 1) granitic and metamorphic basement rocks are exposed at Bodega Head, for about 25 km along the east side of the Point Reyes Peninsula to the west of the San Andreas fault zone, and at Point Reyes (fig. 2). In a petrographic and chemical reconnaissance of the granitic rocks, Ross (1972) noted a general compositional change from mafic (tonalite) to felsic (granite) from north to south. Because of the lack of good continuous exposures and small number of samples investigated, he was not able to determine if the granitic rocks represented separate intrusions or a single zoned pluton.

The petrographic descriptions by Ross distinguished several granitic rock types exposed at Bodega Head: tonalite and granodiorite (fig. 2, loc. 1&2 and 4&5, respectively), pegmatite with quartz, K-feldspar and plagioclase crystals as large as one foot across exposed in a cliff at location 3, and porphyritic granodiorite with distinctive pink K-feldspar phenocrysts found only as cobbles on the beach at locations 4 and 5.A plethora of aplite and pegmatite dikes intrude the granodiorite at locations 4 and 5.

The compositionally different rock types are also different with respect to age and isotopic signatures (table 1). Three fractions of zircon from the tonalite are concordant at an apparent U-Pb age of about 98 Ma (table 5, Mattinson, 1978). SHRIMP-RG ages for five zircons from the tonalite (J. Wooden, oral communication, 2001) range from 143 Ma to 95 Ma (table 5). Until additional SHRIMP data can be completed, the emplacement age for this body is not precisely determined. Mattinson interpreted his data to indicate an age of about 104 Ma for the time of emplacent of this pluton. The whole-rock range of tonalite of Bodega Head Rb/Sr values (0.173-0.213, table 1) is too small to permit any meaningful age information to be derived from our data. Assuming an age of 104 Ma (Mattinson, 1978) for the tonalite yields a narrow range of calculated initial $^{87}Sr/^{86}Sr$ values (0.70634-0.70671) for specimens from locations 1 and 2 (table 1). Whole-rock granodiorite of Bodega Head and mafic inclusion specimens (locations 4 and 5, figure 2) have a Rb-Sr isochron age with a large uncertainty of about 100 Ma and initial $^{87}Sr/^{86}Sr$=0.7060±18 (table 1). The whole-rock specimens of porphyritic granodiorite, aplite, and pegmatite, and K-feldspar from pegmatite and the porphyritic granodiorite at locations 4 and 5 have a Rb-Sr isochron age of about 95 Ma with initial $^{87}Sr/^{86}Sr$=0.70552±55 (table 1). Plagioclase and K-feldspar from the pegmatite at location 3 (fig. 2) have a Rb-Sr isochron age of 91.8±2.0 Ma and initial $^{87}Sr/^{86}Sr$=0.70672±5.

Biotite Rb-Sr ages from the tonalite, granodiorite and porphyritic granodiorite of Bodega Head are all the same with an average of 85.5±0.5 Ma (tables1, 5). Hornblende from the tonalite at location 2 has a K-Ar age of 94.3±3.0 Ma (table 5,Evernden and Kistler, 1970) whereas hornblende from another sample from the same location has a $^{40}Ar/^{39}Ar$ incremental heating plateau age of 89.3±0.45 Ma (tables 3, 5). Hornblende from the granodiorite of Bodega Head has a $^{40}Ar/^{39}Ar$ incremental heating plateau age of 92.3±0.47 Ma (tables 3, 5). Sphene and apatite from tonalite of Bodega Head at location 1 (fig.2) have a U-Pb K-feldspar-sphene-apatite isochron age of 93±2 Ma (table 5,Mattinson, 1978).

Ross (1972) noted a general change in rock type from tonalite to granite from north to south for the granitic rock exposures on the Point Reyes Peninsula. The average composition was granodiorite. We have differentiated four granitic rock units on the Peninsula (Figure 2, table 1): biotite granite of Tomales Bay, porphyritic granodiorite of Point Reyes, granodiorite of Tomales Point, and tonalite and granodiorite of McClure's and Kehoe Beaches with Rb-Sr whole-rock isochron ages and initial $^{87}Sr/^{86}Sr$ values of 82.0±3.0 Ma, 0.70863±24; 85.2±15 Ma, 0.70775±29; 94.1±3.6 Ma, 0.70618±6; 109.6±9.5 Ma, 0.70662±22, respectively.

The $^{87}Rb/^{86}Sr$ values (table 1) of the granodiorite of Tomales Point are all less than 0.5 and a meaningful Rb-Sr isochron age cannot be derived for these rocks. However, modal mineral compositions (Ross, 1972) and the Rb and Sr concentrations of specimens of this pluton are distinctive and similar to those of the granodiorite of the Farallon Islands (table 1). A combined Rb-Sr whole-roock isochron for these two similar plutonic rocks has an age of 94.1±3.6 Ma, initial $^{87}Sr/^{86}Sr$=0.70618±6. Aplite and pegmatites that intruded the granodiorite of Tomales Point at locations 7,9, and14 (fig.2) have a Rb-Sr whole-rock isochron age of 87.3±3.8 Ma and initial $^{87}Sr/^{86}Sr$=0.70627±14 (table 1). A fourth pegmatite at location 13 (fig.2) has initial $^{87}Sr/^{86}Sr$=0.70668 at 87 Ma (table 1).

Aplites and pegmatites that intruded the tonalite and granodiorite of McClure's and Kehoe Beaches at locations, 16,17, and 20 (fig.2) are collinear on the same Rb-Sr whole-rock isochron as the host rocks and represent felsic differentiates of this pluton. The Rb-Sr whole-rock age is 109.6±9.5 Ma (table 1) and is consistent with discordant U-Pb zircon dates of 104, 102, 98, and 96 Ma from two specimens collected on McClure's Beach (Mattinson, 1978, table 5). In contrast, in this pluton, a whole-rock pegmatite, K-feldspar, biotite Rb-Sr isochron for a specimen at location 21 on Kehoe Beach has an age of 88.2±5.2 Ma, initial $^{87}Sr/^{86}Sr$=0.70715±45 (fig.2, table 1). A whole-rock-K-feldspar Rb-Sr isochron age is 79.8±3 Ma, initial 87Sr/86Sr=0.70794±5 for another pegmatite in this pluton at location 18 (fig.2, table 1).

The pluton called porphyritic granodiorite of Point Reyes has K-feldspar megacrysts in specimens of granodiorite, but is equigranular tonalite in some beach exposures (location 25,

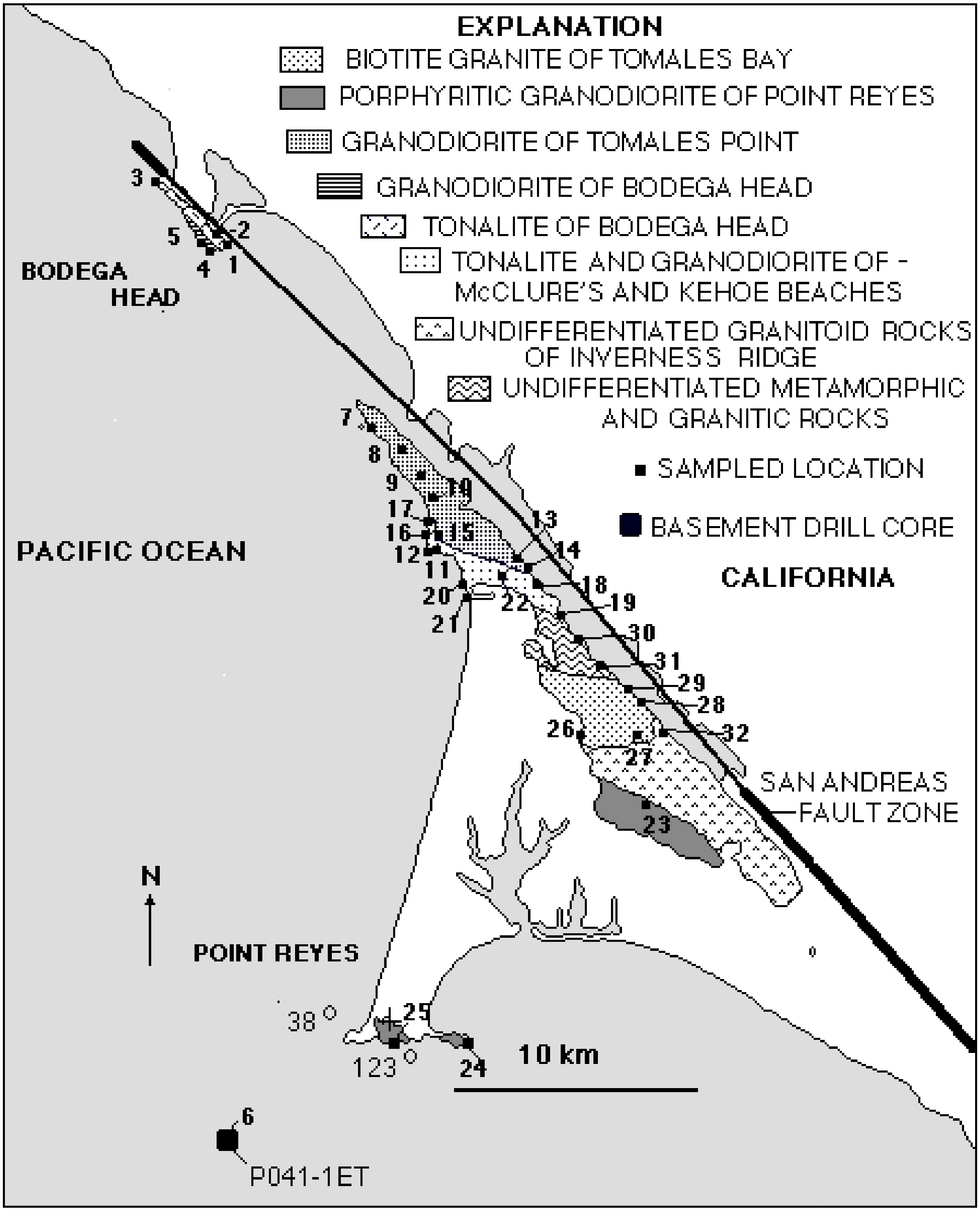

Figure 2. Map showing granitic and metamorphic rock exposures (modified from Galloway, 1977) and sample locations at Bodega Head and Point Reyes. Location 6 is for 5 samples of tonalite basement from an 18 foot long core at a depth of 4700 feet (1432 meters).

fig.2) below the Point Reyes lighthouse and on Point Reyes Hill (location 23, fig. 2). Numerous aplite and granite dikes intruded the granodiorite at location 24 (fig.2). All but one of these dikes (PR-15-88) are collinear with the granodiorite and tonalite specimens and have an age of 85.2±19 Ma, initial $^{87}Sr/^{86}Sr$=0.70775±29.

The biotite granite of Tomales Bay is exposed on the beach of Tomales Bay (locations 28 and 29, fig.2), on the road to McClures's Beach (location.27, fig 2) and on the road to Point Reyes lighthouse (location 26, fig.2). The Rb-Sr isochron for this pluton is from whole-rock granite, aplite, and K-feldspar and biotite from a pegmatite and granite, respectively. This felsic pluton is 82.0±3 Ma with initial $^{87}Sr/^{86}Sr$=0.70863±24 (table 1).

The porphyritic granodiorite of Point Reyes and the biotite granite of Tomales Bay have been described as an intrusive suite and correlated with plutons to the south in Monterey Bay and on the Monterey Peninsula (Kistler and Champion, 1997, Stakes and others, 1998, 1999). The pluton correlations are discussed below in more detail in the sections on the Santa Lucia Mountains and Monterey Bay.

Small, isolated beach-exposures of biotite granodiorite in schist at locations 30, 31, and 32 (fig.2, table 1) are possibly equivalent to similar isolated granitoid rocks that intruded schist to the south near Santa Cruz (fig. 5).

Location 6, figure 2 is for five specimens from an 18 feet long drill core of tonalite recovered at a depth of 4700 feet (1432 meters) at offshore site P041-1ET by Shell Oil Company. The rock is a mafic foliated tonalite with abundant mafic inclusions. One tonalite, three mafic inclusions, and one pegmatite taken from the core have Rb/Sr whole-rock age of 75±29 Ma with initial $^{87}Sr/^{86}Sr$=0.70658±39. The large age uncertainty is due to the small spread of $^{87}Rb/^{86}Sr$ values and small number of samples analyzed. The deformation and petrographic character of this tonalite is like the tonalite of Bodega Head that suggests its age is closer to the upper limit of the isochron uncertainty.

Biotite Rb-Sr ages (tables 1, 5) range from 89.2 Ma to 79.8 Ma from north to south along the Point Reyes Peninsula. Those in the north have been variably reset in the thermal aureole of the plutons in the south, whereas they approximate emplacement ages for the southern plutons. $^{40}Ar/^{39}Ar$ biotite and hornblende incremental heating plateau ages (table 3, table 5) show a similar age pattern from 87.3 Ma to 81.3 Ma and from 91.5 Ma to 83.3 Ma, respectively. Sphene and apatite from the tonalite of McClure's and Kehoe Beaches (locations 11 and 16, fig.2) are collinear on the K-feldspar, sphene, apatite U-Pb isochron of 93±2 Ma for the tonalite of Bodega Head (Mattinson, 1978, table 5). This age for these minerals reflects resetting in the thermal aureole of the adjacent 94 Ma granodiorite of Tomales Point.

Farallon Islands and Cordell Bank (figure 3)

Specimens of granitic rocks were collected from all of the Farallon Islands and from submerged rock pinnacles along the Cordell Bank (fig. 3). Specimens from Southeast Farallon Island are all subaerial, whereas those from Middle and North Farallon Islands and along the Cordell Bank were dredged from ships or collected by SCUBA divers. Specimens from all of the Farallon Islands are hornblende-bearing biotite granodiorite. The granodiorites and two pegmatites and their K-feldspars have a Rb-Sr isochron age of 94.0±3.7 Ma with initial $^{87}Sr/^{86}Sr$=0.70613±11 (table 1). This age is the same as a U-Pb age of about 95 Ma for zircons extracted from several samples on Southeast Farallon Island (Mattinson, 1990).

Sheared biotite granodiorite from Fanny Shoals and Noonday Rock on the Cordell Bank (fig. 3) have a Rb-Sr whole-rock age of about 106 Ma and initial $^{87}Sr/^{86}Sr$=0.7055 based on a two point isochron (table 1, FAIS8-91, FAIS9-91). Using this apparent age, two other sheared biotite granodiorite specimens from Noonday Rock (FAIS-1-91, FAIS-1A-91, table 1) have initial $^{87}Sr/^{86}Sr$ values of 0.70496 and 0.70457, respectively.

Eight zircons from a sheared biotite granodiorite collected at a depth of 140 feet on the northern Cordell Bank (location COBA2-92, fig3, table 5) have an age of 100 Ma by SHRIMP-RG ion microprobe analysis (J. Wooden, personal communication, 2000). Assuming this same age, a sphene-bearing biotite tonalite and a sheared biotite granodiorite from two other pinnacles on the northern Cordell Bank (locations COBA 1-92, COBA 3-92, fig. 3, table 1) have initial $^{87}Sr/^{86}Sr$ values of 0.7051 and 0.7058, respectively. Mattinson (1990) reported a conventional U-Pb zircon date of about 95 Ma for biotite granite collected from another pinnacle (location 812001, fig.3) on the northern Cordell Bank.

We dredged several sites along the length of the Cordell Bank from the USGS research vessel Farnella in 1990. A granitic bedrock sample, tonalite of Cordell Bank, was broken off and collected from a depth of 210 feet at location COBA6-90 (fig.3, table 1, table 5) to the west of the Farallon Islands. Conventional U-Pb ages were determined from four fractions of zircon and two fractions of sphene, and from 25 zircon spots by SHRIMP ion microprobe (Kistler and Wooden, 1994, fig. 4). The U-Pb systematics are very complex and indicate both inheritance and loss of lead in the zircons from this rock. The conventional U-Pb zircon dates are concordant and range from 99 Ma to 91 Ma. The average of the two U-Pb sphene ages is 97.8 Ma. The SHRIMP ion microprobe data include concordant zircon ages of 111, 126, and134 Ma that indicate inheritance of Mesozoic and possibly Paleozoic crystals, whereas discordant zircons have $^{206}Pb / ^{238}U$ ages that range from about 105 Ma to 91 Ma and $^{207}Pb / ^{235}U$ ages that suggest an inherited Precambrian population. We interpret the cluster of SHRIMP age data and oldest conventional concordant U-Pb age of 99 Ma as the emplacement age of this tonalite. The U-Pb sphene age of 97.8 Ma, biotite Rb-Sr and $^{40}Ar/^{39}Ar$ total fusion ages of 88.3 Ma and 91.33±051 Ma, hornblende $^{40}Ar/^{39}Ar$ incremental heating plateau age of 89.09±0.55 Ma, and U-Pb zircon ages as young as 91 Ma indicate variable resetting by a thermal disturbance of the pluton about 10 m.y. after it was emplaced.

Three other dredge sites from the Farnella (COBA2, 3, and 4-90, table 1) recovered only cobbles of granitic rock. Tonalite cobbles (COBA3-90-2 wr, COBA2-90 wr) have Rb and Sr abundances and initial $^{87}Sr/^{86}Sr$ values at a 95 Ma assumed age (0.7063 and 0.7061, respectively) that suggest they are derived from a granitic rock source like the Farallon Islands. Tonalite (COBA3-90-3 wr) and pegmatite (COBA3-90-2P) at an assumed 95 Ma age have initial $^{87}Sr/^{86}Sr$= 0.7051±2 like the tonalite collected from the nearby pinnacle at location COBA 1-92 wr. The cobble of tonalite and aplite that intrudes it from dredge site COBA4-90 have an apparent age of 90 Ma and initial $^{87}Sr/^{86}Sr$=0.70716 that suggest a source from a granitic rock terrane similar to the Point Reyes Peninsula.

Sample site COBA 1-90 (fig.3, table 1) is the same as dredge site MUL-49-11 (Hanna, 1952). We were given a sample bag of cobbles from this site by the curator at the California Academy of Sciences. This was the only material that remained from that collected by Hanna

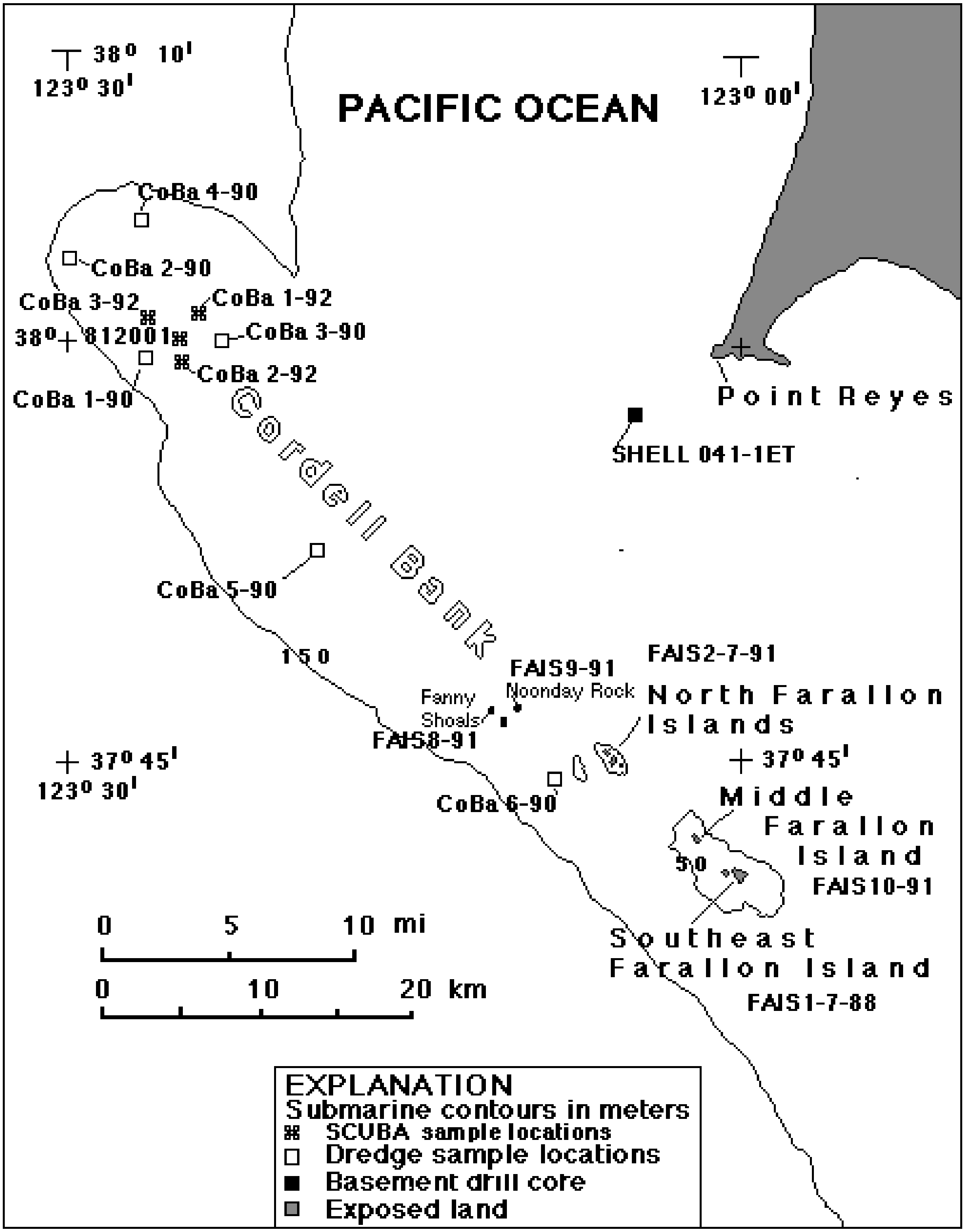

Figure 3. Map showing locations of granitic rock specimens collected from the Farallon Islands and the Cordell Bank. The map and submarine contours are simplified from McCulloch and others (1985).

from the cruise of the research vessel USS MULBERRY in 1949. We determined Rb and Sr concentrations and $^{87}Sr/^{86}Sr$ for a tonalite and crosscutting aplite and its K-feldspar from this collection. These data yield an age of 94.6 Ma and initial $^{87}Sr/^{86}Sr$=0.70448.

Granitic rocks collected in place along the Cordell Bank range from about 106 Ma to 95 Ma with initial $^{87}Sr/^{86}Sr$ values from about 0.7046 (FAIS-1A-91, Noonday Rock) to about 0.7055
(COBA6-90, tonalite of Cordell Bank). The isotopic signatures of granitic rock cobbles dredged from various sites along the Cordell Bank record sources from local rocks and the Farallon Islands. Cobbles from one dredge site (COBA4-90, fig. 3, table 1) possibly were derived from as far away as the Point Reyes Peninsula.

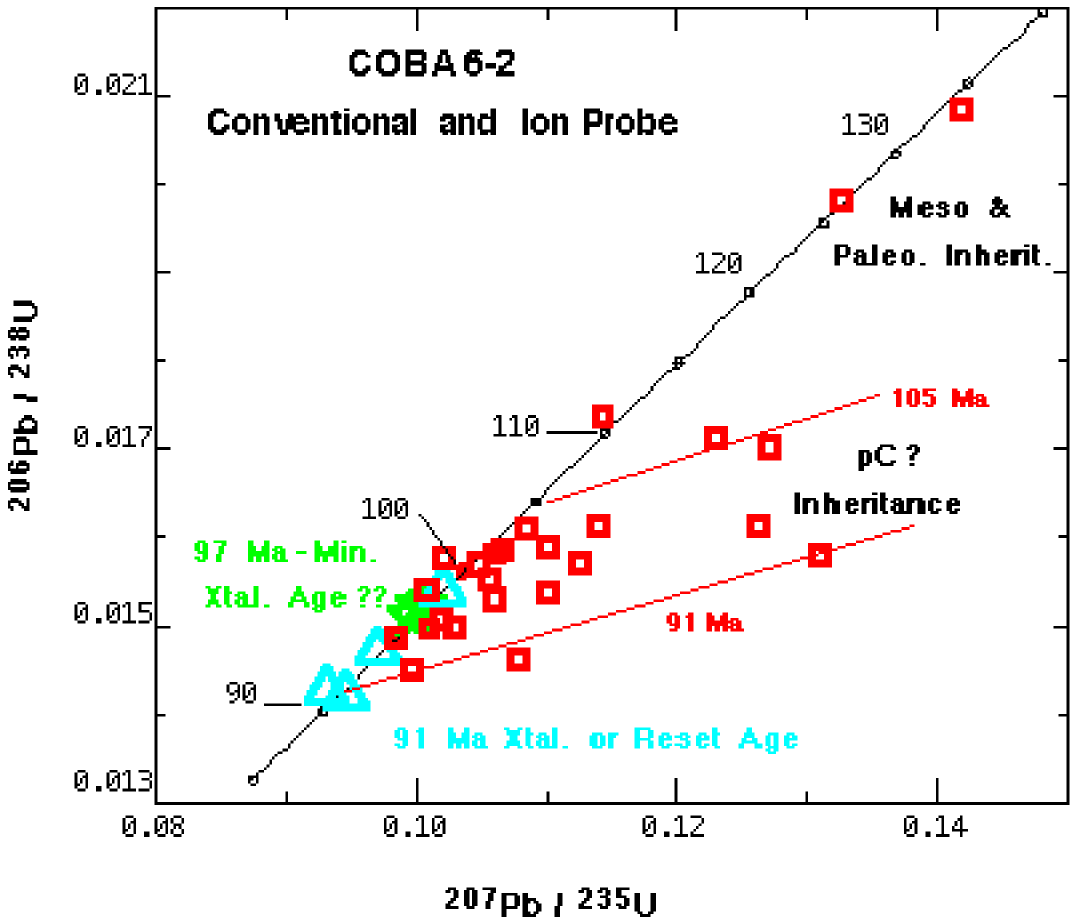

Figure 4. Modified concordia diagram for tonalite specimen COBA6-90 of four fractions of zircons (triangles) and two of sphenes (stars) dated by conventional U-Pb isotope dilution techniques and of twenty-five zircon spots (squares) dated by SHRIMP ion microprobe techniques (Kistler and Wooden, 1994).

Montara Mountain (figure 5)

Montara Mountain is a granitic rock body 30 square miles in area that crops out to the south of San Francisco along the Pacific Coast (fig. 1). Strongly foliated tonalite is the most common rock type (Ross, 1972) but there are minor phases as mafic as gabbro and as felsic as granite. James (1992) dated a sample from the northern part of the pluton from the Devils Slide area (location 13, fig.5) by conventional U-Pb techniques on zircon, sphene, and apatite. Three zircon samples gave concordant ages of about 104 Ma. Mattinson (1994) obtained the same U-Pb age result using stepwise dissolution dating.

Using this age for the pluton yields a large variation in calculated initial $^{87}Sr/^{86}Sr$ from 0.7046 (location 13, fig.5, table 1) to 0.707 (location 1, fig.5, table 1). The initial $^{87}Sr/^{86}Sr=0.706$ isopleth (Kistler and Peterman, 1973, 1978) trends east-west across the pluton and separates samples collected in the northern third with initial $^{87}Sr/^{86}Sr$ values <0.7060 from samples collected in the southern two-thirds with $^{87}Sr/^{86}Sr$ values >0.7060 (table 1). Specimens from the south tonalite of Montara Mountain have a Rb-Sr whole-rock age of 106±20 Ma, with initial $^{87}Sr/^{87}Sr=0.70640\pm27$ (table 1). Whole-rock chemical compositions (Ross, 1972) and textural characteristics, Rb and Sr concentrations, Sr isotopic values, and apparent age of the south tonalite of Montara Mountain are similar to those of the tonalite of Bodega Head.

Pegmatites that intrude the south tonalite of Montara Mountain are 90 Ma at locations 2 and 3 and are about 76 Ma at location 11 (table 1, fig. 5). Pegmatites that intrude the north tonalite of Montara Mountain are 89 Ma at North Peak (location 12, fig.5) and 88.5 Ma in a

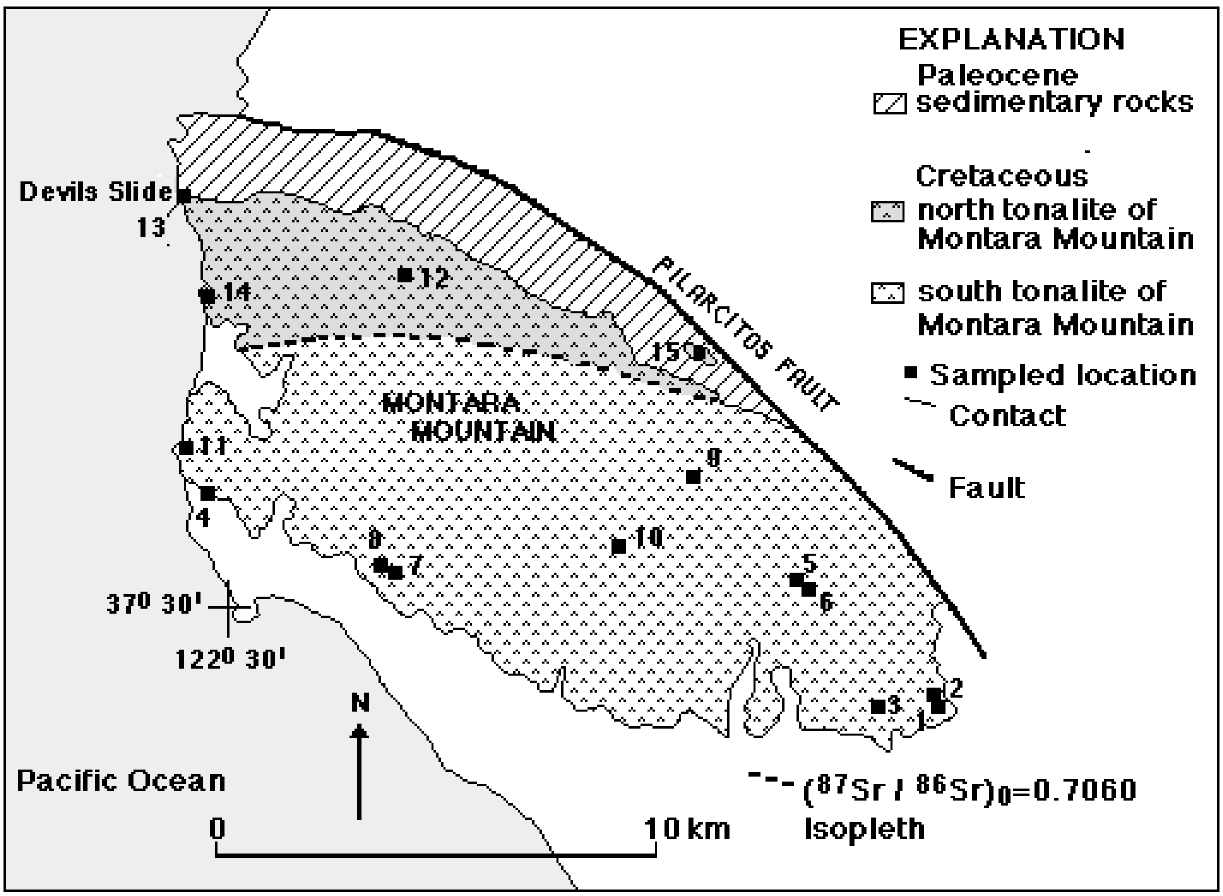

Figure 5. Outline map of Montara Mountain showing sample locations and initial $^{87}Sr/^{86}Sr=0.7060$ isotopic boundary between the north and south tonalites of Montara Mountain.

specimen taken from a Caltrans drill core at Devils Slide (location 13, fig. 5).

Biotite Rb-Sr ages are 86.1 Ma from the south tonalite of Montara Mountain (locations 7 and 8, fig. 5, table 1), whereas $^{40}Ar/^{39}Ar$ incremental heating plateau ages for biotite and hornblende are 88.07±0.66 Ma, 89.10±0.58 Ma and 90.32±0.48 Ma, 89.95±0.56 Ma from the same two localities, respectively (tables3, 5). Curtis and others (1958) reported a K-Ar date of 89.5± 2.5 Ma for biotite from a specimen of north tonalite of Montara Mountain at the Pilarcitos Dam site (location 15, fig. 5, table 5). James reported $^{238}U/^{206}Pb$ ages of 94 Ma and 93 Ma for sphene and apatite, respectively, from the north tonalite of Montara Mountain at location 13 (fig. 5, table 5) at Devils Slide.

Ben Lomond Mountain-Santa Cruz Area (figure 6)

The Ben Lomond Mountain area of the Santa Cruz Mountains is a complex of plutonic igneous rocks and metamorphosed sedimentary rocks that underlie a capping of Cenozoic deposits north of Santa Cruz, east of the San Gregorio-Hosgri fault zone, and southwest of the Vergeles-Zayante fault zone (fig. 1). The distribution of the granitic and metamorphic rocks in this area is shown in figure 6 (modified from Leo, 1967, and Ross, 1972). Seven major granitic plutons are identified by mapping and isotope studies. Most of the granitic rocks are tonalite (Ross, 1972), called the northern tonalite of Ben Lomond and the southern tonalite of Ben Lomond (James, 1992, fig. 6). A garnet bearing granite called the alaskite of Smith Grade by Leo (1967) crops out near the center of the basement complex. Isolated outcrops of granodiorite, along and east of HWY 1, are called the granodiorite of Glen Canyon (James, 1992, fig. 6). Leo (1967) mapped gabbro and gneiss bodies near the center of the complex (fig. 6). Finally, we separated granitoid rocks in the Bonny Doon, Felton, and Santa Cruz area on the basis of their age and isotopic characteristics (fig. 6).

By U-Pb dating of zircons, James (1992) identified both an undeformed group of plutons between 91 and 103 Ma and a deformed group of plutons greater than 103 Ma and less than 130 Ma. Our Rb-Sr dating indicates all of these plutons are between 121 Ma and 99 Ma.

The granodiorite of Glen Canyon is exposed in a quarry at the intersection of Glen Canyon Road and Hwy 17 (location 4, fig. 6), in discontinuous exposures in stream bottoms to the east of Hwy 17 (locations 5, 6, and 7, fig. 6), at K13-87 wr (location DR1105, west branch of Soquel Creek, Ross, 1972), along the Bridge Creek Trail (specimens BL1, 2, 4-89, table 1), and at Olive Springs quarry west of and near the Vergeles-Zayante fault zone. This is the oldest pluton indicated by Rb-Sr whole-rock data in the Ben Lomond Mountain-Santa Cruz area at 121±6 Ma with initial $^{87}Sr/^{86}Sr$=0.70561±16. James Included this pluton in his older group and interpreted his zircon data to give a minimum age of 108 Ma. One of our specimens (location 4, fig. 6) is from the same quarry as James' zircon locality. The granodiorite from location 5 (fig. 6) is assigned to this pluton by Ross (1972), but with its crosscutting pegmatites give a Rb-Sr whole-rock age of 110.3±4.8 Ma with initial $^{87}Sr/^{86}Sr$=0.70506±34. This result indicates the granodiorite of Glen Canyon is composed of at least two plutons with different ages and isotope signatures, but with similar appearances.

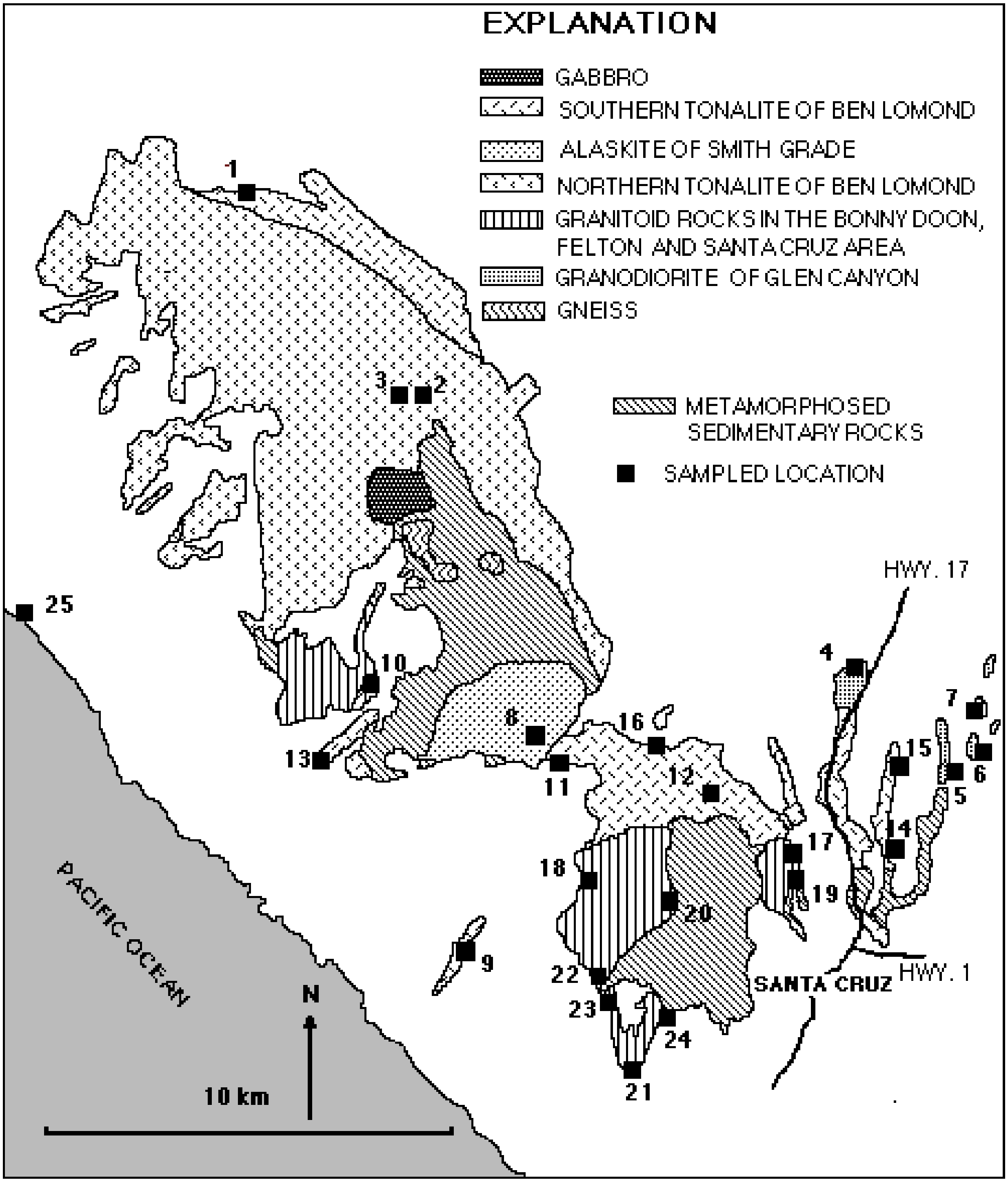

Figure 6. Map (modified from Leo, 1967, Ross, 1978, and James, 1992) showing sample locations and the distribution of granitic and meatmorphic rocks in the Ben Lomond-Santa Cruz area.

A mixed assemblage of tonalite, granodiorite, granite, and garnet bearing granite is discontinuously exposed to the east, west, and south of the large exposure of metamorphosed sedimentary rocks near Santa Cruz and also to the west of the metamorphosed sedimentary rocks near Bonny Doon (fig.6). Rb-Sr whole-rock data from these rocks lie along two parallel errorchrons of 117±15 Ma with initial $^{87}Sr/^{86}Sr$ values of 0.70902±44 and 0.70722±44 (table 1).

Whole-rock specimens of the northern tonalite of Ben Lomond and the alaskite of Smith Grade (fig. 6, locations 2, 3, and location 8, respectively) are collinear on a Rb-Sr isochron at 109.4±4.2 Ma with initial $^{87}Sr/^{86}Sr$=0.70565±12 (table 1). On the basis of very complex U-Pb zircon and monazite data, James (1992) placed the alaskite of Smith Grade in his older group with a minimum age of 126 Ma.

We assign samples from locations 9-16 and 1 (fig. 6) to the southern Ben Lomond tonalite. Our location 11 (fig. 6) is from the same locality as James' location 9 (1992) from this pluton. The Rb-Sr whole-rock age for samples from this pluton is 102.2±4.2 Ma with initial $^{87}Sr/^{86}Sr$=0.70638±20 (table 1). The zircon U-Pb data for the southern Ben Lomond tonalite are discordant (James (1992, table 5). From these data James interpreted the emplacement age of the southern Ben Lomond tonalite as 91 Ma.

A specimen called *northern* tonalite of Ben Lomond by James (1992) and our specimen of a tonalite (location 1, fig.6) are very close together. The initial $^{87}Sr/^{86}Sr$ values 0.70638±20 (table 1) of our tonalite K1A-87 and cross-cutting pegmatite and aplite K1C-87 and K1D-87 and 0.70677 for apatite from James' location (1992) indicate this is more of the southern tonalite of Ben Lomond and it is shown as such on the map (fig. 6) and also in table 1. In addition, U-Pb zircon data (James, 1992) are discordant but interpreted to give an emplacement age of 99 Ma, which is within experimental error of our Rb-Sr whole-rock age of 102.2±4.2 Ma for the southern tonalite of Ben Lomond.

James (1992) reports U-Pb zircon dates of about 109 Ma for Laguna Creek orthogneiss (shown as gneiss on fig. 6) and 100 Ma for gabbro (fig. 6). Apatite $^{87}Sr/^{86}Sr$ values for the gneiss and gabbro are 0.70677 and 0.70672, respectively (James, 1992).

Specimens of a small body of granite and cross cutting pegmatite, adamellite of Clark (1981), (location 24, fig.6), yield a Rb-Sr age of 99.4 Ma with initial $^{87}Sr/^{86}Sr$=0.71472±10 (table 1).

Granitic basement was recovered from an exploratory oil well in the Santa Cruz area near the shore of Monterey Bay (Texaco Poletti #1 from 9163 ft., location 25, fig. 6). This granodiorite has an initial $^{87}Sr/^{86}Sr$=0.7038 at an assumed age of 100 Ma (table 1).

Rb-Sr ages for biotites from the northern tonalite of Ben Lomond (locations 2, 3 fig.6) are 83.6±2.0 Ma and 83.9±2.0 Ma, from the granodiorite of Glen Canyon (locations DR 1105 (Ross, 1976, and 5, 6, 7 fig 6) are 88.5±2.1 Ma, 88.9±2.1 Ma, 87.4±2.0 Ma, and 72.2±1.8 Ma, and from a tonalite in the Santa Cruz area of the Santa Cruz Mountains (location 20, fig. 6) is 85.14±2.0 Ma (tables 1, 5). Biotite $^{40}Ar/^{39}Ar$ ages from two specimens of northern tonalite of Ben Lomond are 86.54±0.44 Ma and 87.26±0.44 Ma and for hornblende are 89.95±0.56 Ma and 91.02±0.47 Ma (tables 3, 5, locations 2 and 3, fig. 6). A $^{40}Ar/^{39}Ar$ biotite age for a specimen of the granodiorite of Glen Canyon is 88.16±0.44 Ma (tables 3, 5, Location 5, fig. 6). A U-Pb age of monazite from the alaskite of Smith Grade is 101 Ma and of apatite and sphene from the southern tonalite of Ben Lomond are 92 Ma and 96 Ma, respectively (James, 1992, table 5).

Santa Lucia Mountains (Figure 7)

Ross (1976) published a map (fig. 7) and described the general geology of the northern Santa Lucia Range. The basement rocks are medium- to high grade metamorphosed sedimentary rocks and granitic rocks. Remnants of a presumably once continuous cover of Cretaceous and Tertiary sedimentary rocks are exposed throughout the area. He identified and named eleven northwest-trending fault zones in the range and three of these, the Sur, the Blue Rock-Miller Creek, and the Palo Colorado-Coast Ridge faults, are labeled A. B, and C (fig.7), respectively.

Both Early and Late Cretaceous plutons crop out in the northern Santa Lucia Range. Among the Late Cretaceous plutons are three contiguous granitic rock bodies that extend to the south for about fifteen miles from the Monterey Peninsula (fig. 7, locations 1-20); the quartz diorite (tonalite) of Sobaranes Point, the granodiorite of Cachagua, and the porphyritic granodiorite of Monterey (Ross, 1976). Ross could not find sharp contacts between these units and considered them as parts of a single, compositionally zoned pluton. Our Rb-Sr data from the host rocks, cross-cutting aplites and pegmatites, and feldspar separates are compatible with this conclusion and yield a whole-rock, K-feldspar isochron 83.5±6.2 Ma with initial $^{87}Sr/^{86}Sr$=0.70787±6 (table 1). We will call these plutons the intrusive suite of the Monterey Peninsula in the rest of this report. Three aplites and one pegmatite that intruded the porphyritic granodiorite of Monterey (locations 2, 3, 8, and 18, figure 7) are more fractionated than the other aplites and pegmatites sampled in this intrusive suite and lie on a separate isochron at 82±4 Ma with initial $^{87}Sr/^{86}Sr$=0.70732±72.

Other Late Cretaceous plutons are granodiorites in the Carmel Valley to the east of the Blue Rock-Miller Creek fault (B, fig. 7) that are older and have more radiogenic initial strontium isotopic values than the intrusive suite of the Monterey Peninsula. Granodiorites (locations 39-42, fig.7) and pegmatites (locations 21 and 39) are 93±10 Ma, initial $^{87}Sr/^{86}Sr$=0.70913±19. Another granodiorite east of the Blue Rock-Miller Creek fault crops out at location 43 (fig.7). The host granodiorite, a K-feldspar separated from the granodiorite, and a crosscutting garnet-bearing aplite dike have a Rb-Sr ischron age of 97±10 Ma with initial $^{87}Sr/^{86}Sr$=0.70817±19.

Another Late Cretaceous pluton, the granite of Pine Canyon crops out at the nothern end of the Sierrra de Salinas (locations 44-46, fig.7). Three whole-rock samples form a Rb-Sr isochron of 80.1±8 Ma with initial $^{87}Sr/^{86}Sr$=0.71000±10 (table 1). Rb-Sr whole-rock values of two garnet bearing aplites (locations 44, 47, fig.7) are not collinear with the granite samples and assuming an 80 Ma age for them gives initial $^{87}Sr/^{86}Sr$ values of 0.71070 and 0.70920.

The oldest pluton identified in the Santa Lucia Mountains, the Early Cretaceous granodiorite-quartz diorite of Bear Mountain and Junipero Serra Peak, was dated by Rb-Sr whole-rock analyses (locations 35-36, fig. 7) at 117±12 Ma with initial $^{87}Sr/^{86}Sr$=0.7082±5 (Everenden and Kistler, 1970). The data for this pluton are collinear with Rb-Sr whole-rock data for the quartz diorite of Paraiso Paloma area (table 1, locations 21-34, fig. 7) with a combined isochron age for these plutons at 117±12 Ma with initial $^{87}Sr/^{86}Sr$=0.70824±10.

Ross (1976) identified the diorite of Corral de Tierra (location 37, fig. 7) and the porphyritic granodiorite of Sand Creek (location 38, fig. 7) as older and the same age as the quartz diorite of the Paraiso Paloma area. Our Rb-Sr whole-rock data for single samples of each of these plutons give calculated initial $^{87}Sr/^{86}Sr$ values at 117 Ma of 0.70987 and 0.70830 for the Sand Creek and Corral de Tierra, respectively (table 1).

The charnokitic tonalite of Compton (1960) is intruded into the Coast Ridge Belt of Metamorphic rocks of Ross (1976, fig. 7). This belt of rocks is bounded on the east by the Palo Colorado-Coast Ridge fault and on the west by the Sur fault, C and A (fig.7) respectively, and it is distinguished from other metamorphosed sedimentary rocks exposures in the northern Santa Lucia Range by an abundance of marble and amphibolite bodies (Ross, 1976). Mattinson (1978)

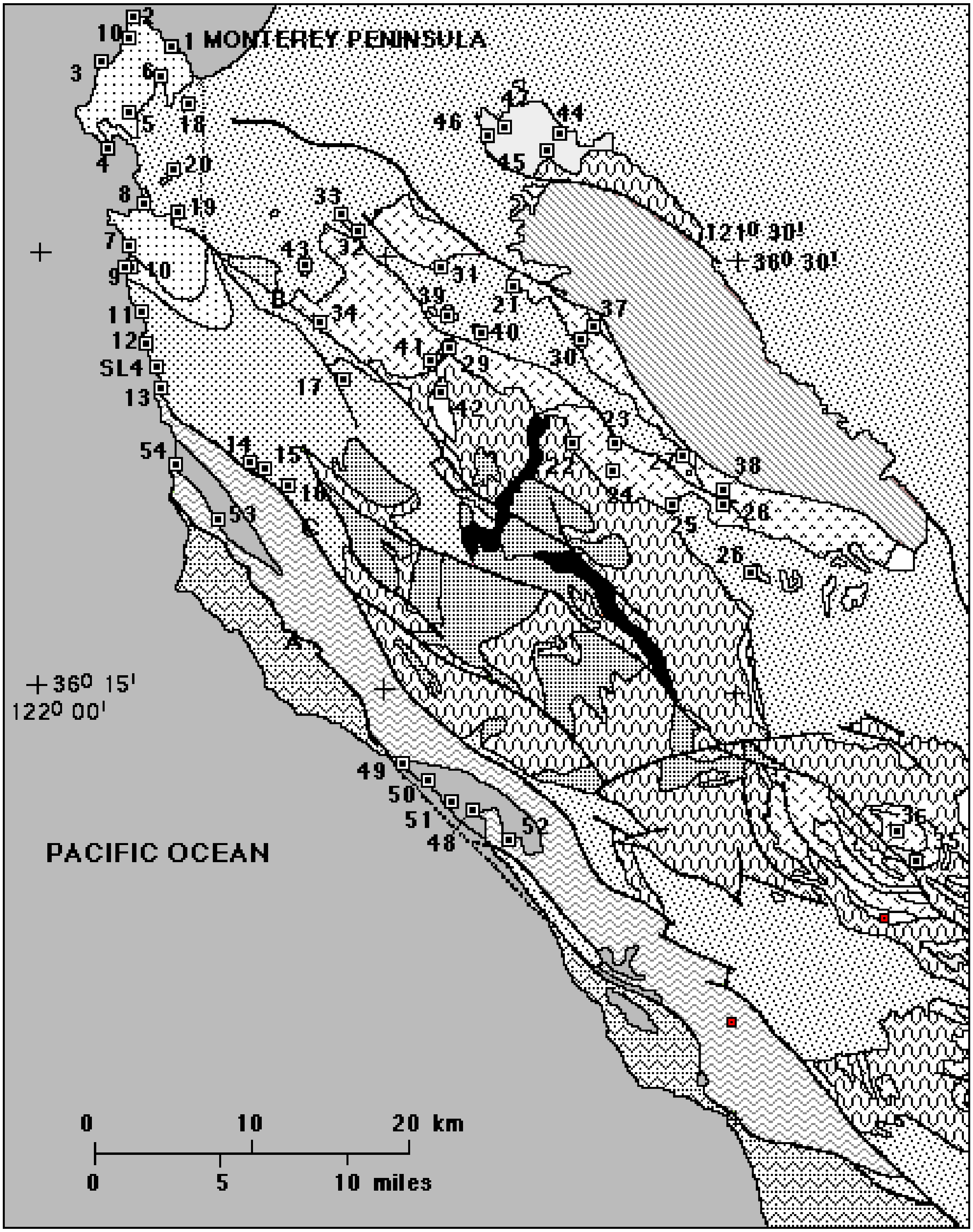

Figure 7. Geologic map of the northern Santa Lucia Range (modified from Ross, 1976) showing locations of samples described in this study.

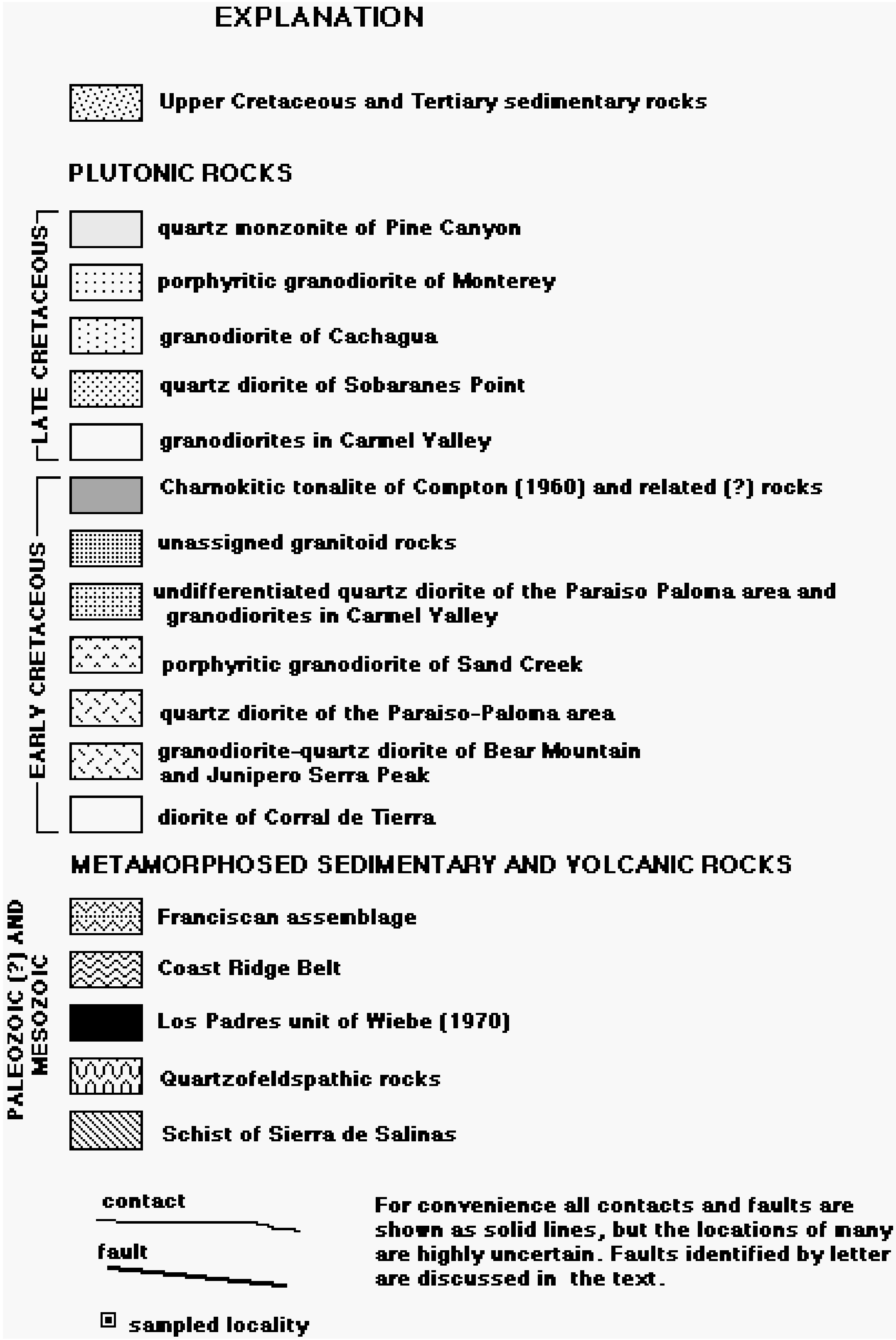

Figure 7, continued. Explanation for figure 7.

reported concordant U-Pb zircon ages for samples from two locations in the charnokitic tonalite at about 100 Ma. At this age, four specimens of charnokitic tonalite (locations 48, 50, 51, fig. 7,) have calculated initial $^{87}Sr/^{86}Sr$ values of 0.70610-0.70660 (table 1). Samples of garnet bearing quartzofeldspathic gneiss collected at the northern and southern ends of the mapped pluton (locations, 49,52, fig. 7) have calculated initial $^{87}Sr/^{86}Sr$ values of 0.71010, 0.71030, and 0.70830 at the age of the charnokite.

Another tonalitic pluton that Ross (1976) suggested was related to the charnokitic tonalite of Compton intruded the northern exposures of the Coast Ridge Belt matamorphic rocks. However, Compton (1960) did not consider this pluton to be related to the charnokitic body. We took four samples from this body (location 53, fig. 7) and had whole-rock powder from an analyzed specimen furnished to us by Ross (location 54, fig.7). Three specimens of tonalite and a pegmatite from this body have radiogenic Sr isotopic compositions (initial $^{87}Sr/^{86}Sr$ of 0.70830-0.70905 at 100Ma, table 1) similar to garnet bearing quartzofeldspathic gneisses sampled to the south. However, a biotite-rich granodiorite (SANLU9C-91) has an initial Sr isotopic composition at 100 Ma (0.70620, table 1) similar to values for the charnokitic tonalite (0.70610-0.70660).

Mineral ages by the K-Ar, $^{40}Ar/^{39}Ar$, Rb-Sr, and U-Pb techniques have been determined for plutons of the northern Santa Lucia Range. Except for U-Pb zircon dates of about 100 Ma for the charnokitic tonalite of Compton (1960), regardless of technique or mineral dated, the ages fall in the narrow range from about 83.5 to 69 Ma (table 1, table 5).

For the intrusive suite of Monterey, Rb-Sr biotite ages for the porphyritic granodiorite of Monterey are 75.8 Ma, and 75.5 Ma, and for the quartz diorite of Sobaranes Point 78 Ma (tables 1, 5). Curtis and others (1958) reported a K-Ar age for biotite from the porphyritic granodiorite of Monterey at 79.7 Ma. Hornblende and biotite $^{40}Ar/^{39}Ar$ ages for the quartz diorite of Sobaranes Point and the porphyritic granodiorite of Monterey are 80.18±0.47 Ma, 79.90±0.45 Ma and 78.03±0.40 Ma, 77.75±0.40 Ma, respectively (table 3, table 5). Mattinson (1978) reported a U-Pb mineral isochron age of 78.3±2 Ma for K-feldspar, sphene and apatite from the quartz diorite of Sobaranes Point (table 5).

A Rb-Sr biotite age from the quartz diorite of Paraiso Paloma area is 72.9 Ma (tables 1, 5). Hornblende K-Ar ages are 77 Ma and 76 Ma (Evernden and Kistler (1970) for gabbro, and biotite K-Ar ages are 69 Ma an 70 Ma (Compton, 1966) for the granodiorite-quartz diorite of Bear Mountain and Junipero Peak (table 5). $^{40}Ar/^{39}Ar$ ages for biotite and hornblende from the qaurtz diorite of Paraiso Paloma area are 74.41±0.38 Ma and 76.53±0.43 Ma (tables 3 and 5) respectively.

Biotite from the charnokitic tonalite of Compton (1960) has a Rb-Sr age of 83.8 Ma (tables 1, 5). The biotite and hornblende from the same sample (SANLU11a-91) have $^{40}Ar/^{39}Ar$ ages of 79.50±0.40 Ma and 78.91 Ma (tables 3 and 5), respectively. Two other hornblendes from the charnokite have $^{40}Ar/^{39}Ar$ ages of 82.19±0.42 Ma and 83.46±0.44 Ma (tables 3 and 5). Mattinson (1978) reported an age of 78.2±2 Ma for two apatite separates from the charnokite that lie on the same U-Pb mineral isochron for the quartz diorite of Sobaranes Point discussed above (table 5).

MONTEREY Bay (Figure 8)

Monterey Bay is excised by the Monterey Canyon on the continental margin between Santa Cruz and Monterey Peninsula (fig. 8). The seismically active San Gregorio and Monterey Bay fault zones bound the canyon. Detailed field observations and controlled sampling of sedimentary, volcanic, and granitoid rocks on the canyon escarpments was done using a diamond drilling system deployed from MBARI's (Monterey Bay Aquarium Research Institute) ROV

Ventana, a tethered remotely operated vehicle (Stakes and others, 1998, 1999). The southern meander of the canyon provides exposures of Salinian granitic rocks on the eastern and southern walls for over 25 km continuously into Carmel Canyon, the southern extension of the San Gregorio fault zone. Granitic rocks were sampled along the northern 11 km of the canyon wall at 9 locations at depths of 600 to 900 meters. Five locations, spanning 6 km at the center of the traverse are of a biotite granite, 81.8±3 Ma, with a distinctive initial $^{87}Sr/^{86}Sr$=0.70897 (fig. 9). The two southernmost locations along the traverse and immediately NW of the Monterey Peninsula are petrographically and isotopically equivalent to the porphyritic granodiorite of Monterey. The two northernmost locations at the mouth of Soquel Canyon and north of the Monterey Bay fault zone are of tonalite that can be petrographically and isotopically correlated with granitic rocks in the southern Santa Cruz Mountains.

In the Point Reyes area, the biotite granite of Tomales Bay is exposed along the southern end of Tomales Bay immediately west of the San Andreas and San Gregorio faults (fig. 2). Rb-Sr whole-rock and mineral data of the biotite granite of Tomales Bay are collinear with whole-rock and mineral data of the biotite granite with distinctive age and initial $^{87}Sr/^{86}Sr$ values from the center of our canyon traverse (table 1, fig.9). These two granitic rock exposures along with the porphyritic granodiorites of Monterey and Point Reyes form a unique correlation to be used in restoring the right-lateral offset of Salinian basement along the San Gregorio fault zone. We include the biotite granite in Monterey Canyon, the biotite granite of Tomales Bay, and the porphyritic granodiorite of Point Reyes in the intrusive suite of the Monterey Peninsula.

Gabilan Range (figure 10)

The Gabilan Range is the largest exposure of granitic rocks in the Salinian composite terrane and their distribution is shown in figure 10 (modified from Ross, 1972). Kistler and Peterman (1973) reported Rb-Sr whole-rock data for the quartz diorite-granodiorite of Johnson Canyon, the granodiorite of Gloria Road, and the quartz monzonites of Bickmore Canyon and of Fremont Peak. These data gave an apparent age of about 109 Ma with initial $^{87}Sr/^{86}Sr$=0.7082±5. However, U-Pb zircon ages for these same plutons are 84 Ma, 91 Ma, 84 Ma, and 105 Ma, respectively (Mattinson, 1990, table 5). The slope of the Rb-Sr whole-rock isochron and resulting 109 Ma age for these four plutons was controlled by the data for quartz monzonite of Fremont Peak (the greatest $^{87}Rb/^{86}Sr$ value with the most radiogenic measured $^{87}Sr/^{86}Sr$ value, table 1).

We report new Rb-Sr whole-rock data in the Gabilan Range for the tonalite of Vergeles and the granodiorite of Gloria Road (table 1). Ross (1972) showed the tonalite of Vergeles as a single pluton. However our data from this body indicate it is at least two plutons with different ages and initial $^{87}Sr/^{86}Sr$ values. We call the first of these the north tonalite of Vergeles, and samples of the tonalite, mafic inclusion and felsic dike (location 1, fig. 10, table 1) have a Rb-Sr whole-rock age of 113±12 Ma with initial $^{87}Sr/^{86}Sr$=0.70573±13. The second of these we call the south tonalite of Vergeles, and whole-rock specimens of three specimens of tonalite and a felsic dike (location 2, fig. 10, table 1) have a Rb-Sr age of 88.5±6.6 Ma with initial $^{87}Sr/^{86}Sr$=0.70692±34. Mattinson (1990) reported an U-Pb zircon age of 95 Ma for a specimen (location 10, fig. 10) near our specimen (location 2, figure 10).

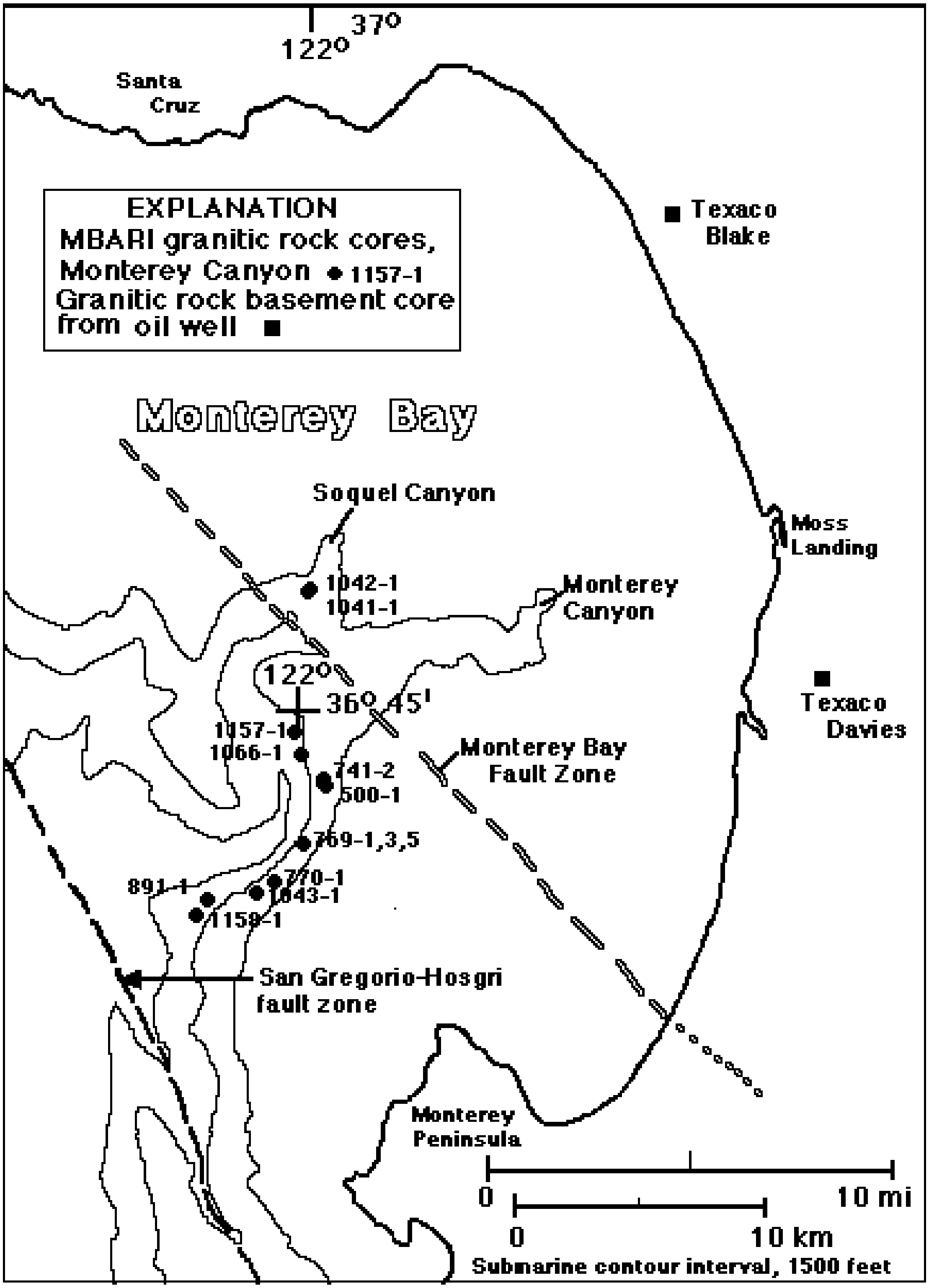

Figure 8. Diagram showing granitic rock sample localities collected using the ROV Ventana along the walls of Monterey and Soquel Canyons, and locations of basement core samples from two exploratory oil wells near the shore of Monterey Bay.

Samples of the granodiorite of Gloria Road (location, 6, fig. 10, table 1) have Rb-Sr whole-rock age of 82.6 ±5 Ma with initial $^{87}Sr/^{86}Sr$=0.70788±10. Mattinson (1990) reported an

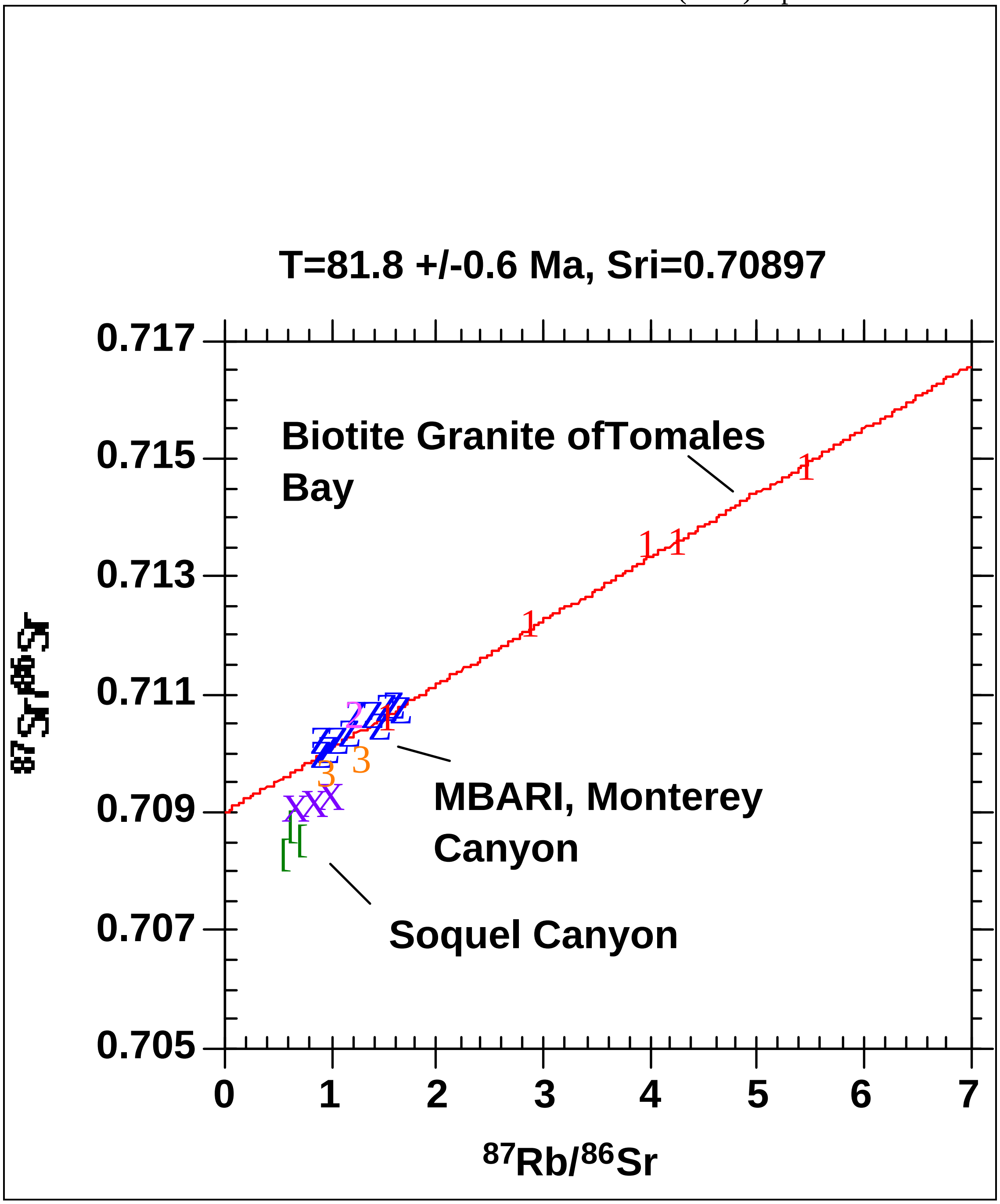

Figure 9. Rb-Sr whole-rock, mineral isochron diagram for the biotite granite in Monterey canyon (crosses) and the biotite granite of Tomales Bay (X's). Data for porphyritic granodiorite of Monterey sampled in the canyon are dots and stars. Soquel Canyon samples are squares.

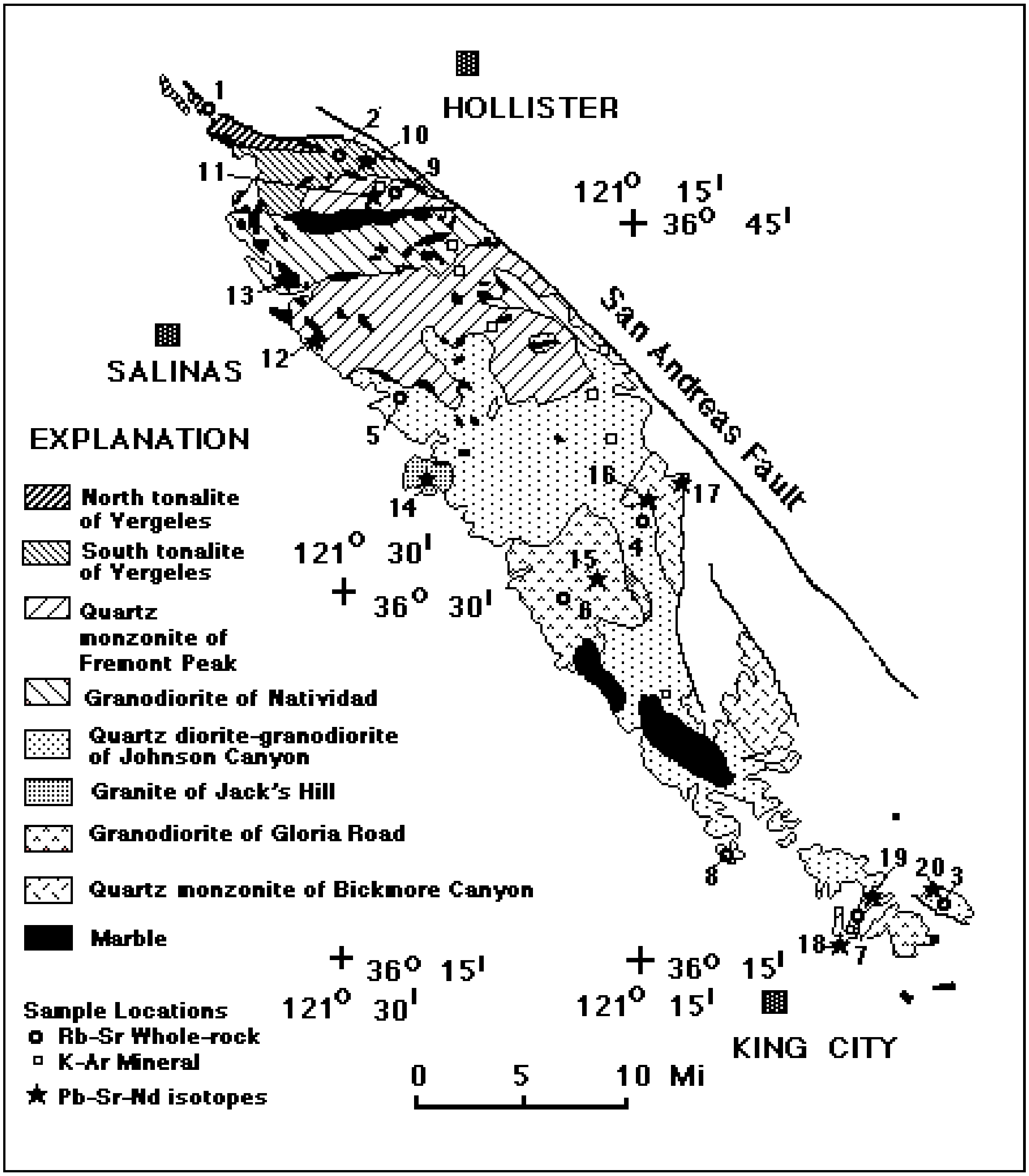

Figure 10. Map showing sample locations in granitic rocks of the Gabilan Range for Rb-Sr whole-rock determinations (open circles, this report, Kistler and Peterman, 1973), K-Ar biotite and hornblende ages (open squares, Curtis and others, 1958; Huffman, 1972), and U-Pb zircon ages, Pb and Nd initial isotopic compositions (stars, Mattinson, 1990).

U-Pb zircon date of 91 Ma and an initial $^{87}Sr/^{86}Sr$=0.70813 for a nearby specimen from this pluton (location 15, fig.10), but also an U-Pb zircon date of 80 Ma for another sample of granodiorite of Gloria Road in the southern exposures of the Gabilan Range (location 19, fig. 10). Ross (1984,fig. 5) correlated the granodiorite of Gloria Road with the porphyritic granodiorite of Monterey. The Rb-Sr ages and initial Sr isotopic compositions of these plutons are compatible with his correlation.

Zircon U-Pb dates from the quartz diorite-granodiorite of Johnson Canyon (locations 16, 18, and 20, fig. 10) range between about 85 Ma and 83 Ma (Mattinson, 1990, table 5), and Rb-Sr whole rock initial $^{87}Sr/^{86}Sr$ (Kistler and Peterman, 1973) ranges between 0.7083 and 0.7088 (table 1, locations 3,4,5, and 7, fig. 10). The quartz monzonite of Bickmore Canyon (location 8, figure 10) has initial $^{87}Sr/^{86}Sr=0.70860$ (Kistler and Peterman, 1973, table 1) and a U-Pb zircon date (location 17, fig. 10) of 84 Ma (Mattinson, 1990, table 5). The quartz monzonite of Fremont Peak is about 105 Ma on the basis of U-Pb zircon analysis (Mattinson, 1990, locations 11, 12, fig. 10). The initial $^{87}Sr/^{86}Sr$ value for this pluton (location 9, fig. 10) is 0.70835 (Kistler and Peterman, 1973).

K-Ar dates for 3 biotite specimens from the quartz monzonite of Fremont Peak range range from 72 Ma to 81 Ma, for 2 biotite specimens from the granodiorite of Natividad are 80 Ma and 84 Ma, and for one biotite specimen from the granodiorite of Gloria Road is 72 Ma (Huffman, 1972). K-Ar dates for 2 hornblende, biotite pairs are 85 and 84 Ma and 76 and 81 Ma, respectively for the quartz diorite-granodiorite of Johnson Canyon (Huffman, 1972). A K-Ar biotite date of 80 Ma (Curtis and others, 1958) was reported for the quartz diorite-granodiorite of Johnson Canyon. K-Ar sample locations are shown with open squares on figure 10 and dates are tabulated in table 5.

Southern Salinian Composite Terrane (Figure 11)

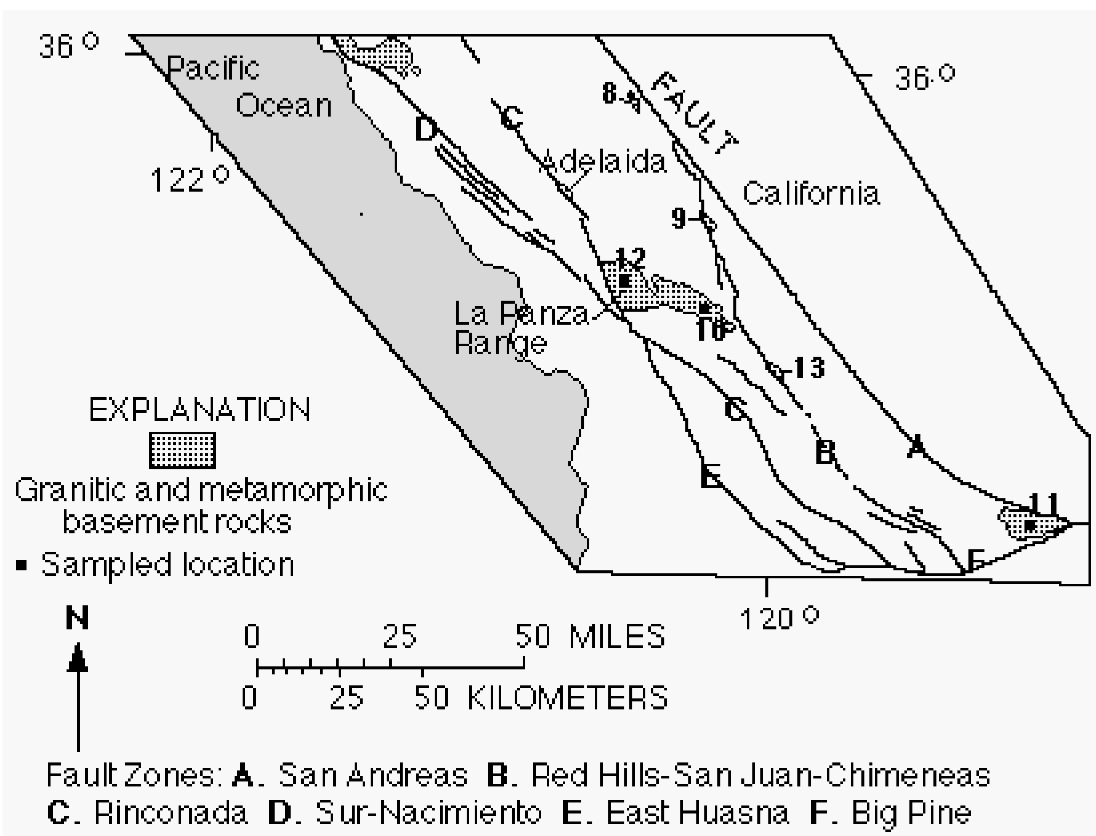

Figure 11. Map showing granitic rock exposures and fault zones in the southern Salinian composite terrane.

The granitic rock exposures in the southern Salinian composite terrane are widely separated. Ross (1972) in his petrographic discussion of these rocks noted textural and mineralogical similarities between the Stockdale Mountain, the Adelaida and La Panza Range exposures. However, a large variation in modal composition in these rocks prevented him from calling them a single pluton. Mattinson (1990) reported an initial $^{87}Sr/^{86}Sr$ value of 0.70911 for apatite from the pluton at Adelaida (fig. 11). The granitic rock of Strockdale Mountain (location 8, fig. 11) has an initial $^{87}Sr/^{86}Sr$=0.7076 at an assumed age of 110 Ma (Kistler and others, 1973, table 1). The pluton of the La Panza Range has whole-rock initial $^{87}Sr/^{86}Sr$=0.7081±1 (locations 10, 12, fig.11, table 1) and 0.7091 for a crosscutting aplite dike. Mattinson (1990) reported initial $^{87}Sr/^{86}Sr$=0.70885, 0.70903, and 0.71002 for apatites from three samples of this pluton. The large variation in initial $^{87}Sr/^{86}Sr$ indicates these three granitic rock exposures are not of a single pluton.

Ross (1984) named the area between the Red Hills-San Juan-Chimenas (B, figure 11) and the San Andreas fault zones (A, figure 11) the Barrett Ridge slice of the southern Salinian composite terrane. In this area, exposures of granitic rocks and cores of basement rocks from exploratory oil wells are generally gneissic and different from granitic rocks to the west. The gneiss of Red Hills (location 9, fig. 11) has a whole-rock initial $^{87}Sr/^{86}Sr$=0.7095 (Kistler and others, 1973, table 1) and 0.70948, 0.70917, and 0.70911 for apatites from three specimens at an age of 82 Ma (Mattinson, 1990). The southernmost basement rock exposures of the Barrett Ridge slice, homogenized gneiss and felsic intrusions at Mount Abel (location 11, fig. 11), were shown to be different from the rest of the Salinian composite terrane with the gneiss having an initial $^{87}Sr/^{86}Sr$=0.71640 at 110 Ma (table 1). The isotopic composition for this gneissic tonalite (trondjhemite) was more radiogenic than any other known in the Salinian terrane at that time, and Kistler and others (1973) suggested the gneiss was of Precambrian age. In addition the two specimens from a felsic intrusion at Mount Abel gave a Rb-Sr whole-rock apparent age of 180 Ma with initial $^{87}Sr/^{86}Sr$=0.7083 (Kistler and others, 1973), older than any other known in the Salinian block. Mattinson (1990) reported $^{87}Sr/^{86}Sr$ of 0.76072 and 0.74864 for apatite from two samples of gneiss from Barret Ridge (location 13, fig.11). Mattinson (1990) also reported apatite $^{87}Sr/^{86}Sr$ values for five specimens of granitic rocks from Barrett Ridge that range from 0.71131 to 0.75094. These data, along with Pb and Nd isotopic data from the same rocks (Mattinson, 1990), confirm Precambrian gneisses in the Barrett Ridge slice of the Salinian composite terrane. U-Pb ages of zircons from granitic dikes and small felsic intrusions into the gneisses are mostly about 80 Ma (Mattinson, 1990) and their generally radiogenic initial Sr isotopic compositions indicate they were locally mobilized from the enclosing wall rocks.

Initial Sr, Pb, and Nd isotopic compositions

In addition to U-Pb zircon dates, Mattinson (1978, 1990) and James (1992) reported initial Pb and Sr isotopic compositions for some Salinian plutons. Mattinson (1990) also reported initial Nd isotopic compositions for some of them. We have determined aditional initial Sr, Pb, and Nd compositions for Salinian plutons. All of these data are summarized in table 2, exclusive of gneisses and plutons in the Red Hills and Barrett Ridge reported by Mattinson (1990).

K-feldspar contains very low concentrations of U, and, therefore, the Pb isotopic composition of this mineral has a very small radiogenic Pb contribution from U decay. The Pb isotopic compositions in table 2 were determined on K-feldspar separates from the granitic rocks and represent initial values of these ratios at the time of emplacement of the plutons. Figure 12 is a plot of initial $^{207}Pb/^{204}Pb$ Vs $^{206}Pb/^{204}Pb$ for Salinian plutons. A positive correlation is apparent between these isotope ratios, but the regression lines through the two sets of data have different slopes. Model lead ages from these slopes are about 2800 Ma and 2200 Ma for Mattinson-James and our data, respectively. The older apparent age of the two is because the Mattinson-James data are dominated by many, very radiogenic samples from the Gabilan, Adelaida, and La Panza Ranges. Regardless, both of these apparent model lead ages are older than any known source material in the area and the regression lines are due to mixing of source materials for the plutons. Mattinson (1990) suggested that the trend for his data could be due to mixing of MORB sources with evolved crustal sources with a possible third source like Barrett Ridge gneisses.

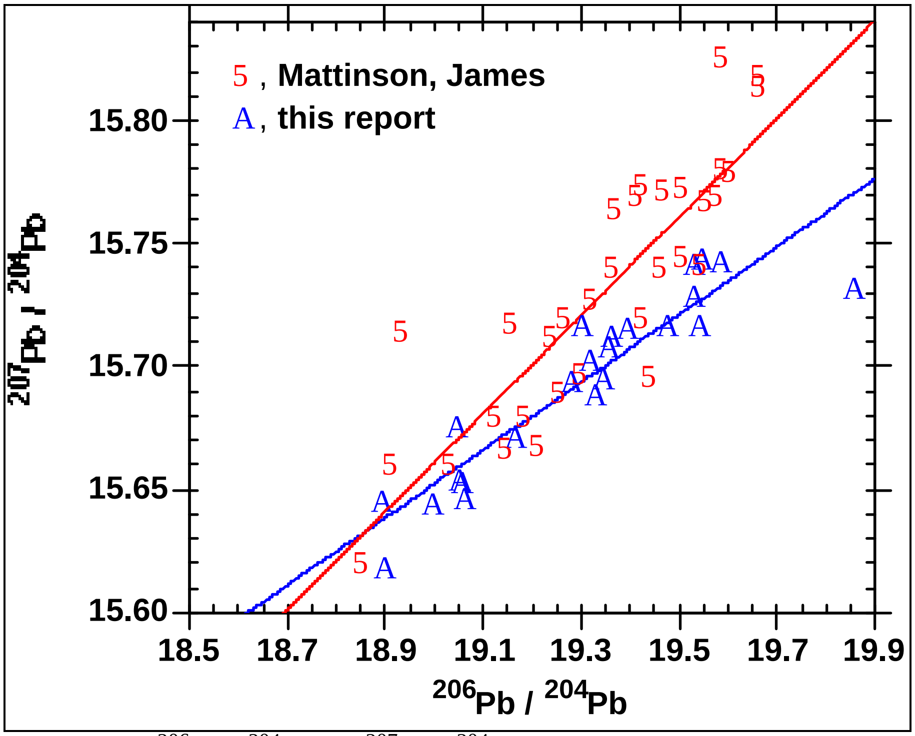

Figure 12. Plot of initial ^{206}Pb / ^{204}Pb Vs ^{207}Pb / ^{204}Pb for plutons in the Salinian composite terrane. Data for plutons and gneisses from the Barrett Ridge slice (Mattinson, 1990) are not shown. Data from Mattinson (1978, 1990) and James (1992) are crosses; data from this report are open diamonds.

Initial $^{87}Sr/^{86}Sr$ Vs initial $^{206}Pb/^{204}Pb$ values (table 2) are plotted in figure 13. The positive correlation between these isotope ratios can also be explained by mixing of MORB like and evolved crustal sources.

Initial $^{87}Sr/86^{Sr}$ Vs inital $^{206}Pb/^{204}Pb$ values for plutons in the Sierra Nevada are compared to values of these ratios for plutons in the Salinian composite terrane in Figure 14. The hSierra Nevada Pb data, from Doe and Delevaux (1973) and Kistler and Wooden (unpublished data), are from the north end to the south end of exposures in the range. The Sr data are from Kistler and Peterman (1973) and Kistler (unpublished data). The Sierran and Salinian data overlap with samples having $^{87}Sr/^{86}Sr$ less than 0.708 and $^{206}Pb/^{204}Pb$ less than 19.4, whereas only one Sierran sample plots in the field $^{87}Sr/^{86}Sr>0.708$ and $^{206}Pb/^{204}Pb>19.4$. This egregious specimen from location 24 in Kistler and Peterman (1973) and Doe and Delevaux (1973) in the southern Sierra Nevada is in the Salinian-western Mojave terrane of Kistler (1990). This terrane was characterized by plutons with initial $^{87}Sr/^{86}Sr$ >0.706 and $\delta^{18}O$>+9 per mil. In the Salinian plutons of this study and of Masi and others (1981) 95 percent of the 66 granitic samples analysed have $\delta^{18}O$ > +9 per mil (table 4). In addition to δ18O>+9 per mil, $^{206}Pb/^{204}Pb$>19.4 is also characteristic of granitic rocks in the Salinian-western Mojave terrane. In contrast, Sierra Nevada plutons have $\delta^{18}O$ <+9 per mil and $^{206}Pb/^{204}Pb$<19.4.

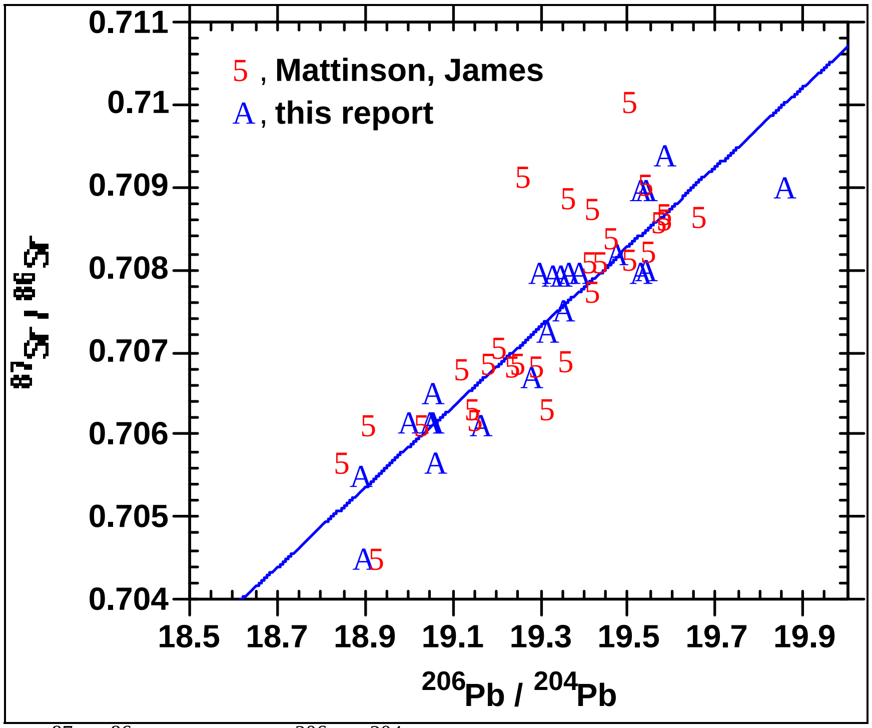

Figure 13. Initial $^{87}Sr/^{86}Sr$ Vs initial $^{206}Pb/^{204}Pb$ for Salinian plutons. The data points of Mattinson (1990) that pull off to the left of the regression line could represent mixing with a third source like Barrett Ridge gneisses.

Mattinson (1990) reported initial $^{143}Nd/^{144}Nd$ isotopic compositions for a few plutons from the Salinian terrane and we have added a few more. The Nd data are reported in the ε notation of DePaolo and Wasserburg, 1976 (table 2). Initial Nd Vs initial Sr isotopic values for plutons in the Salinian composite terrane, the western Mojave Desert (Miller and others, 1996), and the Sierra Nevada are plotted in figure 15. Most of the plutons from the Salinian and the western Mojave Desert have more radiogenic Sr isotopic values for given Nd isotopic values than plutons in the Sierra Nevada. Salinian-western mojave data plot to the right of the well-defined
trend for Sierra Nevada plutons (fig. 15). We can add Sr-Nd isotopic correlations to Pb and oxygen isotopic values to characterize the Salinian-western Mojave terrane of Kistler (1990).

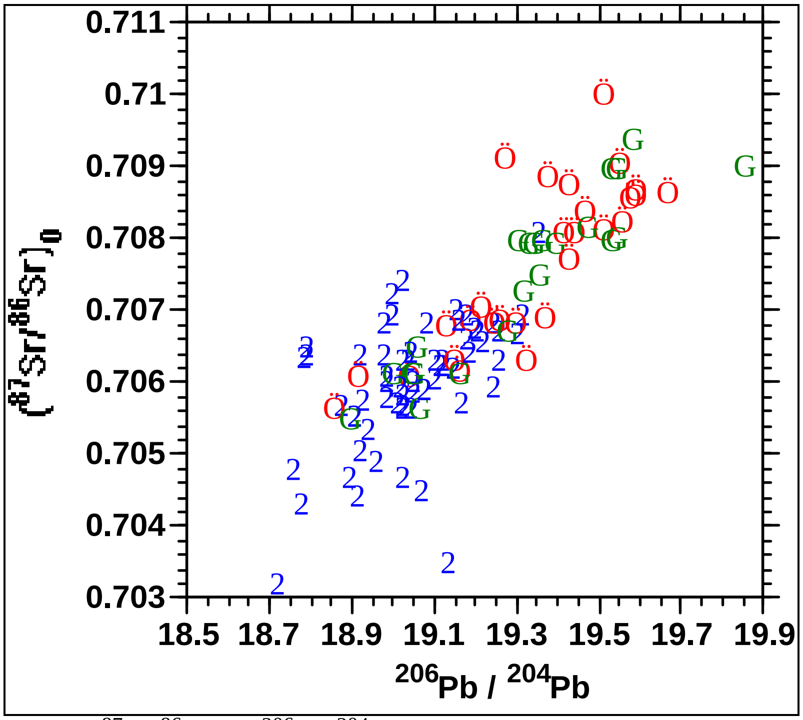

Figure 14. Plot of initial $^{87}Sr/^{86}Sr$ Vs $^{206}Pb/^{204}Pb$ for Sierra Nevada and Salinian plutons. Open crosses (Sierra Nevada, Doe and Delevaux, 1973, Kistler and Wooden, unpublished data); circled dots (Salinia, Mattinson (1990) and James (1992)), open squares (Salinia, this report, table 2).

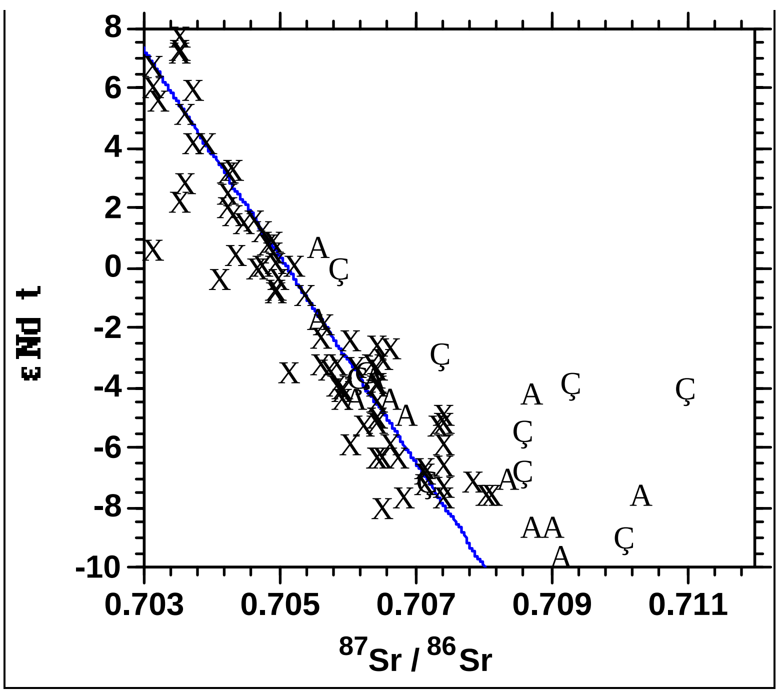

Figure 15. Plot of initial Nd Vs initial Sr isotopic values for plutons in the Salinian composite terrane (open diamonds, Mattinson, 1990, this report), northwestern Mojave Desert (open triangles, Miller and others, 1996), and Sierra Nevada (dots, Kistler, 1993).

THERMAL HISTORIES OF PLUTONS IN THE SALINIAN COMPOSITE TERRANE

^{238}U-^{206}Pb, Rb-Sr, $^{40}Ar/^{39}Ar$, K-Ar, and fission track ages of minerals from granitic rocks in the Salinian composite terrane are summarized in table 5. Evernden and Kistler (1970) noted that plutons in the Junipero Serra Peak area of the Santa Lucia Mountains were dated at 117 Ma by Rb-Sr whole-rock data and at 79 Ma (Campanian) by K-Ar biotite and hornblende dates. However, these rocks are unconformably overlain by Campanian sedimentary rocks. A possible solution to this observation was that the K-Ar dates reflected the time when the rocks were uplifted to crustal depths where they could cool to temperatures of less than 300^{o}C that are compatible with equal retention of radiogenic argon in biotite and hornblende. Mattinson (1978) used zircon $^{206}Pb/^{238}U$ dates, Pb/U K-feldspar, sphene, apatite isochron dates, hornblende and biotite K-Ar dates, and sphene and apatite fission-track dates to plot thermal histories of plutons at Bodega Head and the Point Reyes Peninsula in the northern part, and the Santa Lucia Mountains in the central part the terrane. For the northern part of the terrane, Mattinson (1978) modeled a relatively simple, but long emplacement and cooling history for plutons by interpreted ^{238}U-^{206}Pb zircon dates at 104 Ma (t=750±50^{o} C) with closure to Pb loss at 100 Ma (t=700±50^{o}C), Ar loss from hornblende and Pb loss from spene and apatite ceased at about 95 Ma (t=500±50^{o}C), and finally fission-tracks were retained in sphene and apatite at 87 Ma (t=300±50^{o}C) and 68 Ma (t=100±50^{o}C), respectively. Using the same closure temperatures for minerals, the model showed the same age for emplacement and closure to Pb loss for zircons at 100 Ma for the charnokitic tonalite of Compton (1960) in the Santa Lucia Mountains in the central part of the terrane. However, U-Pb isochron ages for sphene and apatite and K-Ar ages for hornblende and biotite clustered between 80 and 75 Ma. This clustering of mineral ages was interpreted to indicate the Santa Lucia Mountains remained at depth with elevated temperatures for about 25 m.y. after emplacement of the plutons. At this time, the terrane cooled rapidly to give similar ages for minerals with radically different closure temperartures. Like Evernden and Kistler (1970), Mattinson (1978) appealed to very rapid uplift and erosion to cause the cooling.

The mineral ages summarized in table 5 permit a more detailed look at thermal histories for plutons in the Salinian terrane. In addition to those mineral closure temperatures used by Mattinson (1978), Rb-Sr whole-rock ages are interpreted as emplacement ages, $^{40}Ar/^{39}Ar$ incremental heating plateau ages reflect the same closure temperatures as K-Ar ages for biotite and hornblende, and biotite Rb-Sr ages reflect a closure temperature of 250^{o}C because, with a few exceptions, they are slightly younger than $^{40}Ar/^{39}Ar$ ages on the same mineral sample. We note that the Late Cretaceous plutons of the intrusive suite of the Monterey Peninsula and other plutons had not been recognized at the time Evernden and Kistler(1970) and Mattinson (1978) suggested Late Cretaceous K-Ar and fission track ages for plutons in the Santa Lucia Mountains and elsewhere in the Salinian composite terrane were due to rapid cooling during uplift and erosion.

Figure 16 shows plots of age versus mineral closure temperatures for radiogenic daughter product loss and fission-track annealing for different minerals from four plutons in the northern and central Salinian composite terrane. Closure temperatures for the minerals are from Mattinson (1978) except for sphene fission-track (280^{O}C) because in most cases their ages are lower than coexisting biotite K-Ar ages, and biotite Rb-Sr (250^{O}C).

The Rb-Sr whole-rock ages from the intrusive suite of Monterey Peninsula are 83.5±6.2 Ma and 82±4 Ma for garnet bearing aplites and pegmatites that intrude the porphyritic

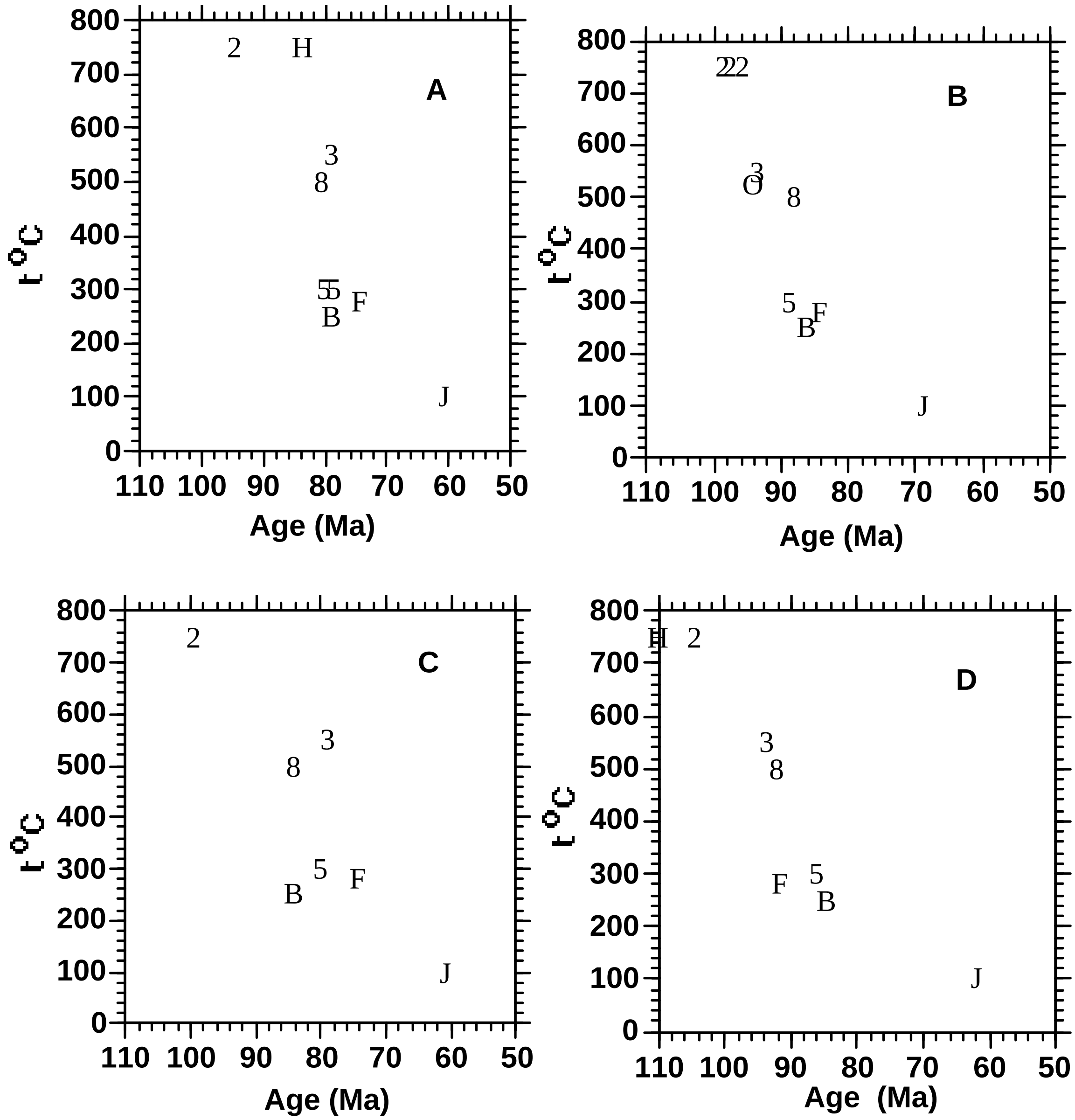

Figure 16. Diagrammatic plots of thermal histories for plutons from the central (**A**. quartz diorite of Sobaranes Point, **C**. charnokitic tonalite of Compton (1960)) and northern (**B**. tonalite of Bodega Head, **D.** tonalite of McClure's Beach) Salinian composite terrane. Symbols: **triangle**, Rb-Sr whole-rock isochron age; **open cross**, zircon $^{238}U/^{206}Pb$ age; **star**, K-feldspar, apatite, sphene U/Pb isochron age; **x**, hornblende $^{40}Ar/^{39}Ar$ incremental heating plateau age; **solid cross**, biotite $^{40}Ar/^{39}Ar$ incremental heating plateau age or K-Ar age; **circled dot**, hornblende K-Ar age; diamond, sphene fission-track age; **square**, Rb-Sr biotite age; **solid circle**, apatite fission-track age.

granodiorite of Monterey (table 1). The specimen of quartz diorite of Sobaranes Point of the intrusive suite of Monterey Peninsula (location 11, fig. 7) is from the same location as specimen SL-4 (Mattinson, 1978). Mineral ages from this location record a very simple thermal history (fig. 16A) in comparison to the other locations plotted. The two discordant $^{238}U/^{206}Pb$ ages of 94Ma and 90 Ma indicate they are affected by inheritance of old zircons but the pluton can not be less than 79 Ma as indicated by the U-Pb sphene-apatite isochron age (specimen SL-4, Mattinson, 1978). The U-Pb sphene-apatite, $^{40}Ar/^{39}Ar$ hornblende and biotite incremental heating plateau, K-Ar biotite, and Rb-Sr biotite ages range from 80.2 Ma to 78.3 Ma at this location (table 5, fig. 16A). The apatite fission track age reflects a very low temperature disturbance of unknown origin at this location (table 5, Naeser and Ross, 1976). The quartz diorite of Sobaranes Point is theoldest known member of the intrusive suite of the Monterey Peninsula. The Rb-Sr whole-rock isochron age 83.5±6.2 Ma (table 1) for the suite that includes the granodiorite of Cachagua and the porphyritic granodiorite of Monterey is taken to closely approximate its time of emplacement. The mineral ages with closure temperatures that range from about 550 to 250^{O}C overlap within experimental error with the emplacement age and show that Late Cretaceous mineral ages of the suite simply reflect rapid cooling due to shallow emplacement (less than 10 km) in an environment where the ambient temperature was less than 250^{O}C.

Mattinson (1978) used mineral ages of plutons from widely separated areas for his model of the thermal history for the central Salinian composite terrane. These included U/Pb ages of zircon and apatite from the charnokitic tonalite of Compton (1960) (location 49, fig. 7), U/Pb ages of apatite and sphene from the quartz diorite of Sobaranes Point (location 11, fig. 7), K-Ar hornblende age from gabbro in the Junipero Serra area (location 35, fig. 7), K-Ar biotite age from the porphyritic granodiorite of Monterey (location 8, fig.7), and sphene and apatite fission-track ages from the quartz diorite of Sobaranes Point (location11, fig. 7). He noted the 100 Ma age of emplacement indicated by the concordant U-Pb ages of the charnokitic tonalite of Compton (1960) and the clustering of the other mineral ages near 70 to 80 Ma indicated the region was cooled rapidly some 25 m.y. after pluton emplacement probably due to rapid uplift. He also noted the pattern of mineral ages could reflect rapid cooling after emplacement at 100 Ma and then resetting of mineral ages by a thermal event at about 70 Ma.

Figure 16C is a plot of age versus closure temperatures for minerals from a single pluton in the central Salinian composite terrane, the charnokitic tonalite of Compton (1960). In this pluton (locations 49, 50, and 51, fig.7), zircon $^{238}U/^{206}Pb$ ages (Mattinson, 1978) are 100 Ma, but apatite $^{238}U/^{206}Pb$, hornblende and biotite $^{40}Ar/^{39}Ar$ incremental heating plateau ages, and biotite Rb-Sr age fall in the narrow range from 83.8 Ma to 78.2 Ma (table 5). The narrow range of ages from minerals, other than zircon, with large differences in closure temperatures and the correspondence of ages with those in the nearby intrusive suite of the Monterey Peninsula indicates they were reset in the thermal aureole that accompanied the emplacement of that suite.

The thermal history for plutons in the northern Salinian composite terrane was determined from age determinations of minerals in the tonalite of Bodega head, tonalite and granodiorite of McClure’s Beach, and porphyritic granodiorite of Point Reyes (Mattinson, 1978). The mineral ages from these widely separated plutons indicated a simple but prolonged cooling history: some 5 m. y. after emplacement of the plutons at 104 Ma (interpreted concordant zircon U/Pb age) the zircons closed to Pb loss (100 Ma), after another 5 to 6 m. y. the U-Pb system in apatite and sphene closed (95 Ma). At the same time hornblende closed to Ar loss. Ar loss from biotite and fission tracks in sphene closed at 87 to 82 Ma.

Figure 16B is a plot of age versus closure temperatures for minerals from a single pluton in the northern Salinian composite terrane, the tonalite of Bodega Head. In addition to the concordant zircon $^{238}U/^{206}Pb$ ages (97Ma, 98Ma, Mattinson, 1978, location 1, fig. 2) we report concordant zircon $^{238}U/^{206}Pb$ ages of 95 Ma from 3 crystals (determined by SHRIMP-RG, J. Wooden, personal communication, 2000) and 119 Ma and 143 Ma from two other crystals from the tonalite of Bodega Head (location 2, fig.2). Additional data on the plot are, the hornblende

K-Ar (94 Ma) and sphene and apatite U/Pb isochron age (93) Ma (Mattinson, 1978), $^{40}Ar/^{39}Ar$ incremental heating plateau ages of biotite and hornblende concordant at 88 Ma (tables 3, 5), and sphene and apatite fission-track ages are 84Ma and 68 Ma, respectively (Naeser and Ross, 1976). The zircon U/Pb data show inherited old zircons are entrained in this pluton and the younger concordant zircon ages 98Ma to 95 Ma can be interpreted to indicate an emplacement age of about 104 Ma (Mattinson, 1978) or an emplacement age of 95 Ma that is the same within experimental errors with the U/Pb sphene and apatite and K/Ar hornblende ages of 93 Ma and 94 Ma, respectively. The Rb/Sr biotite and the biotite and hornblende $^{40}Ar/^{39}Ar$ incremental heating plateau ages are the same, with an average age of 87±1 Ma. The sphene fission-track age is 84 Ma in this pluton (Naeser and Dodge, 1976).

Figure 16 D is another plot of age versus closure temperatures for minerals from a single pluton in the northern Salinian composite terrane, the tonalite of McClure's Beach. Whole-rock specimens of this pluton lie on a Rb-Sr isochron at 109.6±9.5 Ma (table 1). Discordant zircon $^{238}U/^{206}Pb$ ages are 102, 98 and 96 Ma (location 16, fig.2, Mattinson, 1978). Sphene and apatite are part of the same U/Pb isochron for the tonalite of Bodega head at 93 Ma (Mattinson, 1978). $^{40}Ar/^{39}Ar$ hornblende and biotite incremental heating plateau ages are 92 Ma and 86 Ma, respectively, Rb/Sr biotite age is 85 Ma, and sphene fission-track age is 91 Ma (Naeser and Ross, 1976). The data represented on figure 16 D can be interpreted to show the pluton was emplaced 105±5 Ma, and was effected by a high temperature event (greater than 550^{O}C) about 93 Ma to reset the U/Pb sphene and apatite age and the $^{40}Ar/^{39}Ar$ hornblende age. Slow cooling to below the closure temperature of Rb/Sr biotite (less than 250^{O}C) took about 10 m.y.

In the northern Salinian composite terrane, this report has identified the granodiorite of Tomales Point (94 Ma, table 1) and the porphyritic granodioriteof Point Reyes and biotite granodiorite of Tomales Bay (85.2 Ma and 82 Ma, respectively). The latter two plutons are part of the intrusive suite of the Monterey Peninsula. The granodiorite of Tomales Point is exposed between the tonalite of Bodega Head and the tonalite of McClure's Beach, whereas the the plutons of the intrusive suite of the Monterey Peninsula are within 3 km to the south of the tonalite of McClure's Beach (fig.2). Based on these observations, our preferred thermal history for this part of the Salinian composite terrane is: Emplacement of the tonalite of Bodega Head and the tonalite of McClure's Beach 100±5 Ma. Emplacement of the granodiorite of Tomales Point at 94.1±3.6 Ma and resetting the sphene, apatite U/Pb isochron age in the tonalities of Bodega Head and McClure's Beach (93±2 Ma) and the K-Ar hornblende age in the tonalite of Bodega Head (94 Ma). Variable resetting of $^{40}Ar/^{39}Ar$ incremental heating plateau ages of biotite and hornblende to less than 91 Ma and with biotite Rb/Sr ages to as young as 84.5 Ma in both of the older tonalities and also in the granodiorite of Tomales Point indicates a second thermal event. We interpret this second resetting event to have occurred during emplacement of the 85.2±19 Ma porphyritic granodiorite of Point Reyes.

Our data indicate the Late Cretaceous mineral ages (95 Ma to 80 Ma) in both the northern and central Salinian composite terrane either date the emplacement of a pluton or date minerals with ages reset in the thermal contact aureoles of younger plutons.

SUMMARY

The study of initial $^{87}Sr/^{86}Sr$ of plutons in the Sierra Nevada (Kistler and Peterman, 1973) showed the 0.706 value of this ratio marked a fundamental crustal boundary. The 0.706 isopleth of this ratio in the southern tail of the Sierra trended at a high angle into the San Andreas fault zone. The reconnaissance strontium isotopic study of plutons in the Salinian composite terrane by Kistler and others (1973) was done to test suggested right-lateral offset along the San Andreas fault zone by tracing this isotopic boundary. All but one of the plutons sampled in the initial study of the Salinian block had initial Sr isotopic values greater than 0.706 and the suggested recostruction along the fault placed the Salinian plutons as far north as Bodega Head to the south of the 0.706 isopleth in the southern Sierra Nevada. Mapping by Ross (1989) in the southern Sierra Nevada showed the plutons that define the 0.706 isopleth in the southern Sierra Nevada (Kistler and Ross, 1990) are juxtaposed along a complex of faults. The greater density of sampling in the present study of the Salinian composite terrane identifies the 0.706 isopleth in the northern Gabilan Range, the Santa Cruz Mountains, Montara Mountain, Bodega Head, and the Cordell Bank. Mapping in the Salinian composite terrane has not identified any faults along this isotopic boundary, but this is probably because of the poor bedrock exposures in the California Coast Ranges and on the sea floor. The 0.706 isopleth is offset by the San Gregorio-Hosgri and San Andreas fault zones from the Santa Cruz Mountains to Bodega Head. In addition to these fault zones, this observation requires a cryptic fault to the east of the San Gregorio fault to place Montara Mountain, bisected by the isopleth (fig.5), in its present position south of San Francisco (Champion, 1989).

Emplacement ages of plutons exposed in a region with a complex post-emplacement deformational or thermal history are determined by U-Pb zircon dates and/or Rb-Sr whole-rock isochrons. In the Salinian composite terrane, there are two groups of plutons; an older deformed group and an undeformed younger group (Compton, 1960, Leo, 1967). Determining emplacement ages from the older group of plutons requires interpretation of U-Pb zircon dates complicated by discordance, and multistage histories that include both inheritance and Pb loss (James, 1992, Mattinson, 1994). An illustration of the problem of U-Pb zircon dating is given by Kistler and Wooden (1994) and figure 4 in this report. Interpretation of Rb-Sr whole-rock isochron dates is complicated by the possibility that isochrons are mixing lines or are rotated to younger ages by resetting during younger events. If Rb/Sr have a small range of values and initial Sr isotopic ratios are variable, isochron ages will have large errors. In spite of these difficulties, The U-Pb zircon and Rb-Sr whole-rock studies yield similar results for the two periods of emplacement for plutons in the Salinian composite terrane: Early Cretaceous (122 to100 Ma) and Late Cretaceous (95 to 82 Ma) from Rb-Sr whole-rock dating in this report; Early Cretaceous (110 Ma to 100 Ma) and Late Cretaceous (95 to 80 Ma) by U-Pb zircon dating (Mattinson, 1990); Early Cretaceous (less than 130 Ma and greater than 103 Ma) and Late Cretaceous (103 to 91 Ma) by U-Pb zircon dating (James, 1992).

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Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
BODEGA HEAD (Figure 2)								
tonalite of Bodega Head								
(1) BH 5-88 wr	70.7	409	0.173	0.500	0.70741	0.70674	>104 [8]	tonalite
(1) BH 6-88 wr	74.1	403	0.183	0.532	0.70743	0.70671	>104	mafic inclusion
(1) BH 7-88 wr	28.9	136	0.213	0.616	0.70717	0.70634	>104	pegmatite
(2) 1Ketal73 wr [1]	66.9	389	0.172	0.497	0.70730	0.70663	>104	tonalite
(2) BH 8-88 wr	77.8	376	0.207	0.599	0.70745	0.70664	>104	tonalite
(2)BH 8-88 biot.	401.5	11.4	35.340	103.510	0.83317	0.70676	85.98	biotite
(2)BH 8-88 hbde.	8.8	49.2	0.179	0.518	0.70733	0.70672	91.8	hornblende
(3) BH 9-88 ksp	302	142	2.127	6.150	0.71475	0.70672	91.8	pegmatite K-feldspar
(3) BH 9-88 pla	10.9	171	0.064	0.184	0.70702	0.70672	91.8	pegmatite plagioclase
granodiorite of Bodega Head								
(4)BH 1-88 wr	85.8	296	0.29	0.839	0.70722	0.7060±18	100±15	granodiorite
(4)BH 2-88 wr	107	282	0.379	1.098	0.70763	0.7060	100	mafic inclusion
(4)BH 4-90 wr	82.2	290	0.283	0.820	0.70718	0.7060	100	mafic inclusion
(4)BH 5-90 wr	93.4	270	0.346	1.000	0.70730	0.7060	100	granodiorite
(4)BH 1-88 biot.	344.0	25.1	13.734	39.920	0.75459	0.70620	85.3	biotite
(4)BH 1-88 hbde.	na	na	na	na	na	na	na	hornblende
aplites and pegmatites of western Bodega Head								
(4)BH 1-90 ksp	240	191	1.250	3.620	0.71080	0.70552±55	95±17	pegmatite K-feldspar
(5)BH 4-88 wr	93	271	0.343	0.992	0.70699	0.70552	95	aplite
(5)BH 2-90 wr	92.9	246	0.377	1.090	0.70718	0.70552	95	aplite
(5)BH 3-88 wr	111	186	0.596	1.726	0.70770	0.70552	95	pegmatite
(5)BH 3-90 wr	144	161	0.893	2.580	0.70879	0.70552	95	pegmatite
(5)BH 7-90 ksp	133	158	0.845	2.450	0.70864	0.70552	95	pegmatite K-feldspar
porphyritic granodiorite of Bodega Head (float)								
(5)BH 6-90 ksp	198	211	0.941	2.720	0.70895	0.70552	95±17	K-feldspar
(5)BH 6-90 wr	91.9	185	0.497	1.440	0.70747	0.70552	95	granodiorite
(5)BH 6-90 biot.	572.4	6.9	82.903	246.880	1.00619	0.70568	85.6	biotite
POINT REYES (Figure 2)								
Shell P-041-1, drill core tonalite								
(6)PR 2-89 wr	95	249	0.382	1.110	0.70769	0.70619	95?	pegmatite
(6)PR 1-89 wr	99.9	441	0.227	0.657	0.70730	0.70641	95?	tonalite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continue

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
Shell P-041-1, drill core tonalite_ continued								
(6)PR 3-89 wr	155	434	0.357	1.030	0.70772	0.70633	95?	mafic inclusion
(6)PR 4-89 wr	106	426	0.249	0.720	0.70731	0.70634	95?	mafic inclusion
(6)PR 5-89 wr	151	401	0.376	1.090	0.70777	0.70630	95?	mafic inclusion
granodiorite of Tomales Point.								
(7)PR 1-90 wr	70.4	512	0.137	0.400	0.70664	0.70618±6	94.1±3.6	granodiorite
(7)PR 4-90 wr	82	514	0.159	0.460	0.70675	0.70618	94.1	granodiorite
(8)PR 6-90 wr	69.9	529	0.132	0.380	0.70665	0.70618	94.1	granodiorite
(9)PR 7-90 wr	74	548	0.135	0.390	0.70662	0.70618	94.1	granodiorite
(10)PR 9-90 wr	73.8	489	0.151	0.440	0.70688	0.70618	94.1	granodiorite
(7)PR 3-90 wr	137	553	0.248	0.720	0.70705	0.70618	94.1	mafic inclusion
(7)PR 5-90 wr	49.4	670	0.074	0.210	0.70657	0.70618	94.1	synplutonic dike
(13)PR 1-92 wr	69.8	538	0.13	0.376	0.70681	0.70618	94.1	tonalite.
13)PR 1a-92 wr	91.8	501	0.183	0.529	0.70732	0.70618	94.1	mafic incl
(13)PR 2-92 wr	67	573	0.117	0.338	0.70680	0.70618	94.1	tonalite
(15)PR 12-88 wr	62.2	550	0.113	0.327	0.70680	0.70618	94.1	tonalite
(14)PR 3-92 wr	60.7	566	0.107	0.31	0.70673	0.70618	94.1	tonalite
(13)PR 2a-92 wr	147	375	0.391	1.132	0.70808	0.70668	87	pegmatite
(7)PR 2-90 wr	141	93.8	1.500	4.340	0.71160	0.70627±14	87.3±3.8	pegmatite
(14)PR 3a-92 wr	154	127	1.220	3.530	0.71070	0.70627	87.3	aplite
(9)PR 8-90 wr	57.1	126	0.453	1.310	0.70789	0.70627	87.3	pegmatite
(7)PR 1-90 biot	394.7	21.7	18.210	53.020	0.77142	0.70614	86.6	biotite
(7)PR 3-90 biot	427.2	20.2	21.160	61.650	0.78105	0.70618	85.5	biotite
(7)PR 4-90 biot	402.2	19.8	20.270	59.067	0.78117	0.70627	89.2	biotite
(7)PR 4-90 hbde	10.2	77.2	0.132	0.383	0.70685	0.70627	89.2	hornblende
Tonalite and granodiorite of McClure's and Kehoe Beaches								
(11)PR 5-88 wr	94	167	0.563	1.62	0.70883	0.70662±22	109.6±9.5	granodiorite
(12)PR 7-88 wr	94.5	139	0.68	1.96	0.70938	0.70662	109.6	granodiorite
(16)PR 8-88 wr	109	373	0.292	0.845	0.70796	0.70662	109.6	tonalite
(17)PR 10-88 wr	84.5	368	0.230	0.664	0.70757	0.70662	109.6	tonalite
(16)2Ketal73 wr [1]	110	354	0.312	0.903	0.70820	0.70662	109.6	tonalite
(16)PR 9-88 wr	142	181	0.785	2.27	0.71019	0.70662	109.6	porphyritic aplite
(17)PR 11-88 wr	183	414	0.442	1.279	0.70858	0.70662	109.6	aplite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
POINT REYES (Figure 2) Continued								
Tonalite and granodiorite of McClure's and Kehoe Beaches_continued								
(18)PR 4-92 wr	107	379	0.281	0.813	0.70783	0.70662	109.6	granodiorite
(19)PR 5-92 wr	156	228	0.683	1.977	0.70973	0.70662	109.6	granodiorite
(20)PR 7-92 wr	160	223	0.719	2.081	0.71003	0.70662	109.6	granodiorite.
(21)PR 8-92 wr	72.3	377	0.192	0.555	0.70753	0.70662	109.6	granodiorite.
(22)PR 4-88 wr	167	247	0.676	1.957	0.70990	0.70662	109.6	tonalite
(20)PR 7B-92 wr	165	329	0.502	1.453	0.70898	0.70662	109.6	granodiorite
(20)PR 7A-92 wr	186	219	0.847	2.451	0.71046	0.70662	109.6	mafic inclusion
(20)PR 7C-92 wr	208	238	0.873	2.527	0.71051	0.70662	109.6	pegmatite
(17)PR 10-88 hbde	11.3	45.1	0.25	0.722	0.70745	0.70662	109.6	hornblende
(17)PR 10-88 biot	447.4	12.1	37.09	108.69	0.83716	0.70668	84.5	biotite
(21)PR 8B-92 wr	66.2	692	0.0956	0.277	0.70753	0.70715±45	88.2±5.2	aplite
(21)PR 8A-92 wr	122	183	0.668	1.933	0.70967	0.70715	88.2	pegmatite
(21)PR8A-92 ksp	323.7	148.4	2.180	6.315	0.71484	0.70715	88.2	K-feldspar
(21)PR 8A-92 biot	660.1	8.2	80.890	240.970	1.01132	0.70715	88.2	biotite
(11)PR 6-88 wr	142	113	1.257	3.639	0.71140	0.70686	88.03	aplite
(18)PR 4A-92 wr	156	206	0.756	2.188	0.71070	0.70794	79.8	pegmatite
(18)PR4A-92 ksp	239	275	0.869	2.515	0.71114	0.70794	79.8	K-feldspar
porphyritic granodiorite of Point Reyes								
(23)PR 10-90 wr	100	485	0.206	0.596	0.70825	0.70775±29	85.2±19	tonalite
(24)PR 13-88 wr	127	413	0.308	0.890	0.70860	0.70775	85.2	granodiorite
(24)PR 14-88 wr	100	403	0.248	0.718	0.70891	0.70775	85.2	granodiorite
(24)LPR-3 wr	131	441	0.297	0.859	0.70895	0.70775	85.2	granodiorite
(24)PR 6-89 wr	155	542	0.286	0.827	0.70883	0.70775	85.2	mafic vein
(24)PR 7-89 wr	120	327	0.366	1.062	0.70893	0.70775	85.2	mafic inclusion
(24)PR 8-89 wr	123	383	0.321	0.929	0.70878	0.70775	85.2	tonalite
(25)PR 6-93 wr	110	407	0.269	0.778	0.70872	0.70775	85.2	tonalite
(24)PR 9-89 wr	115	317	0.362	1.050	0.70909	0.70775	85.2	granite dike
(24)PR10-89 wr	101	275	0.367	1.063	0.70912	0.70775	85.2	aplite
(24)PR 11-89 wr	124	304	0.407	1.180	0.70939	0.70775	85.2	aplite
(24)PR 12-89 wr	175	224	0.78	2.260	0.71040	0.70775	85.2	aplite
(24)PR 13-88 hbde	13.2	55.1	0.239	0.693	0.70838	0.70775	85.2	hornblende

Porphyritic granodiorite of Point Reyes Continued								
(24)PR 13-88 biot	647.4	15.7	41.270	120.990	0.84503	0.70783	79.8	biotite
biotite granite of Tomales Bay								
(26)PR 3-88 wr	133	396	0.336	0.972	0.70955	0.70863±24	82.0±3	granite
(24)PR 15-88 wr	147	268	0.549	1.587	0.71062	0.70863	82.0	aplite
(27)PR 1-88 wr	154	103	1.495	4.328	0.71358	0.70863	82.0	granite
(28)PR 3-93 wr	112	80.1	1.390	4.020	0.71354	0.70863	82.0	granite
(29)PR 4-93 wr	101	99.5	1.010	2.924	0.71221	0.70863	82.0	granite
(29)PR 4A-93 ksp	205.4	107.7	1.908	5.524	0.71489	0.70863	82.0	pegmatite K-feldspar
(27)PR 1-88 biot	799.6	9.4	85.060	253.220	1.00455	0.70863	82.0	biotite
undifferentiated granitic rocks of Inverness Ridge								
(30)PR 6-92 wr	152	268	0.568	1.644	0.71241	0.70965	117(?)	biotite granodiorite
(32)PR 2-93 wr	83.9	420	0.200	0.579	0.71191	0.71095	117(?)	biotite granodiorite
(32)PR 2A-93 wr	81.6	350	0.233	0.674	0.71089	0.70978	117(?)	biotite granodiorite
(31)PR 5-93 wr	134	99.5	1.340	3.879	0.71423	0.70779	117(?)	biotite granodiorite
(31)PR 5A-93 wr	178	104	1.710	4.952	0.71556	0.70933±23	86.2±3	pegmatite
(31)PR 5A-93 ksp	278.2	141.5	1.967	5.696	0.71614	0.70933	86.2	K-feldspar
(31)PR 5A-93 biot	990.4	6.9	143.750	437.72	1.24535	0.70933	86.2	biotite
FARALLON ISLANDS (Figure 3)								
granodiorite of the Farallon Islands								
3 Ketal 73 wr [1]	54	550	0.098	0.284	0.70660	0.70613±11	94.0±3.7	granodiorite
FAIS1-88 wr	56.7	574	0.099	0.286	0.70637	0.70613	94.0	granodiorite
FAIS2-88 wr	56.4	599	0.094	0.272	0.70645	0.70613	94.0	granodiorite
FAIS3-88 wr	58	581	0.100	0.289	0.70653	0.70613	94.0	granodiorite
FAIS4-88 wr	55.9	563	0.099	0.287	0.70656	0.70613	94.0	granodiorite
FAIS5-88 wr	40.3	610	0.066	0.191	0.70629	0.70613	94.0	granodiorite
FAIS6-88 wr	39.8	529	0.075	0.218	0.70631	0.70613	94.0	granodiorite
FAIS7-88 wr	50.4	550	0.098	0.284	0.70649	0.70613	94.0	granodiorite
FAIS2-91wr	68	422	0.162	0.469	0.70672	0.70613	94.0	granodiorite
FAIS3-91 wr	67	493	0.137	0.396	0.70678	0.70613	94.0	granodiorite
FAIS4-91 wr	70	476	0.148	0.428	0.70674	0.70613	94.0	granodiorite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
granodiorite of the Farallon Islands_continued								
FAIS5-91 wr	63	470	0.135	0.390	0.70665	0.70613	94.0	granodiorite
FAIS6-91 wr	71	466	0.151	0.436	0.70683	0.70613	94.0	granodiorite

FAIS7-91 wr	68	454	0.149	0.431	0.70676	0.70613	94.0	granodiorite
FAIS10-91wr	59	533	0.110	0.318	0.70637	0.70613	94.0	granodiorite
FAIS6A-91 wr	152	190	0.803	2.324	0.70936	0.70613	94.0	pegmatite
FAIS6AK-91 ksp	306.7	92.0	3.340	9.663	0.71903	0.70613	94.0	K-feldspar
FAIS7A-91 wr	146	139	1.050	3.039	0.71017	0.70613	94.0	pegmatite
FAIS7AK-91 ksp	207.6	158.4	1.310	3.793	0.71068	0.70613	94.0	K-feldspar
FAIS6AB-91biot	450.5	112.2	4.015	11.632	0.72098	0.70648	89.2	biotite
FAIS5-88hbde	10.0	61	0.163	0.471	0.70642	0.70612	94.0	hornblende
FAIS5-88 biot	213.3	42.6	5.007	14.510	0.72346	0.70596	84.9	biotite
CORDELL BANK (Figure 3)								
foliated biotite granodiorite of Fanny Shoals from depth of 110 feet								
FAIS8-91 wr	73	258	0.284	0.821	0.70677	0.70554	106.1	granodiorite
sheared biotite granodiorite of Noonday Rock from depth of 90 feet								
FAIS9-91 wr	177	285	0.620	1.794	0.70824	0.70554	106.1	granodiorite
FAIS-1-91 wr	164	146	1.120	3.240	0.70933	0.70496		granodiorite
FAIS-1A-91 wr	211	168	1.260	3.646	0.70949	0.70457		granodiorite
biotite, sphene bearing tonalite at 130 feet depth on northern Cordell Bank								
COBA 1-92 wr	91	375	0.243	0.703	0.70612	0.7051	95 [2]	biotite tonalite
sheared biotite granodiorite at 140 feet depth (COBA2-92) and at 120 feet depth (COBA3-92) on northern Cordell bank								
COBA2-92 zircon	na	na	na	na	na	na	100 [3]	granodiorite
COBA 3-92 wr	108	268	0.402	1.163	0.70746	0.7058	100 [3]	granodiorite
tonalite of Cordell Bank from dredge samples broken from ledge at depth of 210 feet								
COBA6-90-1 wr	47.1	574	0.082	0.237	0.70582	0.70549	99 [4]	tonalite
COBA6-90-2 wr	48.1	561	0.086	0.247	0.70581	0.70549	99 [4]	tonalite
COBA6-90-2 hbde	8.9	103.6	0.086	0.247	0.70581	0.70549	99	hornblende
COBA6-90-2 biot	295.7	25.6	11.530	33.500	0.74753	0.70549	88.3	biotite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	($^{87}Sr/^{86}Sr$) initial	Rb-Sr age (Ma)	Comment
tonalite, granodiorite, and aplite-pegmatite cobbles dredged from Cordell Bank								
COBA3-90-2 wr	54	619	0.087	0.252	0.70663	0.70630	95 [2]	tonalite
COBA3-90-3 wr	131	415	0.316	0.914	0.70654	0.70530	95 [2]	tonalite
COBA3-90-2P wr	120	163	0.738	2.135	0.70784	0.70500	95 [2]	pegmatite

COBA3-90-2Pksp	155.2	244.4	0.635	1.837	0.70773	0.70520	95 [2]	K-feldspar
COBA2-90 wr	81	514	0.158	0.457	0.70669	0.70610	95 [2]	tonalite
[10]COBA1A-90 ksp	258	48.7	5.300	15.359	0.72531	0.70448	94.6	K-feldspar
[10]COBA1B-90 wr	140	76.1	1.840	5.325	0.71103	0.70448	94.6	aplite
[10]COBA1c-90 wr	122	290	0.421	1.218	0.70655	0.70448	94.6	tonalite
COBA4-90 wr	67	369	0.182	0.526	0.70783	0.70716	90	tonalite
COBA4A-90 wr	110	52	2.120	6.137	0.71496	0.70716	90	aplite
MONTARA MOUNTAIN (Figure 5)								
south tonalite of Montara Mountain (Pilarcitos Creek)								
(1)MON1-87 wr	75.4	530	0.142	0.412	0.70764	0.70702	106±20	tonalite
(2)MON3-87 wr	54.1	397	0.136	0.394	0.70751	0.70692	106	granodiorite
(2)MON4-87 wr	75.4	519	0.145	0.420	0.70751	0.70688	106	tonalite
(2)MON2-87 wr	97.8	279	0.351	1.010	0.70815	0.70674	90.0	pegmatite
south tonalite of Montara Mountain (Piambo Quarry)								
(3)MON6-87 wr	119	441	0.270	0.781	0.70769	0.70640±27	106±20	tonalite
(3)MON8-87 wr	52.8	494	0.107	0.309	0.70695	0.70640	106	leucotonalite
(3)MON9-87 wr	38.5	743	0.052	0.150	0.70663	0.70640	106	mafic dike
(3)MON7-87 wr	135	138	0.978	2.830	0.71021	0.70674	90.0	pegmatite
(3)Mon-5-87 wr	140	151	0.927	2.680	0.71002	0.70674	90.0	pegmatite
south tonalite of Montara Mountain								
(4)MON1-97 wr	117	425	0.275	0.796	0.70768	0.70640±27	106±20	tonalite
(5)MON10-87 wr	60.3	516	0.117	0.338	0.70695	0.70640	106	tonalite
(6)MON11-87 wr	66.3	531	0.125	0.361	0.70689	0.70640	106	tonalite
(6)MON12-87 wr	76.7	523	0.147	0.424	0.70699	0.70640	106	tonalite
(7)MON13-87 wr	55.9	614	0.091	0.263	0.70669	0.70640	106	tonalite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
south tonalite of Montara Mountain_continued								
(8)MON14-87 wr	64.5	619	0.104	0.301	0.70667	0.70640	106	tonalite
(9MON11-88 wr	54.6	411	0.133	0.385	0.70731	0.70640	106	tonalite
(10)4Ketal73 wr [1]	43	441	0.109	0.315	0.70720	0.70640	106	tonalite
(8)MON14-87 biot	376.6	29.0	12.970	37.700	0.75252	0.70634	86.1	biotite
(7)MON13-87 biot	349.1	55.2	6.320	18.330	0.72871	0.70634	86.1	biotite

south tonalite of Montara Mountain (Montara Light House)								
(11)MON1-88 wr	70.5	373	0.189	0.549	0.70704	0.70640±27	106±20	tonalite
(11)MON3-88 wr	68.7	403	0.170	0.493	0.70695	0.70640	106	maffic incl.
(11)MON4-88 wr	67.9	397	0.171	0.495	0.70698	0.70640	106	tonalite
(11)MON1-90 ksp	257	146	1.760	5.090	0.71158	0.70614	75.4	K-feldspar
(11)MON2-90 wr	53.7	167	0.322	0.930	0.70713	0.70614	75.4	pegmatite
(11)MON2-88 wr	152	104	1.462	4.231	0.71107	0.70644	77.0	pegmatite
north tonalite of Montara Mountain (North Peak)								
(12)MON10-88 wr	57.2	259	0.221	0.639	0.70611	0.70517	104 [5]	tonalite
(12)MON10a-88 wr	52.5	77.5	0.677	1.960	0.70770	0.70535	89	pegmatite
north tonalite of Montara Mountain (Caltrans drill core at Devils Slide)								
(13)MON8-89 wr	40.2	271	0.148	0.428	0.70523	0.70460	104 [5]	tonalite
(13)MON9-89 wr	101	112	0.902	2.600	0.70787	0.70460	88.5	pegmatite
(13)MON10-89 wr	49.2	258	0.191	0.551	0.70541	0.70460	104 [5]	tonalite
(13)MON6-89 wr	57.9	369	0.157	0.454	0.70564	0.70500	104 [5]	tonalite
(13)MON7-89 wr	48.2	414	0.116	0.336	0.70555	0.70510	104 [5]	tonalite
north tonalite of Montara Mountain (granitoid rocks, Devils Slide area, along beach on west side of HWY 1)								
(14)MON5-88 wr	33.3	339	0.098	0.284	0.70592	0.70550	104 [5]	gabbro
(14)MON6-88 wr	27	444	0.061	0.176	0.70540	0.70514	104 [5]	granodiorite
(14)MON7-88 wr	45.5	252	0.181	0.522	0.70617	0.70540	104 [5]	sheared dike
(14)MON8-88 wr	27.3	232	0.118	0.34	0.70584	0.70534	104 [5]	sheared dike
14)MON9-88 wr	11.7	62.0	0.189	0.546	0.70650	0.70570	104 [5]	albite pegmatite
north tonalite of Montara Mountain (Pilarcitos dam)								
(15)MON12-88 wr	47.3	195	0.243	0.702	0.70680	0.70580	104 [5]	granodiorite mylonite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
granitoid clasts from Caltrans drill core in Paleocene sedimentary rocks north of Devils Slide								
(13)MON1-89 wr	38.7	527	0.073	0.211	0.70758	0.70732	80	granitoid clast
(13)MON2-89 wr	62.8	342	0.184	0.532	0.70829	0.70765	80	granitoid clast
(13)MON3-89 wr	69	268	0.257	0.744	0.70842	0.70752	80	granitoid clast
(13)MON4-89 wr	86.8	396	0.219	0.634	0.70835	0.70759	80	granitoid clast
(13)MON5-89 wr	11.3	371	0.030	0.087	0.70669	0.70659	80	granitoid clast

BEN LOMOND MOUNTAIN-SANTA CRUZ AREA (Figure 6)

northern tonalite of Ben Lomond								
(2)K2-87 wr	64.3	341	0.188	0.544	0.70649	0.70565±12	109.4±4.2	tonalite
(2)K2-87hbde	8.6	46.2	0.186	0.538	0.70633	0.70565	109.4	hornblende
(2)K2-87biot	338.8	24.2	14.010	40.730	0.75409	0.70572	83.6	biotite
(2)K2A-87 wr	65.3	352	0.185	0.535	0.70648	0.70565	109.4	tonalite
(3)K3-87 wr	60.3	320	0.188	0.543	0.70648	0.70565	109.4	tonalite
(3)K3-87hbde	6.7	38.1	0.175	0.508	0.70641	0.70565	109.4	hornblende
(3)K3-87biot	377.3	13.5	27.840	81.310	0.80258	0.70572	83.9	biotite
(3)5Ketal73 wr [1]	61.3	364	0.169	0.489	0.70660	0.70565	109.4	tonalite
granodiorite of Glen Canyon								
BL6a-88 wr	66.6	367	0.181	0.525	0.70640	0.70561±16	121±6	Olive Springs quarry
BL1-89 wr	68.5	321	0.213	0.616	0.70654	0.70561	121	Bridge Creek trail
BL2-89 wr	63	362	0.174	0.503	0.70644	0.70561	121	Bridge Creek trail
BL4-89 wr	60.5	335	0.181	0.524	0.70658	0.70561	121	Bridge Creek trail
(4)BL5-89 wr	97.9	248	0.395	1.143	0.70760	0.70561	121	granodiorite
(4)BL5A-89 wr	133	80.2	1.660	4.806	0.71388	0.70561	121	aplite
(5)K10-87 wr	157	143	1.098	3.180	0.71005	0.70506±34	110.3±4.8	granodiorite
(5)K10A-87 wr	197	75.6	2.606	7.550	0.71696	0.70506	110.3	pegmatite
(5)K10B-87 wr	201	77.5	2.594	7.510	0.71678	0.70506	110.3	pegmatite
(6)K11-87 wr	117	165	0.709	2.050	0.70911	0.70561	121	granodiorite
(6)K11A-87 wr	115	139	0.827	2.390	0.70959	0.70561	121	pegmatite
(7)K12-87 wr	108	112	0.964	2.790	0.71056	0.70561	121	granodiorite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
granodiorite of Glen Canyon_continued								
K13-87 wr (DR1105)	73.5	253	0.290	0.838	0.70731	0.70561	121	Spec. DR1105 [6]
K13-87biot	428.7	10.1	42.280	124.180	0.86243	0.70626	88.5	biotite
(6)K11-87biot	711.1	8.0	89	265.930	1.04255	0.70654	88.9	biotite
(5)K10-87biot	1025.6	21.0	48.800	143.700	0.88459	0.70625	87.4	biotite
(7)K12-87biot	874.1	11.4	76.610	226.680	0.94043	0.70790	72.2	biotite
alaskite of Smith Grade								
(8)K6-87 wr	121	69.6	1.739	5.03	0.71331	0.70565±12	109.4±4.2	granite
(8)K6A-87 wr	119	72.6	1.639	4.74	0.71308	0.70565	109.4	pegmatite

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
(8)K8-87 wr	110	95.9	1.147	3.32	0.71093	0.70565	109.4	granite
southern tonalite of Ben Lomond								
(9)BL10-89 wr	65.7	549	0.120	0.347	0.70666	0.70638±20	102.2±4.2	granodiorite
(1)K1A-87 wr	72.7	395	0.184	0.532	0.70748	0.70638	102.2	tonalite
(1)K1C-87 wr	112	390	0.287	0.830	0.70769	0.70638	102.2	pegmatite
(1)K1D-87 wr	157	46.9	3.134	9.070	0.71917	0.70638	102.2	aplite
(10)K5B-87 wr	177	146	1.210	3.500	0.71186	0.70638	102.2	pegmatite
(11)K7-87 wr	62.7	497	0.126	0.365	0.70653	0.70638	102.2	tonalite
(12)K9-87 wr	84.5	409	0.206	0.596	0.70768	0.70638	102.2	tonalite
(13)BL5-88 wr	87.4	487	0.179	0.519	0.70735	0.70638	102.2	granodiorite
(13)BL5A-88 wr	131	47.9	2.735	7.920	0.71821	0.70638	102.2	aplite-pegmatite
BL6-88 wr	77.8	379	0.205	0.594	0.70709	0.70638	102.2	Olive Springs
(14)BL6-89 wr	81.1	254	0.319	0.923	0.70762	0.70638	102.2	granodiorite
(15)BL7-89 wr	137	173	0.792	2.292	0.70958	0.70638	102.2	granodiorite
(16)BL14-89 wr	95	463	0.205	0.593	0.70704	0.70638	102.2	tonalite
(16)BL14A-89 wr	215	82.9	2.590	7.501	0.71713	0.70638	102.2	pegmatite
(16)BL14B-89 wr	78.9	501	0.157	0.454	0.70685	0.70638	102.2	mafic inclusion
granitoid rocks in the Bonny Doon, Felton and Santa Cruz area of the Santa Cruz Mountains								
(10)K5-87 wr	79.5	437	0.181	0.523	0.70965	0.70902±44	117±15	tonalite
(10)K5A-87 wr	105	549	0.191	0.552	0.71009	0.70902	117	tonalite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
granitoid rocks in the Bonny Doon, Felton and Santa Cruz area of the Santa Cruz Mountains_continued								
(17)BL2A-88 wr	96.8	225	0.430	1.245	0.71119	0.70902	117	garnet-biotite granite
(18)BL13-89 wr	113	108	1.050	3.040	0.71402	0.70902	117	granite
(19)BL1-88 wr	87.1	274	0.318	0.920	0.70867	0.70722±44	117	Garnet-biotite granite
(19)BL1A-88 wr	106	215	0.493	1.427	0.70999	0.70722	117	pegmatite
(17)BL2-88 wr	139	400	0.347	1.004	0.70921	0.70722	117	tonalite
(20)BL3-88 wr	96.8	377	0.256	0.743	0.70809	0.70722±44	117	tonalite
(20)BL3A-88 wr	119	281	0.423	1.226	0.70927	0.70722	117	aplite
(20)BL3B-88 wr	132	163	0.810	2.340	0.71111	0.70722	117	granodiorite
(21)BL4A-88 wr	132	187	0.705	2.043	0.71030	0.70722	117	Granodiorite
BL3-89 wr	155	182	0.852	2.467	0.71164	0.70722	117	tonalite
(22)BL11-89 wr	102	368	0.277	0.802	0.70827	0.70722	117	Tonalite

(23)BL12-89 wr	209	154	1.360	3.937	0.71337	0.70722	117	Porphyritic granite
(23)BL12A-89 wr	190	184	1.030	2.982	0.71239	0.70722	117	Granodiorite
(21)BL4-88 wr	80.4	53.2	1.510	4.377	0.71542	0.70815	117	granodiorite
(20)BL3-88 biot	511.7	13.8	37.040	108.519	0.83846	0.70719	85.14	biotite
adamellite of Clark (1981)								
(24)BL9-89 wr	284	84.1	3.380	9.799	0.72855	0.71472	99.4	adamellite
(24)BL9A-89 wr	434	106	4.090	11.861	0.73146	0.71472	99.4	pegmatite
Texaco Poletti #1 basement drill core								
(25)TP#1(9163 ft) wr	193	79.8	2.410	7	0.71373	0.70379	100	granodiorite
basement drill cores from wells along east margin of Monterey Bay (Figure 8)								
Texaco Blake #1								
TB1(2426 ft) wr	83.7	202	0.414	1.198	0.71056	0.70854	118	granodiorite
TB2(2462 ft) wr	62.7	266	0.236	0.682	0.70969	0.70854	118	granodiorite
TB3(2458 ft) wr	121	446	0.271	0.785	0.70837	0.70725	100	dike
Texaco Davies								
TD(2194 ft) wr	105	516	0.203	0.589	0.70871	0.70788	100	granodiorite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
SANTA LUCIA MOUNTAINS (Figure 7)								
porphyritic granodiorite of Monterey, granodiorite of Cachagua, quartz diorite of Soberanes Point								
(7)SANLU1-90 wr	119	415	0.286	0.830	0.70905	0.70787±10	83.5±6.2	Granodiorite
(7)SANLU1A-90 wr	128	312	0.411	1.190	0.70962	0.70787	83.5	Pegmatite
(8)SANLU2-90 wr	98.7	447	0.221	0.640	0.70837	0.70787	83.5	granodiorite
(1)SANLU10-90 wr	93.7	422	0.222	0.640	0.70879	0.70787	83.5	granodiorite
(2)SANLU11-90 wr	95.8	434	0.221	0.640	0.70868	0.70787	83.5	granodiorite
(10)PACGROVE wr	84.6	411	0.206	0.596	0.70844	0.70787	83.5	granodiorite
(3)SANLU12-90 wr	92.7	431	0.215	0.620	0.70835	0.70787	83.5	granodiorite
(3)SANLU12B-90 wr	150	345	0.436	1.260	0.70934	0.70787	83.5	aplite
(3)SANLU12-90 ksp	204	640	0.319	0.920	0.70876	0.70787	83.5	K-feldspar
(3)SANLU12-90 kspR	na	na	na	0.920	0.70874	0.70787	83.5	2^{nd} digestion
(4)SANLU13-90 wr	84.5	440	0.215	0.620	0.70851	0.70787	83.5	granodiorite

(4)SANLU13-90 wrR	na	na	na	0.620	0.70851	0.70787	83.5	2nd digestion
(4)SANLU13A-90 wr	107	446	0.239	0.690	0.70859	0.70787	83.5	granodiorite
(4)SANLU13B-90 ksp	177	607	0.292	0.840	0.70877	0.70787	83.5	K-feldspar
(5)SANLU14-90 wr	88	451	0.195	0.560	0.70865	0.70787	83.5	granodiorite
(5)SANLU14-90 wrR	na	na	na	0.560	0.70866	0.70787	83.5	2nd digestion
(5)SANLU14A-90 wr	63.1	137	0.459	1.330	0.70959	0.70787	83.5	pegmatite
(5)SANLU14A-90 wrR	na	na	na	1.330	0.70947	0.70787	83.5	2nd digestion
(5)SANLU14B-90 wr	63.5	101	0.629	1.820	0.71017	0.70787	83.5	pegmatite
(5)SANLU14B-90 wrR	na	na	na	1.820	0.71014	0.70787	83.5	1 Ta filament run
(5)SANLU14B-90 wrR	na	na	na	1.820	0.71013	0.70787	83.5	2nd digestion
(6)SANLU15-90 wr	99.7	448	0.223	0.650	0.70877	0.70787	83.5	granodiorite
(6)SANLU15-90 wrR	na	na	na	0.650	0.70869	0.70787	83.5	2nd digestion
(9)SANLU3A-90 wr	91.4	483	0.189	0.550	0.70820	0.70787	83.5	Cachagua
(9)SANLU3-90 wr	101	473	0.213	0.620	0.70838	0.70787±10	83.5±6.2	Cachagua
(10)SANLU4-90 wr	126	368	0.343	0.990	0.70888	0.70787	83.5	pegmatite
(10)SANLU4A-90 wr	82	224	0.365	1.060	0.70887	0.70787	83.5	pegmatite
(11)SANLU5-90 wr	76	637	0.119	0.340	0.70859	0.70787	83.5	Sobaranes
(11)SANLU5A-90 wr	140	399	0.350	1.010	0.70925	0.70787	83.5	pegmatite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
porphyritic granodiorite of Monterey, granodiorite of Cachagua, quartz diorite of Soberanes Point_continued								
(11)SANLU5B-90 wr	83.3	749	0.111	0.320	0.70852	0.70787	83.5	mafic inclusion
(12)SANLU6-90 wr	60.6	542	0.112	0.320	0.70846	0.70787	83.5	Sobaranes
(12)SANLU6A-90 wr	127	459	0.278	0.800	0.70880	0.70787	83.5	pegmatite
(12)SANLU6B-90 wr	132	530	0.249	0.720	0.70870	0.70787	83.5	pegmatite
(13)GB-98-1 wr	113.4	683.8	0.166	0.480	0.70872	0.70787	83.5	Sobaranes
(14)SANLU7-90 wr	70.6	528	0.134	0.390	0.70842	0.70787	83.5	Sobaranes
(15)SANLU9-90 wr	49.9	552	0.091	0.260	0.70841	0.70787	83.5	diorite
(16)SANLU8-90 wr	67.7	580	0.117	0.340	0.70814	0.70787	83.5	Sobaranes
(17)SANLU20-90 wr	107	431	0.249	0.720	0.70853	0.70787	83.5	Sobaranes
(17)SANLU20-90 wrR	na	na	na	na	0.70859	0.70787	83.5	1Ta filament run
(17)SANLU20-90 wrR	na	na	na	na	0.70866	0.70787	83.5	2nd digestion
(17)SANLU20A-90 wr	147	172	0.854	2.470	0.71093	0.70787	83.5	Pegmatite
(18)SANLU1B-94 wr	254	204	1.240	3.590	0.71203	0.70787	83.5	mafic inclusion

(18)SANLU1C-94 ksp	355	450	0.790	2.290	0.71053	0.70787	83.5	pegmatite K-feldspar
(19)SANLU2-94 wr	110	345	0.319	0.923	0.70901	0.70787	83.5	granodiorite
(20)SANLU3-94 wr	72.7	433	0.168	0.486	0.70821	0.70787	83.5	granodiorite
(20)SANLU3-94 ksp	200	635	0.315	0.912	0.70875	0.70787	83.5	K-feldspar
(19)SANLU2A-94 wr	124	134	0.922	2.670	0.71358	0.71035	83.5	aplite dike
(17)SANLU20-90 biot	546.4	21.2	25.730	75.060	0.78859	0.70789	75.8	biotite
(17)SANLU20-90 hbde	11.8	65.5	0.179	0.519	0.70830	0.70789	75.8	hornblende
(11)SANLU5-90 hbde	34.1	85.3	0.399	1.156	0.70935	0.70814	78.73	hornblende
(11)SANLU5-90 biot	416.7	18.6	22.390	65.230	0.78112	0.70814	78.73	biotite
(2)SANLU11-90 biot	683.8	37.7	18.128	52.730	0.76454	0.70799	75.5	biotite
garnet bearing aplites and pegmatites in the porphyritic granodiorite of Monterey								
(8)SANLU2A-90 wr	217	34.9	6.210	17.980	0.72782	0.70732±72	82±4	pegmatite
(2)SANLU11A-90wr	124	42.2	2.940	8.510	0.71717	0.70732	82	aplite
(3)SANLU12A-90wr	201	42.7	4.710	13.640	0.72346	0.70732	82	garnet aplite
(18)SANLU1A-94wr	226	39.5	5.720	16.580	0.72673	0.70732	82	garnet aplite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
SANTA LUCIA MOUNTAINS (Figure 7)_continued								
Quartz diorite of Paraiso Paloma area and granodiorite-quartz diorite of Bear Mountain and Junipero Serra Peak								
(21)SANLU22-90 wr	81.1	619	0.131	0.379	0.70891	0.70824±10	117±12	quartz diorite
(22)SANLU23-90 wr	60.4	689	0.088	0.254	0.70867	0.70824	117	quartz diorite
(23)SANLU24-90 wr	90.5	528	0.171	0.495	0.70915	0.70824	117	quartz diorite
(24)SANLU25-90 wr	74.3	705	0.105	0.300	0.70860	0.70824	117	quartz diorite
(24)SANLU25-90 wrR	74.3	705	0.105	0.300	0.70860	0.70824	117	1 Ta filament run
(24)SANLU25-90 wrR	74.3	705	0.105	0.300	0.70860	0.70824	117	2nd digestion
(25)SANLU26-90 wr	55.7	744	0.075	0.216	0.70876	0.70824	117	quartz diorite
(26)SANLU27-90 wr	58.1	742	0.078	0.227	0.70872	0.70824	117	quartz diorite
(27)SANLU4-91 wr	95.2	662	0.144	0.417	0.70881	0.70824	117	quartz diorite
(28)SALU5A-91 wr	81.6	705	0.116	0.336	0.70895	0.70824	117	quartz diorite
(29)SANLU7A-91 wr	72.7	533	0.136	0.394	0.70887	0.70824	117	granodiorite
(29)SANLU7B-91 wr	60.8	578	0.105	0.304	0.70884	0.70824	117	mafic inclusion
(30)SANLU14-91 wr	62.5	732	0.085	0.246	0.70853	0.70824	117	quartz diorite
(31)SANLU8-91 wr	81.6	455	0.183	0.530	0.70924	0.70824	117±12	tonalite
(32)SANLU16-90 wr	88.7	477	0.186	0.54	0.70896	0.70824	117	granodiorite

(33)SANLU17-90 wr	89.5	386	0.232	0.670	0.70944	0.70824	117	granodiorite
(33)SANLU17-90 wr	89.5	386	0.232	0.670	0.70944	0.70824	117	granodiorite
(33)SANLU17-90 wrR	na	na	na	na	0.70951	0.70824	117	2nd digestion
(34)SANLU19-90 wr	120	445	0.270	0.780	0.70968	0.70824	117	granodiorite
(35)SL-30 wr [7]	22.8	761	0.030	0.090	0.70820	0.70824	117	gabbro
(36)SL-31A wr [7]	149	427	0.349	1.010	0.70990	0.70824	117	granodiorite
(36)SL-29B wr [7]	175	302	0.579	1.680	0.71090	0.70824	117	aplite
(22)SANLU23-90 biot	337.9	25.6	13.210	38.370	0.74818	0.70843	72.9	biotite
(22)SANLU23-90 hbde	7.4	79.0	0.094	0.272	0.70862	0.70843	72.9	hornblende
(25)SANLU26-90 biot	357.5	29.1	12.290	35.680	0.74539	0.70843	72.9	biotite
diorite of Corral de Tierra								
(37)SANLU15-91 wr	13.7	987	0.013	0.038	0.70993	0.70987	>116.7	gabbro
porphyritic granodiorite of Sand Creek								
(38)SANLU5-91 wr	96.7	574	0.168	0.486	0.70908	0.70830	116.7?	granodiorite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
SANTA LUCIA MOUNTAINS (Figure 7)_continued								
granodiorites in Carmel Valley								
(39)SANLU18-90 wr	73.1	549	0.133	0.380	0.70949	0.70913±19	93±10	granodiorite
(39)SANLU18-90 wrR	na	na	na	0.380	0.70952	0.70913	93	1 Ta filament run
(39)SANLU18-90 wrR	na	na	na	0.380	0.70948	0.70913	93	2nd digestion
(39)SANLU18A-90 wr	92.7	229	0.405	1.170	0.71067	0.70913	93	pegmatite
(39)SANLU18A-90 wrR	na	na	na	1.170	0.71068	0.70913	93	2nd digestion
(40)SANLU21-90 wr	110	414	0.265	0.767	0.71006	0.70913	93	granodiorite
(41)SANLU6-91wr	99.7	591	0.169	0.489	0.70986	0.70913	93	granodiorite
(42)SANLU16-91 wr	117	502	0.233	0.674	0.71015	0.70913	93	granodiorite
(21)SANLU22A-90 wr	45.9	617	0.074	0.215	0.70945	0.70913	93	pegmatite
(21)SANLU22B-90 wr	56.7	594	0.095	0.276	0.70969	0.70913	93	granodiorite dike
(43)SANLU4-94 wr	127	408	0.312	0.903	0.70947	0.70817±19	97±10	granodiorite
(43)SANLU4-94 ksp	232	615	0.377	1.090	0.70961	0.70817	97	K-feldspar
(43)SANLU4A-94 wr	134	194	0.691	2.000	0.71094	0.70817	97	garnet aplite
quartz monzonite of Pine Canyon								
(44)SANLU1-91wr	121	313	0.386	1.117	0.71127	0.71000±10	80.1±8	granite
(45)SANLU3-91wr	67.1	618	0.109	0.315	0.71036	0.71000	80.1	granite
(46)SANLU18-91wr	91.4	465	0.196	0.567	0.71074	0.71000	80.1	granite

(44)SANLU2-91wr	132	257	0.515	1.490	0.71238	0.71070	80.1	garnet aplite
(47)SANLU17-91wr	90	118	0.764	2.211	0.71170	0.70920	80.1	garnet aplite
charnokitic tonalite of Compton (1960) and related rocks west of the Palo Colorado fault zone								
(48)DR2291 wr	10	384	0.026	0.075	0.70627	0.70610	100 [8]	pyroxene tonalite
(49)SANLU10-91 wr	54.1	619	0.087	0.252	0.71046	0.71010	100 [8]	garnet foliated granite
(49)SANLU10A-9 1wr	55.4	455	0.122	0.353	0.71084	0.71030	100 [8]	foliated granite
(50)SANLU11-91 wr	9.4	484	0.019	0.055	0.70683	0.70660	100 [8]	foliated tonalite
(50)SANLU11a-91 wr	35.9	446	0.080	0.232	0.70665	0.70631	100 [8]	mafic inclusion
(51)SANLU12-91 wr	16.1	396	0.041	0.119	0.70691	0.70660	100 [8]	foliated tonalite
(52)SANLU13-91 wr	73.9	363	0.204	0.590	0.70912	0.70830	100 [8]	garnet foliated tonalite
(50)SANLU11-91 hbde	9.1	101.3	0.090	0.261	0.70673	0.70632	83.8	hornblende

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
SANTA LUCIA MOUNTAINS (Figure 7)_continued								
charnokitic tonalite of Compton (1960) and related rocks west of the Palo Colorado fault zone_continued								
(50)SANLU11a-91 biot	69.4	54.1	1.280	3.710	0.71076	0.70632	83.8	biotite
(50)SANLU11a-91hbde	30.0	138.5	0.217	0.627	0.70691	0.70632	83.8	hornblende
(51)SANLU12-91hbde	9.9	82.5	0.120	0.346	0.70678	0.70632	83.8	hornblende
(53)SANLU9-91wr	22.1	568	0.039	0.113	0.70848	0.70830	100 [8]	qtz. diorite
(53)SANLU9C-91wr	28.1	253	0.111	0.321	0.70679	0.70620	100 [8]	granodiorite
(54)DR2172wr	46.9	528	0.089	0.275	0.70942	0.70905	100 [8]	tonalite
(53)SANLU9A-91wr	36.7	620	0.059	0.171	0.70891	0.70870	96	granodiorite
(53)SANLU9B-91wr	74.6	176	0.423	1.224	0.71035	0.70870	96	pegmatite
MONTEREY BAY (Figure 8)								
granodiorites from Monterey Canyon, MBARI drill core (Figure 8)								
MBARI-500-1 wr	144	281	0.516	1.485	0.71043	0.70893±12	81.2±2.7	granodiorite
MBARI-500-1ksp	265	456.71	0.578	1.672	0.71069	0.70893	81.2	K-feldspar
MBARI-769-1 wr	135	417	0.323	0.934	0.71002	0.70893	81.2	granodiorite
MBARI-769-1ksp	244	597	0.410	1.190	0.71034	0.70893	81.2	K-feldspar
MBARI-769-5 wr	137	398	0.345	0.998	0.71002	0.70893	81.2	granodiorite
MBARI-770-1 wr	124	379	0.327	0.946	0.71022	0.70893	81.2	granodiorite
MBARI-741-2 wr	140	286	0.490	1.420	0.71065	0.70893	81.2	granodiorite
MBARI-741-2ksp	245	439	0.558	1.610	0.71082	0.70893	81.2	K-feldspar

MBARI-769-3 wr	149	390	0.382	1.110	0.71020	0.70893	81.2	granodiorite
MBARI-769-3ksp	295	545	0.542	1.570	0.71078	0.70893	81.2	K-feldspar
MBARI1066-1 wr	151	346.4	0.436	1.262	0.71063	0.70893	81.2	granodiorite
MBARI-891-1ksp	166	537.6	0.308	0.894	0.70918	0.70810	83.5	K-feldspar
MBARI-891-1 wr	154	426.5	0.361	1.045	0.70927	0.70800	83.5	granodiorite
MBARI-1157-1wr	132	282.3	0.467	1.353	0.70988	0.70824	83.5	granodiorite
MBARI-1158-1wr	94.4	374.7	0.252	0.729	0.70902	0.70814	83.5	granodiorite
MBARI-1043-1wr	120	342.4	0.35	1.014	0.70965	0.70842	83.5	granodiorite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
MONTEREY BAY (Figure 8)								
granodiorites from Soquel Canyon, MBARI drill core (Figure 8)								
MBARI-1042-1wr	139	526.9	0.263	0.763	0.70877	0.70720	117 (?)	granodiorite
MBARI-1041-1wr	141	471.8	0.299	0.865	0.70854	0.70720	117 (?)	granodiorite
MBARI1041-1ksp	153	647.6	0.236	0.683	0.70833	0.70720	117 (?)	K-feldspar
GABILAN RANGE (Figure 10)								
north tonalite of Vergeles								
(1)K14-87 wr	56.2	309	0.182	0.527	0.70658	0.70573±13	113±12	tonalite
(1)K14A-87 wr	63.4	292	0.217	0.628	0.70673	0.70573	113	mafic inclusion
(1)K14B-87 wr	81.4	199	0.409	1.183	0.70763	0.70573	113	felsic dike
south tonalite of Vergeles								
(2)K15-87 wr	159	28.9	5.500	15.940	0.72697	0.70692±34	88.5±6.6	aplite
(2)K16A-87 wr	100	466	0.214	0.619	0.70763	0.70692	88.5	tonalite
(2)K16B-87 wr	89.8	509	0.176	0.509	0.70747	0.70692	88.5	tonalite
(2)K16C-87 wr	58.3	540	0.108	0.312	0.70746	0.70692	88.5	tonalite
quartz diorite-granodiorite of Johnson Canyon								
(3)DR 570 wr	65.9	589	0.112	0.324	0.70920	0.70880 [9]	84 [2]	tonalite
(4)DR 566A wr	83.2	439	0.190	0.550	0.70900	0.70830 [9]	84 [2]	granodiorite
(5)DR 584 wr	94.6	456	0.207	0.599	0.70930	0.70860 [9]	84 [2]	granodiorite
granodiorite of Gloria Road								
(7)G1A wr	108	461	0.234	0.677	0.70910	0.70830 [9]	91 [2]	granodiorite
(6)GARA1-91 wr	95.7	454	0.211	0.611	0.70864	0.70788	82.6	granodiorite

(6)GARA2-91wr	142	195	0.730	2.113	0.71024	0.70788	82.6	pegmatite
(6)GARA2A-91 wr	170	164	1.040	3.011	0.71149	0.70788	82.6	pegmatite
quartz monzonite of Bickmore Canyon								
(8)DR 576 wr	155	254	0.610	1.765	0.71080	0.70860 [9]	84 [2]	quartz monzonite
quartz monzonite of Fremont Peak								
(9)DR 546 wr	148	113	1.310	3.790	0.71400	0.70835 [9]	105 [2]	quartz monzonite

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
Southern Salinian composite terrane (Figure 11)								
La Panza Range								
(10)BR-6-3 wr	99.9	511	0.196	0.567	0.70880	0.7081 [1]	80 [8]	tonalite
(12)LaPaz 1-91 wr	92	498	0.184	0.535	0.70892	0.7082	80 [8]	granodiorite
(12)LaPaz 1A-91 wr	120	232	0.518	1.499	0.71054	0.7088	80 [8]	aplite
(12)LaPaz1AK-91	137.8	155.9	0.884	2.558	0.711159	0.70905	69.5	k-feldspar
granitic rock of Stockdale Mountain								
(8)DR-145C wr	93.5	636	0.147	0.425	0.70820	0.7076 [1]	110 [8]	granodiorite
gneiss of Red Hills								
(9) DR-109 wr	78.7	698	0.113	0.327	0.7100	0.7095 [1]	82 [8]	gneissic tonalite
homogenized gneiss and felsic intrusions at Mount Abel								
(11) DR-745 wr	77.1	746	0.103	0.298	0.71680	0.71640 [1]	110 [1]	gneissic tonalite
(11) DR-753 wr	83.5	655	0.127	0.368	0.70920	0.7083 [1]	180 [1]	granodiorite
(11) DR766B wr	107	142	0.753	2.180	0.7138	0.7083 [1]	180 [1]	granodiorite
GRANITOID COBBLES FROM CRETACEOUS CONGLOMERATES (Figure 1)								
cobbles from nonmarine sequence of Campanian age, San Rafael Mountains (McClean and others, 1977)								
580-11-2 wr	11.8	302	0.039	0.113	0.70431	0.70402	127	pyroxenite
580-8-4 wr	38.4	320	0.120	0.347	0.70455	0.7041	126	granodiorite
580-11-4A wr	102	183	0.557	1.610	0.70681	0.70448	102	granodiorite
580-11-4B wr	45.4	81.6	0.556	1.610	0.70707	0.70474	102	granodiorite
Pescadero Beach, Miocene conglomerate, granitoid cobbles (Figure 1)								
coarse grained								
PesBe1-91 wr	57.6	514	0.112	0.324	0.70642	0.70599	93.2	granodiorite
PesBe2-91 wr	49.1	480	0.102	0.295	0.70654	0.70615	93.2	granodiorite

PesBe3-91 wr	45.6	544	0.084	0.243	0.70653	0.70621	93.2	granodiorite
PesBe4-91 wr	61.5	481	0.128	0.370	0.70686	0.70637	93.2	granodiorite
Pescadero Beach, Miocene conglomerate, granitoid cobbles (Figure 1)								
fine grained								
PesBe5-91 wr	169	82.8	2.040	5.900	0.71539	0.70923	75	granite
PesBe6-91 wr	287	30.1	9.530	27.620	0.73909	0.70923	75	granodiorite
PesBe9-91 wr	108	394	0.273	0.790	0.71042	0.70923	75	granitoid
PesBe11-91 wr	214	53.7	3.980	11.520	0.72139	0.70923	75	granitoid

Table 1. Rb-Sr age and isotopic data for granitoid rocks and minerals of the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	Rb (ppm)	Sr (ppm)	Rb/Sr wt. ratio	$^{87}Rb/^{86}Sr$ atom ratio	$^{87}Sr/^{86}Sr$ measured	$(^{87}Sr/^{86}Sr)$ initial	Rb-Sr age (Ma)	Comment
Pescadero Beach, Miocene conglomerate, granitoid cobbles								
fine grained_continued								
PesBe12-91 wr	355	138	2.580	7.470	0.71719	0.70923	75	granitoid
PesBe13-91 wr	143	293	0.488	1.410	0.71056	0.70923	75	granitoid
PesBe7-91 wr	82.4	765	0.108	0.313	0.71246	0.71200	94	granitoid
PesBe10-91 wr	158	18.9	8.350	24.250	0.74448	0.71200	94	granitoid
Pigeon Point, Upper Cretaceous conglomerate, granitoid cobbles (Figure 1)								
PigPot1-91 wr	27.9	174	0.160	0.462	0.70608	0.70555	80	granodiorite
PigPot2-91 wr	17	152	0.112	0.324	0.70533	0.70497	80	granodiorite
PigPot3-91 wr	7.5	142	0.053	0.152	0.70483	0.70468	80	tonalite
PigPot4-91 wr	8	195	0.041	0.121	0.70542	0.70530	80	granodiorite
PigPot5-91 wr	8	189	0.042	0.121	0.70584	0.70571	80	granodiorite
PigPot6-91 wr	21.4	161	0.133	0.384	0.70587	0.70544	80	granodiorite

Notes and References:

1. Kistler and others, 1973 **2**. Age from U-Pb zircon, Matinson, 1990 **3**. Age from U-Pb zircon, J. Wooden, written communication, 2000 **4**. Kistler and Wooden, 1994 **5**. Age from U-Pb zircon, James 1992 **6**. Ross, 1972 **7**. Evernden and Kistler, 1970 **8**. Age from U-Pb zircon, Mattinson, 1978 **9**. Kistler and Peterman, 1973, **10**. Samples from Hanna, G. D., 1952. **Materials analyzed**: wr=whole-rock, hbde=hornblende, ksp= K-feldspar, pla=plagioclase, biot=biotite, R=duplicate analysis. Rb-Sr ages are whole-rock isochron and or mineral ages.

Table 2. Initial lead, strontium, and neodymium isotopic ratios for granitoid rocks in the Salinian composite terrane California

Sample No.	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	$(^{87}Sr/^{86}Sr)_0$	ε Nd T	Comment
CORDELL BANK						
Coba-1A-90 ksp	18.901	15.618	38.569	0.7045		Figure 3, tonalite
Coba-6-90-2	18.896	15.645	38.646	0.70549		Figure 3, tonalite
1G [2]	18.939	15.714	38.864	0.70448		Figure 3, granodiorite
MONTARA MOUNTAIN						
3 [3]	18.86	15.62	38.5	0.70565*		loc. 13, Fig 5, n. tonalite of Montara Mtn.
MON 11-87	na	na	na	0.70638	-3.9	loc.6, Fig. 5, s. tonalite of Montara Mtn.
Mon-2-97	19.059	15.653	38.702	0.70638		loc.4, Fig. 5, s. tonalite of Montara Mtn.
MON-1-90 kspr	19.002	15.644	38.66	0.70614		loc. 11, Fig. 5, pegmatite
FARALLON ISLANDS						
3G [2]	19.163	15.718	38.905	0.70616*	-4.4 [2]	South East Farallon Island, tonalite
FAIS-6AK-91ksp	19.055	15.654	38.714	0.70614		Figure 3, pegmatite, north Farallon Islands
FAIS-7AK-91 ksp	19.049	15.675	38.782	0.70614		Figure 3, pegmatite, north Farallon Islands
BODEGA HEAD						
4G [2]	19.303	15.697	38.866	0.70683*		BH-1, east tonalite of Bodega Head
BH 8-88	na	na	na	0.70638	-4.4	loc. 2, Fig 2, east tonalite of Bodega Head
BH 6-90 ksp	19.065	15.646	38.745	0.70565		loc. 5, Fig.2, porphyritic granodiorite of Bodega Head
BH-1-90 ksp	19.166	15.671	38.775	0.70612		loc. 4, Fig. 2, pegmatite
BH-9A-88 ksp	19.281	15.694	38.838	0.70672		loc. 3, Fig. 2, pegmatite
POINT REYES						
PR 1 [1]	19.247	15.712	38.916	0.70682*		loc. 16 Fig. 2, tonalite of north McClure's Beach
5G [2]	19.218	15.668	38.787	0.70705*		loc. 12, Fig. 2, granodiorite of south McClures Beach
PR1-88	na	na	na	0.70897	-4.2	loc. 27, Fig. 2, biotite granite of Tomales Bay
PR-4A-92 ksp	19.304	15.717	38.948	0.70794		loc. 18, Fig. 2, pegmatite
PR-8A-92 ksp	19.321	15.703	38.888	0.70709		loc. 21, Fig. 2, pegmatite
PR-4A-93 ksp	19.367	15.712	38.979	0.70897		loc. 29, Fig. 2, pegmatite

PR-5A-93 ksp	19.588	15.743	39.116	0.70933		loc. 31, Fig. 2, pegmatite

Table 2. Initial lead, strontium, and neodymium isotopic ratios for granitoid rocks in the Salinian composite terrane California_Continued

Sample No.	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	$(^{87}Sr/^{86}Sr)_0$	εNd T	Comment
BEN LOMOND MOUNTAIN-SANTA CRUZ AREA						
K2-87	na	na	na	0.70558	-1.7	loc. 2, Fig. 6, northern tonalite of Ben Lomond
K8-87	na	na	na	0.70558	0.9	loc. 8, Fig. 6, alaskite of Smith Grade
2 [3]	19.26	15.69	38.83	0.70677*		loc. 1, Fig. 6, southern tonalite of Ben Lomond
1 [3]	19.19	15.68	38.83	0.70677*		gabbro, Fig. 6
6 [3]	19.13	15.68	38.77	0.70672*		gneiss, Fig. 6
5 [3]	18.92	15.66	38.68	0.70558		loc. 8, Fig. 6, alaskite of Smith Grade
4 [3]	19.04	15.66	38.73	0.70558		loc. 4, Fig. 6, granodiorite of Glen Canyon
SANTA LUCIA MOUNTAINS						
16 [2]	19.429	15.774	39.227	0.70773*		loc. 8, Fig. 7, porphyritic granodiorite of Monterey
17 [2]	19.592	15.78	39.369	0.70868*		loc. 42, Fig. 7, granodiorites in Carmel Valley
SL-1 [1]	19.153	15.667	38.731	0.7063		loc. 50, Fig. 7, charnokitic tonalite of Compton (1960)
SL-2 [1]	19.324	15.728	38.962	0.7063		loc. 51, Fig. 7, charnokitic tonalite of Compton (1960)
SL-4 [1]	19.444	15.696	38.948	0.7081		loc. 11, Fig. 7, quartz diorite of Sobaranes Point
7G [2]	19.67	15.818	39.493	0.70864*		loc. 23, Fig. 7, guartz diorite of Paraiso Paloma area
SANLU13B-90	19.33	15.688	38.949	0.70792		loc. 4, Fig. 7, feldspar megacryst
SANLU12-90 ksp	19.347	15.695	38.979	0.70782		loc. 3, Fig. 7, porphyritic granodiorite of Monterey
SANLU-1C-94 ksp	19.395	15.716	39.036	0.70785		loc. 18, Fig. 7, pegmatite
SANLU-3-94 ksp	19.358	15.708	39.009	0.7075		loc. 20, Fig. 7, porphyritic granodiorite of Monterey
SANLU-4-94 ksp	19.477	15.717	39.076	0.70817		loc. 43, Fig. 7, granodiorites in Carmel Valley

Table 2. Initial lead, strontium, and neodymium isotopic ratios for granitoid rocks in the Salinian composite terrane California_Continued

Sample No.	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	$(^{87}Sr/^{86}Sr)_0$	εNd T	Comment
MONTEREY BAY						
granodiorites from Monterey Canyon						
MBARI-769-1 ksp	19.532	15.729	39.132	0.70897		Fig. 8
MBARI-891-1 ksp	19.532	15.742	39.11	0.70797		Fig. 8
MBARI-500-1 ksp	19.547	15.744	39.151	0.70897		Fig. 8
granodiorite from Soquel Canyon						
MBARI-1041-1 ksp	19.546	15.717	39.06	0.7072		Fig. 8
GABILAN RANGE						
6G [2]	19.37	15.74	39.06	0.7069*	-4.9 [2]	loc. 10, Fig. 10, south tonalite of Vergeles
13 [2]	19.42	15.77	39.12	0.70835		loc. 11, Fig.10, quartz monzonite of Fremont Peak
14 [2]	19.667	15.814	39.446	0.7081*		loc. 12, Fig. 10, quartz monzonite of Fremont Peak
15 [2]	19.472	15.772	39.19			loc. 13, Fig. 10, granodiorite of Natividad
18 [2]	19.609	15.779	39.363			loc. 14, Fig. 10, granite of Jack's Hill
23 [2]	19.514	15.773	39.178	0.70813*		loc. 15, Fig. 10, granodiorite of Gloria Road
24 [2]	19.559	15.767	39.246	0.70822*		loc. 16, Fig. 10, granodiorite of Johnson Canyon
25 [2]	19.594	15.826	39.339	0.7086		loc. 17, Fig.10, quartz monzonite of Bickmore Canyon
8G [2]	19.43	15.72	39.18	0.70875	-8.6 [2]	loc. 18, Fig. 10, granodiorite of Gloria Road
9G [2]	19.47	15.74	39.21	0.70839	-7.0 [2]	loc. 19, Fig. 10, granodiorite of Johnson Canyon
29 [2]	19.58	15.77	39.31	0.70857*		loc. 20, Fig. 10, granodiorite of Johnson Canyon
ADELAIDA						
30 [2]	19.271	15.72	39.184	0.70911*		Adelaida, granodiorite, Fig. 11
LA PANZA RANGE						
LAPAZ-1A-91	19.86	15.732	39.158	0.70900		loc. 12, Fig. 11,granodiorite
31 [2]	19.376	15.764	39.271	0.70885*		granodiorite
12G [2]	19.552	15.742	39.187	0.70903*	-8.6 [2]	granodiorite
36 [2]	19.514	15.745	39.232	0.71002*		granodiorite

Table 2. Initial lead, strontium, and neodymium isotopic ratios for granitoid rocks in the Salinian 1composite terrane California_Continued

Sample No.	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	$(^{87}Sr/^{86}Sr)_0$	εNd T	Comment
RED HILLS						
32 [2]	18.857	15.710	39.393	0.70948*		loc.9, Fig. 11, gneissic quartz diorite
11G [2]	19.033	15.799	39.688	0.70917*	-9.6 [2]	loc.9, Fig.11,gneissic quartz diorite
34 [2]	18.830	15.646	39.166	0.70911		loc.9, Fig.11, gneissic quartz diorite

Notes and References.

1. Mattinson, 1978 **2**. Mattinson, 1990 **3**. James, 1992. * $(^{87}Sr/^{86}Sr)_o$ measured on apatite (Mattinson, 1990 or James, 1992. All other initial Sr isotopic values are from table 1. na is not determined.

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian

composite terrane, California

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)
BODEGA HEAD								
BH8-88-hornblende, East tonalite of Bodega Head, Figure 2, location 2								
600	6.79	0.778	2.16	21.06	1.934	0.067	0.253	22.13±10.75
900	55.04	3.067	4.88	8.60	1.535	0.013	0.319	72.22±4.61
980	46.61	7.559	3.83	7.78	4.262	0.015	0.115	55.71±5.92
1020	85.78	28.639	15.32	6.62	4.706	0.044	0.104	86.50±1.48
1080	90.28	39.102	51.55	6.37	4.926	0.0034	1.099	87.58±0.51
1125	80.62	21.958	5.14	6.96	7.742	0.0058	0.103	85.51±4.34
1200	92.66	49.059	14.83	6.39	5.574	0.0031	0.087	86.77±1.53
1400	97.95	77.022	2.28	6.53	5.270	0.0018	0.093	97.21±9.70
J=0.0086245								
Recalculated total fusion age=84.06±0.77 Ma. Weighted mean plateau age=87.40±0.63 Ma. Fraction of ^{39}Ar in plateau=89.1%.								
BH8-88-biotite, East tonalite of Bodega Head, Figure 2, location 2								
475	47.18	0.373	4.41	4.71	0.117	0.0084	4.191	29.76±0.77
525	86.29	0.249	8.68	7.04	0.030	0.0032	16.359	80.17±0.45
600	94.47	0.471	8.17	6.91	0.022	0.0013	22.083	86.00±0.46
700	94.45	0.543	10.08	7.02	0.026	0.0013	18.772	87.33±0.41
800	93.15	0.552	10.78	7.20	0.034	0.0016	14.507	88.28±0.39
875	93.05	0.786	8.27	7.43	0.051	0.0017	9.683	90.98±0.47
950	93.12	1.148	11.13	7.49	0.074	0.0017	6.632	91.70±0.39
1025	95.50	5.750	11.89	7.20	0.242	0.0011	2.026	90.52±0.37
1075	96.63	5.043	9.40	7.04	0.152	0.0008	3.220	89.53±0.42
1400	97.33	8.391	17.18	6.91	0.202	0.0006	2.423	88.62±0.31
J=0.0074805								
Recalculated total fusion age=85.80±0.44 Ma. Weighted mean plateau age=88.35±0.45 Ma. Fraction of ^{39}Ar in plateau=95.6%.								
BH1-88-hornblende, West granodiorite of Bodega Head, Figure 2, location 4.								
525	15.26	0.645	1.13	39.139	2.591	0.113	0.189	77.14±2.26
600	29.33	0.742	0.95	19.128	1.216	0.046	0.403	72.48±1.97
700	54.35	8.195	1.38	11.841	5.802	0.020	0.084	83.17±1.33
740	81.63	28.124	3.49	9.076	7.817	0.008	0.062	95.55±0.64
750	89.54	36.723	3.29	8.156	5.900	0.005	0.083	94.10±0.63
760	93.31	48.718	1.29	7.816	5.426	0.003	0.090	93.94±1.36

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	$^{40}Ar^{*}$ %	$^{36}Ar_{Ca}$ %	^{39}Ar %	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	K/Ca	Age (Ma)
		BH1-88-hornblende, West granodiorite of Bodega Head, Figure 2, location 4._continued						
780	94.23	50.043	13.90	7.649	5.218	0.003	0.094	92.86±0.35
790	94.36	50.910	9.79	7.634	5.267	0.003	0.093	92.81±0.37
800	95.61	58.419	26.52	7.409	5.358	0.003	0.091	91.31±0.33
810	97.00	66.696	12.81	7.238	5.019	0.002	0.097	90.50±0.33
820	95.59	56.218	4.36	7.433	4.931	0.002	0.099	91.56±0.50
850	94.47	50.114	2.79	7.584	4.971	0.003	0.098	92.29±0.69
875	94.74	57.077	5.30	7.709	6.355	0.003	0.077	94.13±0.47
900	94.65	55.384	8.12	7.709	6.031	0.003	0.081	94.02±0.40
920	94.20	53.998	1.91	7.712	6.197	0.003	0.079	93.64±0.96
950	91.12	43.630	1.00	7.715	6.306	0.004	0.077	90.69±1.75
1400	49.92	7.086	0.60	14.626	6.720	0.027	0.073	94.13±2.92
J=0.0073014								
Recalculated total fusion age=91.87±0.47 Ma. Weighted mean plateau age=92.31 Ma±0.47 Ma. Fraction of 39Ar in plateau=100%.								
BH1-88-biotite, West granodiorite of Bodega Head, Figure 2, location 4								
900	95.45	1.788		7.193	0.070	0.001	7.023	88.48±0.85
1400	96.16	10.443		7.242	0.378	0.001	1.295	89.72±0.82
J=0.0073204								
Calculated age from two increment extraction=89.1±0.84 Ma								
BH6-90-biotite, porphyritic granodiorire of Bodega Head, Figure 2, location 5								
900	95.03	0.298		7.361	0.013	0.001	38.201	89.52±0.69
1400	95.63	2.675		7.225	0.102	0.001	4.824	88.46±0.84
J=0.0072729								
Calculated age from two increment extraction=89.0±0.76 Ma								
POINT REYES								
PR4-90-hornblende, granodiorite of Tomales Point, Figure 2, location 7								
600	6.48	1.232	2.88	11.943	1.751	0.038	0.280	10.93±7.71
900	58.11	7.150	5.55	8.477	3.432	0.013	0.142	68.48±3.88
1000	87.71	29.561	28.04	7.023	4.508	0.004	0.108	85.31±0.81
1050	90.45	35.415	37.57	6.816	4.428	0.003	0.110	85.37±0.63
1100	88.00	29.923	7.43	7.093	4.522	0.004	0.108	86.42±2.87
1150	84.90	34.209	11.70	6.973	6.830	0.005	0.071	82.18±1.84

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	$^{40}Ar^{*}$ %	$^{36}Ar_{Ca}$ %	^{39}Ar %	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	K/Ca	Age (Ma)

PR4-90-hornblende, granodiorite of Tomales Point, Figure 2, location 7_continued

1400	83.71	29.714	6.82	7.063	6.070	0.005	0.080	82.05±3.11

J=0.007837

Recalculated total fusion age=81.79±0.70 Ma. Weighted mean plateau age=85.10±0.62 Ma. Fraction of ^{39}Ar in plateau=91.6%.

PR4-90-biotite, granodiorite of Tomales Point, Figure 2, location 7

475	48.14	0.210	4.84	7.682	0.105	0.013	4.657	42.69 0.66
525	85.05	0.228	5.69	8.537	0.036	0.004	13.442	82.88±0.57
600	92.07	0.337	5.78	8.127	0.027	0.002	18.128	85.35±0.56
700	94.05	0.416	10.64	8.117	0.025	0.002	19.687	87.03±0.37
800	92.48	0.471	11.03	7.979	0.035	0.002	13.936	84.19±0.36
875	93.31	0.616	8.03	8.482	0.044	0.002	11.246	90.15±0.44
950	93.63	1.052	12.62	8.387	0.070	0.002	6.981	89.47±0.35
1025	96.07	4.186	14.02	8.082	0.170	0.001	2.887	88.49±0.33
1075	96.43	2.159	12.13	7.932	0.076	0.001	6.438	87.20±0.34
1400	96.23	6.025	15.23	7.880	0.233	0.001	2.107	86.47±0.31

J=0.0064746

Recalculated total fusion age=84.96±0.43 Ma. Weighted mean plateau age=87.34±0.45 Ma. Fraction of ^{39}Ar in plateau= 89.47%.

PR10-88-hornblende, tonalite of north McClure's Beach, Figure 2, location 17

525	6.65	0.335	1.13	87.167	3.292	0.276	0.149	75.27±4.39
650	22.69	0.348	2.14	27.716	0.900	0.073	0.544	81.34±1.42
725	60.25	7.434	2.44	11.541	4.428	0.017	0.110	89.96±0.90
750	81.66	18.919	2.61	8.614	4.415	0.007	0.111	90.97±0.82
770	91.27	35.481	8.17	7.819	4.461	0.004	0.110	92.26±0.58
775	92.88	40.916	11.18	7.608	4.442	0.003	0.110	91.38±0.56
780	93.93	45.092	12.65	7.537	4.440	0.003	0.110	91.55±0.56
785	95.72	54.606	17.48	7.349	4.430	0.002	0.110	90.98±0.54
790	97.03	63.487	12.18	7.267	4.335	0.002	0.113	91.19±0.55
800	96.42	58.357	7.26	7.254	4.235	0.002	0.115	90.46±0.57
810	98.30	74.686	1.79	7.239	4.054	0.002	0.121	91.98±1.02
850	91.14	35.290	1.81	7.754	4.454	0.004	0.110	91.39±1.02
880	93.86	46.550	11.70	7.604	4.800	0.003	0.102	92.30±0.57
950	94.13	48.943	6.71	7.581	5.038	0.003	0.097	92.29±0.60

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)
PR10-88-hornblende, tonalite of north McClure's Beach, Figure 2, location 17_continued								
1400	57.91	7.292	0.65	12.280	4.887	0.019	0.100	91.98±2.47

J=0.00733

Recalculated total fusion age=91.06±0.46 Ma. Weighted mean plateau age=91.47±0.46 Ma. Fractuon of 39Ar in plateau=96.72%.

PR10-88-biotite, tonalite of north McClure's Beach, Figure 2, location 17

900	94.92	0.415		6.994	0.017	0.001	28.198	86.15±1.10
1400	94.95	2.127		6.923	0.089	0.001	5.492	85.33±0.98

J=0.0073681

Calculated age from two increment extraction=85.7±1.05 Ma.

PR13-88-hornblende, porphyritic granodiorite of Point Reyes, Figure 2, location 24.

600	3.55	0.922	3.46	10.841	1.314	0.038	0.373	-5.78±6.75
900	61.16	7.480	6.11	7.172	2.823	0.010	0.173	64.64±3.67
965	85.16	25.128	11.28	6.392	3.968	0.004	0.123	79.93±1.98
1000	90.20	36.713	29.42	6.246	4.398	0.003	0.111	82.70±0.80
1025	94.41	50.884	25.59	6.151	4.364	0.002	0.112	85.17±0.90
1100	81.44	23.23	13.03	6.250	4.380	0.005	0.112	74.87±1.73
1150	71.79	23.417	6.18	6.466	6.983	0.008	0.070	68.52±3.62
1400	67.28	19.053	4.94	6.541	6.311	0.009	0.077	64.99±4.53

J=0.0083008

Recalculated total fusion age=76.16±0.74 Ma. Weighted mean plateau age=83.46±0.70 Ma, Fraction of ^{39}Ar in plateau = 66.28%.

PR13-88-biotite, porphyritic granodiorite of Point Reyes, Figure 2, location 24

475	33.14	0.152	5.34	6.639	0.085	0.015	5.772	27.46±0.61
525	71.29	0.147	6.54	8.572	0.045	0.008	10.813	75.28±0.53
600	88.26	0.307	7.14	7.179	0.032	0.003	15.176	77.98±0.47
700	92.17	0.458	9.17	7.048	0.031	0.002	15.584	79.92±0.39
800	93.02	0.544	9.35	7.081	0.033	0.002	14.676	81.00±0.39
875	94.19	0.759	11.22	7.310	0.040	0.001	12.254	84.59±0.36
950	94.77	1.030	14.14	7.180	0.048	0.001	10.205	83.62±0.32
1025	95.46	1.838	14.45	7.026	0.073	0.001	6.709	82.45±0.31
1075	95.76	1.148	13.51	6.856	0.041	0.001	11.919	80.75±0.32
1400	95.39	4.818	9.13	6.822	0.194	0.001	2.521	80.06±0.39

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)

PR13-88-biotite, porphyritic granodiorite of Point Reyes, Figure 2, location 24_continued j=0.0069722

Recalculated total fusion age=78.36±0.40 Ma. Weighted mean plateau age = 81.30±0.42 Ma. Fractionof 39Ar in plateau=94.66%.

FARALLON ISLANDS

FAIS5-88- hornblende, biotite granodiorite of the Farallon Islands, southeast Farallon Island, Figure 3.

900	11.52	0.356	6.39	31.741	1.278	0.095	0.383	60.48±3.00
1000	80.22	22.524	19.04	6.683	4.843	0.006	0.101	88.21±0.86
1035	94.81	59.257	40.28	5.696	5.242	0.002	0.093	88.86±0.47
1070	94.37	56.097	14.12	5.783	5.098	0.002	0.096	89.76±1.12
1150	93.36	57.186	19.01	5.747	6.284	0.003	0.078	88.35±0.85
1400	63.94	11.986	1.16	9.450	5.883	0.013	0.083	99.17±13.11

J=0.009315401

Recalculated total fusion age=87.08±0.59 Ma. Weighted mean plateau age=88.76±0.56 Ma. Fraction of ^{39}Ar in plateau=93.61%.

FAIS5-88-biotite, granodiorite of the Farallon Islands, southeast Farallon Island, Figure 3.

700	37.74	0.052	4.99	10.179	0.041	0.021	11.826	60.23±0.66
750	74.63	0.069	7.51	7.246	0.016	0.006	30.836	84.22±0.43
775	87.51	0.136	6.50	6.485	0.014	0.003	35.740	88.29±0.44
800	82.64	0.135	4.85	6.827	0.020	0.004	24.548	87.79±0.54
850	67.10	0.124	4.68	8.320	0.043	0.009	11.486	86.89±0.60
900	68.80	0.170	4.36	8.080	0.054	0.009	9.105	86.54±0.62
950	69.50	0.258	7.54	8.233	0.081	0.008	6.017	89.01±0.47
1000	80.14	1.180	13.93	7.208	0.213	0.005	2.292	89.84±0.35
1050	89.51	2.535	20.09	6.370	0.216	0.002	2.272	88.72±0.30
1100	93.31	1.490	15.71	6.075	0.076	0.001	6.482	88.20±0.30
1200	92.20	4.739	7.84	6.138	0.294	0.002	1.667	88.07±0.39
1400	24.27	0.090	0.17	24.455	0.210	0.062	2.338	92.26±12.98

J=0.0088384

Recalculated total fusion age=85.63±0.44 Ma. Weighted mean plateau age = 88.72±0.46 Ma. Fraction of ^{39}Ar in plateau=65.28 %.

CORDELL BANK

Coba6-90-2-hornblende, tonalite dredged from depth of 210 feet on Cordell Bank, Figure 3.

600	-39.97	1.655	0.72	10.289	3.047	0.050	0.160	-68.52±21.8
900	61.54	8.939	3.32	7.180	3.399	0.010	0.144	70.85±4.40
980	70.97	16.711	4.92	6.488	4.732	0.008	0.103	73.83±2.97

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)
Coba6-90-2-hornblende, tonalite dredged from depth of 210 feet on Cordell Bank, Figure 3._continued								
1015	87.22	32.947	15.59	6.291	4.914	0.004	0.099	87.66±0.97
1045	91.67	44.022	34.31	6.159	4.986	0.003	0.098	90.14±0.50
1150	90.50	41.724	26.14	6.211	5.234	0.003	0.093	89.08±0.62
1400	87.90	37.324	15.01	6.154	5.512	0.004	0.089	86.47±1.00

J=0.0090438

Recalculated total fusion age=86.39±0.59 Ma. Weighted mean plateau age=89.09±0.55 Ma. Fraction of 39 Ar in plateau = 91.04 %.

Coba6-90-2-biotite, tonalite dredged from depyh of 210 feet on Cordell Bank, Figure 3.

475	54.11	0.225	9.95	5.910	0.077	0.009	6.379	70.02±0.86
525	90.78	0.305	11.16	4.428	0.015	0.001	31.904	87.58±0.73
600	98.51	2.604	10.48	4.325	0.019	0.000	26.407	92.69±0.77
700	97.58	1.875	9.81	4.383	0.023	0.000	21.015	93.03±0.81
800	99.27	6.137	12.49	4.423	0.019	0.000	25.514	95.45±0.66
875	99.46	16.009	10.30	4.572	0.038	0.000	12.954	98.76±0.78
950	99.13	9.616	11.73	4.484	0.040	0.000	12.168	96.59±0.70
1025	97.18	3.808	9.47	4.397	0.057	0.000	8.574	92.94±0.84
1100	97.91	8.746	8.57	4.323	0.098	0.000	4.997	92.09±0.92
1400	99.11	51.427	6.03	4.306	0.388	0.000	1.261	92.86±1.28

J=0.012374

Recalculated total fusion age = 91.33±0.51 Ma. No plateau.

MONTARA MOUNTAIN

MON13-87-hornblende, south tonalite of Montara Mountain, Figure 4, location 7.

550	25.17	0.847	0.83	15.974	1.298	0.041	0.377	65.24±2.89
710	67.06	0.747	10.23	7.493	0.236	0.008	2.080	81.11±0.41
740	91.94	12.282	3.45	6.360	0.897	0.002	0.546	94.08±0.72
760	89.53	25.559	3.78	6.273	2.830	0.003	0.173	90.58±0.67
775	88.90	28.460	1.90	6.278	3.482	0.003	0.14.	90.08±1.23
785	84.70	25.450	1.16	6.488	4.274	0.003	0.114	88.76±2.00
795	85.18	37.064	1.52	7.097	7.814	0.006	0.062	97.65±1.53
805	87.84	44.246	0.80	7.018	8.529	0.005	0.057	99.57±2.84
845	75.70	46.863	4.78	8.474	23.010	0.013	0.021	104.49±0.71
875	89.86	60.727	9.23	6.432	12.661	0.006	0.038	93.77±0.43

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	$^{40}Ar^{*}$ %	$^{36}Ar_{Ca}$ %	^{39}Ar %	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	K/Ca	Age (Ma)
MON13-87-hornblende, south tonalite of Montara Mountain, Figure 4, location 7._continued								
900	95.96	60.526	31.73	5.858	4.448	0.002	0.110	90.76±0.29
910	97.57	67.747	5.79	5.731	3.488	0.001	0.140	90.24±0.47
935	98.96	82.407	2.89	5.695	2.991	0.001	0.164	90.91±0.83
985	95.12	63.283	3.34	5.828	6.049	0.003	0.081	89.63±0.74
1050	94.88	73.522	13.51	5.863	10.292	0.004	0.047	90.19±0.35
1150	93.71	73.767	3.70	5.829	12.804	0.005	0.038	88.74±0.70

1400	71.39	42.437	1.36	6.868	18.346	0.011	0.026	80.16±1.74

J=0.00915094

Recalculated total fusion age = 90.39±0.47 Ma. Weighted mean plateau age = 90.32 ±0.48 Ma. Fraction of ^{39}Ar in plateau=60.96%.

MON13-87-biotite, south tonalite ofMontara Mountain, Figure 4, location 7.

575	4.15	0.045	0.64	99.150	0.540	0.322	0.908	65.72±6.21
600	10.70	0.006	1.04	46.220	0.034	0.140	14.568	78.77±2.93
625	16.29	0.019	2.06	29.976	0.061	0.085	8.074	77.77±1.76
650	25.93	0.011	4.91	19.135	0.021	0.048	23.809	78.99±1.07
651	27.06	0.009	0.33	31.046	0.027	0.077	17.829	131.78±8.54
675	27.25	0.014	6.77	18.130	0.024	0.045	20.420	78.65±1.00
700	21.27	0.000	6.44	25.389	0.000	0.068		85.82±1.44
725	12.87	0.003	5.09	42.347	0.012	0.125	41.006	86.56±2.51
735	5.64	0.001	1.70	125.942	0.012	0.402	42.143	112.13±7.63
737	9.58	0.007	2.17	56.378	0.045	0.172	10.841	85.80±3.99
740	14.00	0.011	1.76	39.357	0.046	0.115	10.714	87.50±3.85
745	16.34	0.001	1.68	34.088	0.005	0.096	104.529	88.45±3.82
755	17.28	0.017	1.78	31.238	0.056	0.087	8.752	85.79±3.59
775	19.07	-0.008	2.40	30.811	0.025	0.084	-19.721	93.16±2.85
800	22.88	0.007	2.86	25.970	0.018	0.068	27.139	94.18±2.39
850	12.29	0.029	5.43	45.348	0.148	0.135	3.316	88.52±2.69
875	4.27	0.025	4.27	119.143	0.365	0.386	1.344	80.87±7.40
885	3.68	0.024	3.36	145.745	0.430	0.475	1.140	85.35±9.05
905	4.95	0.019	4.29	119.436	0.275	0.384	1.783	93.72±7.34

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)
MON13-87-biotite, south tonalite ofMontara Mountain, Figure 4, location 7._continued								
920	9.95	0.026	4.29	71.195	0.210	0.217	2.331	111.73±4.26
935	15.67	0.043	4.27	40.100	0.184	0.114	2.658	99.50±2.93
960	24.23	0.097	6.27	24.378	0.228	0.063	2.146	93.67±1.87
1000	37.16	0.096	11.30	15.178	0.117	0.032	4.203	89.53±1.08
1050	45.68	0.213	12.30	11.385	0.158	0.020	3.094	88.01±0.90

J=0.0090207

Recalculated total fusion age=81.09±0.82 Ma. Weighted mean plateau age = 88.07±0.66 Ma. Fraction of ^{39} Ar in plateau=84.58 %.

MON14-87-hornblende, south tonalite of Montara Mountain, Figure 4, location 8

600	17.84	0.299	4.81	25.474	0.788	0.071	0.621	88.96±6.55

650	36.65	1.768	1.69	11.660	1.672	0.025	0.293	83.81±18.13
725	44.80	10.121	1.50	8.204	6.409	0.017	0.076	72.54±20.51
800	54.91	24.975	2.31	9.494	17.908	0.019	0.027	102.82±13.1
875	78.03	29.853	11.99	6.055	7.094	0.006	0.069	92.76±2.57
950	87.39	34.195	54.22	5.205	4.258	0.003	0.115	89.22±0.63
1025	88.38	49.919	5.34	5.174	7.476	0.004	0.065	89.88±5.72
1200	87.18	51.669	18.05	5.286	9.049	0.005	0.054	90.64±1.72

J=0.011115

Recalculated total fusion age = 90.05±1.03 Ma. Weighted mean plateau age = 89.57 ± 0.72 Ma. Fraction of ^{39}Ar in plateau=100%.

MON14-87-biotite, south tonalite of Montara Mountain, Figure 4, location 8.

600	24.28	0.019	20.83	16.528	0.030	0.042	16.163	79.73±1.16
650	95.48	0.304	16.70	4.564	0.008	0.001	63.605	86.42±0.67
700	97.769	0.619	11.03	4.584	0.008	0.000	64.332	88.82±0.98
750	97.38	0.803	8.06	4.622	0.012	0.000	41.483	89.19±1.32
800	93.74	0.722	5.09	4.708	0.026	0.001	18.512	87.49±2.07
850	91.04	0.856	3.62	4.993	0.048	0.002	10.195	90.05±2.89
900	95.60	2.230	6.98	4.836	0.060	0.001	8.222	91.56±1.51
950	95.08	2.648	8.64	4.738	0.078	0.001	6.286	89.28±1.23
1000	96.13	3.307	8.21	4.648	0.075	0.001	6.522	88.56±1.30
1050	97.37	5.338	6.68	4.556	0.081	0.000	6.031	87.93±1.58
1100	99.33	43.877	3.01	4.529	0.247	0.000	1.981	89.16±3.47

J=0.1126

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	**^{40}Ar* %**	**^{36}Ar$_{Ca}$ %**	**^{39}Ar %**	**^{40}Ar/^{39}Ar**	**^{37}Ar/^{39}Ar**	**^{36}Ar/^{39}Ar**	**K/Ca**	**Age (Ma)**

MON14-87-biotite, south tonalite of Montara Mountain, Figure 4, location 8._continued

Recalculated total fusion age =86.69±0.60 Ma. Weighted mean plateau age = 89.10± 0.58 Ma. Fraction of ^{39}Ar in plateau=62.85 %.

BEN LOMOND MOUNTAIN-SANTA CRUZ AREA , FIGURE 5

K2-87-hornblende, northern tonalite of Ben Lomond, Figure 5, location 2

600	1.88	0.157	0.30	107.362	2.106	0.357	0.232	34.14±53.06
900	36.20	1.000	4.75	13.686	1.125	0.030	0.435	82.62±3.28
1000	73.62	17.114	8.03	7.227	4.977	0.008	0.098	88.81±1.92
1035	90.88	43.858	49.90	5.926	5.250	0.003	0.093	89.88±0.42
1070	86.91	33.649	9.28	6.097	5.070	0.004	0.096	88.47±1.66
1150	89.82	40.916	22.68	6.061	5.489	0.004	0.089	90.56±0.73
1400	57.43	9.385	5.05	9.496	5.310	0.015	0.092	91.00±3.04

J=0.0094522

Recalculated total fusion age =89.36±0.62 Ma. Weighted mean plateau age=89.95±0.56 Ma. Fraction of ^{39}Ar in plateau=94.94%.

K2-87-biotite, northern tonalite of Ben Lomond, Figure 5, location 2.

700	84.96	0.136	3.45	6.536	0.067	0.003	29.405	85.86±0.63
750	94.88	0.246	12.93	5.877	0.009	0.001	54.251	86.21±0.29
775	98.05	0.515	11.43	5.718	0.007	0.000	73.451	86.67±0.30
800	97.79	0.670	7.10	5.712	0.010	0.000	49.235	86.35±0.37
850	96.43	1.164	4.57	5.870	0.030	0.001	16.500	87.48±0.49
900	96.28	2.064	4.54	5.935	0.056	0.001	8.730	88.29±0.50
950	89.94	0.922	6.96	6.047	0.070	0.002	6.986	84.13±0.38
1000	96.71	9.222	11.35	5.863	0.235	0.001	2.088	87.64±0.30
1050	98.17	13.794	17.21	5.712	0.192	0.000	2.552	86.69±0.27
1100	98.34	5.187	10.38	5.688	0.059	0.000	8.335	86.47±0.31
1200	98.29	15.021	8.36	5.680	0.196	0.000	2.505	86.32±0.34
1400	78.16	0.687	0.16	6.296	0.116	0.005	4.131	76.17±12.53

J=0.0087779

Recalculated total fusion age=86.09±0.43 Ma. Weighted mean plateau age=86.54±0.44 Ma. Fraction of 39Ar in plateau =100.00%.

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)
K3-87-hornblende, northern tonalite of Ben Lomond, Figure 5, location 3.								
550	26.90	0.407	0.23	23.680	0.899	0.059	0.545	101.37±9.79
725	43.09	0.832	1.24	10.562	0.641	0.020	0.764	72.99±1.88
775	59.95	3.336	0.76	5.517	0.966	0.008	0.507	53.34±3.01
850	65.40	4.703	0.17	6.014	1.301	0.007	0.376	63.27±13.65
900	89.21	34.809	10.53	6.484	4.695	0.004	0.104	92.50±0.36
925	96.15	62.813	15.99	5.904	4.698	0.002	0.104	90.83±0.30
950	98.08	77.837	53.22	5.831	4.612	0.002	0.106	91.49±0.29
975	93.59	47.920	3.99	5.876	4.305	0.002	0.112	88.04±0.62
1025	97.35	73.742	9.53	5.802	5.106	0.002	0.096	90.42±0.36
1125	95.71	65.068	3.85	5.872	5.760	0.002	0.085	90.01±0.64
1400	84.63	32.739	0.51	5.278	4.967	0.004	0.098	71.86±4.38

J=0.0090676

Recalculated total fusion age =90.55±1.57 Ma. Weighted mean plateau age =91.02±0.47 Ma. Fraction of 39Ar in plateau =97.09%.

K3-87-biotite, northern tonalite of Ben Lomond, Figure 5, location 3.

500	53.73	0.039	0.98	8.842	0.020	0.014	23.951	75.90±1.19
575	64.64	0.044	4.56	8.058	0.016	0.001	30.487	83.05±0.44
625	79.71	0.042	6.69	6.664	0.007	0.005	68.224	84.65±0.34
650	91.01	0.087	6.41	5.951	0.006	0.002	83.626	86.27±0.32
675	92.38	0.156	6.28	5.912	0.009	0.001	55.747	86.98±0.32
700	92.74	0.204	4.11	5.891	0.011	0.001	45.029	87.00±0.38
725	92.04	0.211	3.44	5.966	0.013	0.002	39.065	87.44±0.41
750	92.24	0.269	2.87	5.962	0.016	0.002	31.480	87.58±0.46
775	91.40	0.233	3.24	6.048	0.015	0.002	32.274	88.01±0.43
800	90.71	0.315	2.37	6.135	0.023	0.002	21.742	88.59±0.53
825	88.66	0.369	1.69	6.190	0.033	0.002	14.983	87.39±0.70
850	84.91	0.276	2.77	6.632	0.035	0.003	14.053	89.62±0.49
900	89.39	0.398	6.59	6.187	0.033	0.002	14.882	88.06±0.33
950	93.00	0.384	11.89	5.871	0.020	0.001	24.867	86.96±0.28
975	94.47	0.288	5.03	5.779	0.011	0.001	42.957	86.94±0.34
1000	95.49	0.565	14.14	5.719	0.018	0.001	27.224	86.97±0.28
1020	96.91	2.014	10.38	5.638	0.043	0.001	11.333	87.01±0.28

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^oC	$^{40}Ar^*$ %	$^{36}Ar_{Ca}$ %	^{39}Ar %	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	K/Ca	Age (Ma)
K3-87-biotite, northern tonalite of Ben Lomond, Figure 5, location 3._continued								
1040	97.22	3.972	3.22	5.629	0.078	0.001	6.310	87.15±0.42
1060	98.40	12.425	1.17	5.543	0.147	0.000	3.329	88.40±0.96
1100	95.90	8.651	1.78	5.644	0.268	0.001	1.829	86.23±0.66
1200	79.11	10.864	0.39	5.594	0.980	0.002	0.500	79.11±2.77

J=0.0090444

Recalculated total fusion age =86.72±0.43 Ma. Weighted mean plateau age =87.26±0.44 Ma. Fraction of 39Ar in plateau =84.43%.

K10-87-biotite, granodiorite of Glen Canyon, Figure 5, location 5.

600	24.12	0.040	0.86	10.274	0.039	0.026	12.651	41.70±2.15
650	53.82	0.043	1.49	7.299	0.018	0.011	27.092	65.65±1.24
700	80.39	0.039	5.46	6.003	0.006	0.004	84.444	80.33±0.43
750	93.28	0.082	11.91	5.646	0.004	0.001	128.421	87.48±0.30
775	96.40	0.119	11.66	5.516	0.003	0.001	173.147	88.31±0.29
800	97.12	0.137	9.94	5.489	0.003	0.001	191.229	88.53±0.31
850	96.17	0.138	7.82	5.557	0.004	0.001	138.090	88.75±0.34
900	92.86	0.123	4.91	5.736	0.006	0.001	79.039	88.45±0.44

950	91.70	0.092	6.61	5.795	0.005	0.002	89.666	88.26±0.38
1000	94.35	0.081	17.10	5.621	0.003	0.001	154.927	88.08±0.28
1025	95.69	0.185	8.83	5.553	0.005	0.001	91.381	88.25±0.32
1050	94.41	0.159	5.13	5.550	0.006	0.001	80.992	87.05±0.42
1100	95.73	0.197	5.55	5.552	0.006	0.001	86.750	88.27±0.51
1200	95.33	0.153	4.15	5.575	0.005	0.001	100.951	88.27±0.49
1400	82.36	0.012	0.17	6.213	0.016	0.004	29.849	85.06±10.37

J=0.0094351

Recalculated total fusion age =86.99±0.44 Ma. Weighted mean plateau age =88.16±0.44 Ma. Fraction of ^{39}Ar in plateau =92.20%.

SANTA LUCIA MOUINTAINS, FIGURE 6

SANLU5-90-hornblende, quartz diorite of Sobaranes Point, Figure 6, location 11.

600	9.83	1.162	0.40	18.181	2.450	0.056	0.200	29.47±23.62
900	74.02	1.662	14.19	5.935	0.329	0.005	1.489	71.50±0.70
1000	89.18	23.998	17.92	5.467	2.327	0.003	0.210	79.29±0.57
1035	94.80	47.494	26.60	5.239	2.993	0.002	0.163	80.77±0.42
1070	96.02	55.256	26.31	5.120	3.013	0.001	0.162	79.97±0.42

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	**^{40}Ar* %**	**^{36}Ar$_{Ca}$ %**	**^{39}Ar %**	**^{40}Ar/^{39}Ar**	**^{37}Ar/^{39}Ar**	**^{36}Ar/^{39}Ar**	**K/Ca**	**Age (Ma)**
	SANLU5-90-hornblende, quartz diorite of Sobaranes Point, Figure 6, location 11._continued							
1150	93.28	47.079	12.13	5.305	3.898	0.002	0.125	80.52±0.79
1400	96.89	68.403	2.45	6.397	5.137	0.002	0.095	100.65±3.71
J=0.0092006								
Recalculated total fusion age =79.24±0.47 Ma. Weighted mean plateau age = 80.18±0.47 Ma. Fraction of ^{39} Ar in plateau =82.97%.								
SANLU5-90-biotite, quartz diorite of Sobaranes Point, Figure 6, location 11.								
600	3.40	0.215	0.39	6.890	0.180	0.023	2.719	3.94±4.97
650	31.02	0.302	1.25	3.103	0.081	0.007	6.038	16.16±1.56
700	66.16	0.137	1.91	4.771	0.028	0.005	17.711	52.46±1.02
750	86.98	0.152	5.47	5.106	0.013	0.002	39.085	7.038±0.42
800	96.51	0.373	11.35	4.814	0.007	0.001	65.443	76.69±0.28
850	97.50	0.608	9.85	4.826	0.009	0.000	57.055	77.64±0.29
900	97.53	0.808	5.50	4.864	0.011	0.000	43.038	78.27±0.41
950	97.02	1.393	5.60	4.984	0.025	0.000	19.766	79.75±0.40
1000	97.63	2.414	14.62	4.963	0.033	0.000	14.749	79.92±0.26
1050	97.64	2.995	15.39	4.863	0.040	0.000	13.133	78.34±0.26
1100	97.85	2.122	14.91	4.784	0.025	0.000	19.592	77.26±0.25
1200	98.13	12.553	13.53	4.776	0.141	0.000	3.472	77.36±0.26

1400	77.06	0.708	0.22	5.095	0.105	0.004	4.668	65.02±8.38

J=0.0093475

Recalculated total fusion age =76.25±0.39 Ma. Weighted mean plateau age = 78.03±0.40 Ma. Fraction of 39Ar in plateau =90.98%.

SANLU20-90-hornblende, quartz diorite of Sobaranes Point, figure 6, location 17.

600	96.19	16.016	0.41	14.330	1.296	0.002	0.378	212.74±18.5
900	99.43	48.615	15.66	5.789	0.252	0.000	1.951	92.40±0.58
1000	91.62	28.591	19.51	5.501	2.289	0.002	0.214	80.78±0.49
1035	94.75	46.766	27.04	5.263	2.954	0.002	0.166	79.98±0.39
1070	96.09	55.070	24.00	5.151	2.949	0.001	0.166	79.40±0.41
1150	91.94	42.936	11.28	5.356	4.018	0.002	0.122	79.05±0.76
1400	79.43	24.123	2.10	6.369	5.249	0.006	0.093	81.25±3.90

J=0.0090725

Recalculated total fusion age =82.43±0.47 Ma. Weighted mean plateau age=79.90±0.45 Ma. Fraction of 39Ar in plateau =83.92%.

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	**$^{40}Ar^{*}$ %**	**$^{36}Ar_{Ca}$ %**	**^{39}Ar %**	**$^{40}Ar/^{39}Ar$**	**$^{37}Ar/^{39}Ar$**	**$^{36}Ar/^{39}Ar$**	**K/Ca**	**Age (Ma)**
SANLU20-90-biotite, quartz diorite of Sobaranes Point, figure 6, location 17.								
650	35.06	0.112	1.29	4.858	0.045	0.011	10.913	28.24±1.43
700	64.89	0.095	2.22	5.786	0.025	0.007	19.973	61.67±0.85
750	87.12	0.120	8.27	5.087	0.010	0.002	48.890	72.58±0.32
800	95.93	0.196	15.88	4.809	0.005	0.001	106.935	75.49±0.25
850	96.84	0.276	9.57	4.831	0.005	0.000	99.114	76.52±0.29
900	97.59	0.016	6.37	4.919	0.000	0.000	2235.50	78.48±0.36
950	96.12	0.774	8.99	4.974	0.018	0.001	27.322	78.17±0.30
1000	96.63	1.931	13.05	4.889	0.038	0.001	12.811	77.27±0.26
1050	98.01	0.603	14.27	4.857	0.007	0.000	75.239	77.84±0.25
1100	99.58	3.409	14.55	4.757	0.004	0.000	138.013	77.46±0.25
1200	97.28	15.313	5.44	4.749	0.269	0.000	1.823	75.60±0.39
1400	77.50	0.694	0.11	5.484	0.109	0.004	4.513	69.66±16.00

J=0.0092626

Recalculated total fusion age =75.73±0.38 Ma. Weighted mean plateau age =77.75±0.40 Ma. Fractionof ^{39}Ar in plateau =57.23%.

SANLU23-90-hornblende, quartz diorite of Paraiso Paloma area, figure 6, location 22.

600	3.40	0.222	0.14	126.497	3.458	0.414	0.141	69.00±64.19
900	363.86	1.074	2.44	12.247	1.067	0.026	0.459	72.16±3.53
1000	84.60	25.788	11.30	5.651	3.793	0.004	0.129	76.46±0.79
1035	94.42	52.417	29.12	5.069	3.795	0.002	0.129	76.55±0.37

1070	95.65	59.020	29.60	4.996	3.764	0.002	0.130	76.43±0.37
1150	93.34	56.123	16.23	5.141	5.372	0.003	0.091	76.83±0.58
1400	92.94	48.949	11.17	5.140	4.279	0.002	0.114	76.44±0.80

J=0.0090337

Recalculated total fusion age =76.42±0.41 Ma. Weighted mean plateau age =76.53±0.43 Ma. Fraction of ^{39}Ar in plateau =97.4%.

SANLU23-90-biotite, quartz diorite of Paraiso Paloma area, figure 6, location 22

600	43.15	0.027	0.21	16.365	0.031	0.031	15.635	113.31±8.85
650	38.26	0.043	0.96	5.656	0.019	0.012	25.572	35.49±2.04
700	68.11	0.049	1.93	5.992	0.012	0.006	41.608	66.36±1.03
750	84.12	0.050	6.53	5.216	0.005	0.003	94.074	71.23±0.38
800	99.55	0.540	13.64	4.698	0.001	0.000	777.846	75.84±0.25
850	98.27	0.202	10.85	4.697	0.002	0.000	275.303	74.86±0.28

Table 3. Results of ^{40}Ar/^{39}Ar incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	^{40}Ar* %	^{36}Ar$_{Ca}$ %	^{39}Ar %	^{40}Ar/^{39}Ar	^{37}Ar/^{39}Ar	^{36}Ar/^{39}Ar	K/Ca	Age (Ma)
SANLU23-90-biotite, quartz diorite of Paraiso Paloma area, figure 6, location 22_continued								
900	96.82	0.400	7.98	4.697	0.007	0.000	69.909	73.79±0.32
950	96.25	0.619	8.29	4.829	0.013	0.001	36.642	75.38±0.32
1000	97.56	1.980	12.25	4.737	0.266	0.000	18.471	74.96±0.27
1050	98.16	1.957	11.88	4.680	0.019	0.000	26.080	74.52±0.27
1100	98.17	2.261	14.51	4.630	0.021	0.000	22.933	73.74±0.25
1200	98.45	2.084	10.77	4.619	0.016	0.000	30.523	73.79±0.27
1400	92.91	0.770	0.21	4.859	0.033	0.001	14.928	73.25±9.04

J=0.0091803

Recalculated total fusion age =73.95±0.38 Ma. Weighted mean plateau age =74.41±0.38 Ma. Fraction of ^{39}Ar in plateau =76.73%.

SANLU11A-91-hornblende, charnokitic tonalite of Compton (1960), figure 6, location 50.

900	62.43	3.287	13.08	6.539	1.057	0.009	0.463	64.63±0.76
1000	79.73	10.217	5.97	5.654	1.642	0.004	0.298	71.27±1.54
1035	93.38	34.476	12.61	5.353	2.289	0.002	0.214	78.89±0.75
1070	94.05	37.601	22.58	5.296	2.325	0.002	0.210	78.61±0.46
1150	94.79	43.186	45.01	5.283	2.544	0.002	0.192	79.05±0.31
1400	48.38	11.264	0.64	7.065	5.870	0.014	0.083	54.44±14.36

J=0.0089284

Recalculated total fusion age =76.30±0.46 Ma. Weighted mean plateau age =78.91±0.46 Ma. Fraction of ^{39}Ar in plateau =80.20%.

SANLU11A-91-biotite, charnokitic tonalite of Compton (1960), figure 6, location 50.

600	50.14	0.036	0.39	44.94	0.103	0.076	4.738	336.33±5.03
650	79.73	0.091	2.40	2.181	0.005	0.001	98.311	28.30±0.90

700	95.97	0.132	1.96	5.758	0.004	0.001	132.396	88.46±1.09
750	95.26	0.114	4.04	5.334	0.003	0.001	140.481	81.50±0.57
800	97.88	0.030	8.41	5.078	0.000	0.000	1335.83	79.75±0.34
850	99.01	0.394	11.59	4.962	0.002	0.000	264.786	78.85±0.29
900	99.40	0.400	7.40	5.028	0.001	0.000	530.914	80.18±0.36
950	98.72	0.964	5.71	5.472	0.007	0.000	68.166	86.51±0.44
1000	98.89	0.177	5.73	5.565	0.001	0.000	440.358	88.10±0.44
1050	98.39	2.560	7.67	5.216	0.024	0.000	20.397	82.29±0.36
1100	99.11	0.510	18.48	4.874	0.002	0.000	240.086	77.57±0.25
1150	99.21	0.549	21.29	4.781	0.002	0.000	273.113	76.18±0.24

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	**$^{40}Ar^{*}$ %**	**$^{36}Ar_{Ca}$ %**	**^{39}Ar %**	**$^{40}Ar/^{39}Ar$**	**$^{37}Ar/^{39}Ar$**	**$^{36}Ar/^{39}Ar$**	**K/Ca**	**Age (Ma)**
SANLU11A-91-biotite, charnokitic tonalite of Compton (1960), figure 6, location 50._continued								
1200	98.99	0.298	4.73	4.808	0.001	0.000	353.740	76.45±0.49
1400	91.85	0.185	0.20	5.076	0.009	0.001	51.660	74.92±10.31
J=0.0090946								
Recalculated total fusion age =79.50±0.40 Ma. No plateau.								
SANLU11-91-hornblende, charnokitic tonalite of Compton ((1960), Figure 6, location 50.								
550	1.00	0.171	0.19	447.308	9.703	1.501	0.0520	72.96±29.08
650	4.05	0.414	0.75	102.473	5.202	0.334	0.094	67.68±6.56
725	6.00	0.337	0.70	67.381	2.726	0.215	0.179	65.88±4.28
800	20.59	1.992	0.75	21.521	4.417	0.059	0.111	72.13±2.25
850	16.23	1.406	1.67	29.554	4.489	0.085	0.109	77.95±1.81
875	12.54	0.760	0.72	38.713	3.299	0.115	0.148	78.85±2.90
900	13.77	0.720	0.81	38.816	3.088	0.114	0.158	86.58±2.73
910	16.82	0.882	0.97	30.931	2.910	0.088	0.168	84.32±2.22
920	37.34	2.449	3.60	13.632	2.725	0.030	0.179	82.53±0.79
930	36.47	2.446	1.21	13.741	2.782	0.030	0.176	81.30±1.38
940	44.57	3.306	1.05	11.357	2.735	0.022	0.179	82.08±1.48
945	46.87	3.724	0.82	10.542	2.752	0.020	0.178	80.17±1.85
950	85.21	19.177	14.51	6.016	2.659	0.004	0.184	83.10±0.30
951	79.72	14.091	2.85	6.304	2.649	0.005	0.185	81.52±0.59
955	71.45	9.832	0.93	6.807	2.684	0.007	0.182	78.94±1.59
960	75.05	11.414	1.06	6.571	2.673	0.006	0.183	80.02±1.40
965	76.08	11.888	0.91	6.527	2.665	0.006	0.184	80.57±1.62
970	91.48	30.600	8.21	5.525	2.591	0.002	0.189	81.96±0.31

975	83.79	18.048	1.64	5.966	2.685	0.004	0.182	81.08±0.92
980	83.70	18.479	3.57	6.002	2.796	0.004	0.175	81.48±0.49
985	90.59	28.945	8.41	5.589	2.681	0.002	0.182	82.10±0.31
990	92.90	35.469	26.58	5.470	2.652	0.002	0.184	82.40±0.28
995	93.12	36.152	12.44	5.562	2.692	0.002	0.182	83.95±0.19
1000	90.55	29.230	3.62	5.790	2.830	0.003	0.173	84.95±0.48
1100	67.48	13.945	2.02	7.536	5.033	0.010	0.097	82.58±0.80

J=0.009180

Table 3. Results of $^{40}Ar/^{39}Ar$ incremental heating analysis of hornblende and biotite from granitoid rocks of the Salinian composite terrane, California_Continued

Temp. ^{o}C	$^{40}Ar^{*}$ %	$^{36}Ar_{Ca}$ %	^{39}Ar %	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	K/Ca	Age (Ma)
SANLU11-91-hornblende, charnokitic tonalite of Compton ((1960), Figure 6, location 50._continued								
Recalculated total fusion age =82.18±0.43 Ma. Weighted mean plateau age =82.19±0.42 Ma. Fraction of 39Ar in plateau =75.35%.								
SANLU12-91-hornblende, charnokitic tonalite of Compton (1960), figure 6, location 51.								
550	9.01	0.431	0.25	104.185	5.221	0.322	0.094	148.29±8.43
700	11.00	1.266	0.93	46.650	6.770	0.142	0.072	82.66±3.11
750	23.81	5.583	0.26	17.460	10.000	0.048	0.049	67.39±6.68
800	36.35	9.447	0.62	12.748	10.758	0.030	0.045	74.99±2.85
850	49.34	14.221	0.79	11.083	11.825	0.022	0.041	88.22±2.21
900	66.24	15.582	4.53	8.216	6.493	0.011	0.075	87.51±0.55
910	83.58	19.951	6.69	6.348	3.277	0.004	0.149	85.18±0.39
920	89.85	28.396	7.62	5.817	2.934	0.003	0.167	83.92±0.35
930	88.93	28.767	1.87	5.725	3.212	0.003	0.152	81.81±0.95
940	89.88	30.477	1.76	5.598	3.111	0.003	0.157	80.87±1.00
975	94.27	41.477	51.44	5.540	2.781	0.002	0.176	83.84±0.28
1000	91.42	35.709	21.82	5.660	3.370	0.003	0.145	83.12±0.29
1025	75.73	27.722	1.01	6.221	7.324	0.007	0.067	76.05±1.71
1050	56.99	27.142	0.27	9.302	18.921	0.019	0.026	86.00±6.20
1400	45.59	19.647	0.15	11.884	20.089	0.027	0.024	87.92±11.66

J=0.0090926

Recalculated total fusion age =83.88±0.44 Ma. Weighted mean plateau age =83.46±0.44 Ma. Fraction of ^{39}Ar in plateau =84.49%.

Table 4. Oxygen isotopic data and initial ^{87}Sr / ^{86}Sr values for granitic rocks in the Salinian Composite terrane.

Sample No	δ^{18} O	Initial $^{87}Sr/^{86}Sr$	Location	Rock type
Bodega Head, Figure 2				
tonalite of Bodega head				
BH6-88	9.0	0.70671	loc.1	Mafic inclusion
1Ketal73[1]	9.1	0.70663	loc.2	Tonalite
BH8-88	9.0	0.70676	loc.2	tonalite
Granodiorite of Bodega Head				
BH1-88	9.2	0.7060	loc. 4	Granodiorite
BH2-88	9.0	0.7060	loc. 4	Mafic inclusion
Point Reyes, Figure 2,				
Shell P-041-1, drill core tonalite				
PR2-89	11.1	0.70619	loc. 6	Pegmatite
PR4-89	9.1	0.70634	loc. 6	Mafic inclusion
PR5-89	9.9	0.70630	loc. 6	Mafic inclusion
Tonalite and granodiorite of McClure's and Kehoe Beaches				
PR7-88	9.3	0.70662	loc. 12	granodiorite
PR8-88	10.1	0.70662	loc. 16	tonalite
PR10-88	10.1	0.70662	loc. 17	tonalite
2Ketal73[1]	10.0	0.70662	loc. 16	tonalite
PR6-88	8.9	0.70686	loc. 11	aplite
Porphyritic granodiorite of Point Reyes				
PR14-88	11.0	0.70775	loc. 24	granodiorite
Biotite granite of Tomales Bay				
PR1-88	10.1	0.70863	loc.27	granite
Farallon Islands, Figure 3,				
Granodiorite of the Farallon Islands				
3Ketal73[1]	11.8	0.70613	fig. 3	granodiorite
FAIS4-91	11.5	0.70613	fig. 3	granodiorite
FAIS5-91	11.5	0.70613	fig. 3	granodiorite
FAIS10-91	10.7	0.70613	fig. 3	granodiorite
Cordell Bank, Figure 3				
Foliated biotite granodiorite of Fanny Shoals from deprh of 110 feet				
FAIS8-91	10.2	0.70554	fig.3	granodiorite
Sheared biotite granodiotite of Noonday Rock from depth of 90 feet				
FAIS9-91	12.5	0.70554	fig. 3	granodiorite
Tonalite of Cordell Bank from dredge samples broken from ledge at depth of 210 feet				
COBA6-90-1	9.5	0.70549	fig.3	tonalite
Montara Mountain, Figure 5,				
South tonalite of Montara Mountain				
MON1-87	10.5	0.70702	loc. 1	tonalite
MON9-87	9.8	0.70640	loc.3	mafic dike
MON5-87	8.5	0.70674	loc. 3	pegmatite
MON11-87	9.7	0.70640	loc. 6	tonalite
MON12-87	10.9	0.70640	loc.6	tonalite
MON13-87	9.9	0.70640	loc. 7	tonalite
4Ketal73[1]	9.4	0.70640	loc.10	tonalite
North tonalite of Montara Mountain				
MON5-88	9.3	0.70550	loc. 14	gabbro
MON9-88	11.1	0.70570	loc. 14	albite pegmatite
MON12-88	11.2	0.70580	loc. 15	granodiorite

Table 4. Oxygen isotopic data and initial ^{87}Sr / ^{86}Sr values for granitic rocks in the Salinian Composite terrane._continued

Sample No	δ^{18} O	Initial $^{87}Sr/^{86}Sr$	Location	Rock type
Ben Lomond Mountain-Santa Cruz area, Figure 6				

Northern tonalite of Ben Lomond				
K2-87	9.2	0.70565	loc. 2	tonalite
5Ketal73[1]	9.6	0.70565	loc. 3	tonalite
Alaskite of Smith Grade				
K8-87	12.4	0.70565	loc. 8	granite
Southern tonalite of Ben Lomond				
BL6-88	11.5	0.70638	Olive Springs	tonalite
BL7-89	11.5	0.70638	loc. 15	granodiorite
BL14-89	10.5	0.70638	loc. 16	tonalite
BL14A-89	11.6	0.70638	loc. 16	pegmatite
BL14B-89	9.9	0.70638	loc. 16	mafic inclusion
Adamellite of Clark (1981)				
BL9-89	12.4	0.71472	Loc. 24	Granite
Santa Lucia Mountains, Figure 7				
Porphyritic granodiorite of Monterey, granodiorite of Cachagua, quartz diorite of Sobaranes Point				
SANLU1-90	11.2	0.70787	loc. 7	porphyritic granodiorite
SANLUI4-90	10.9	0.70787	loc. 5	porphyritic granodiorite
SANLU3-90	10.9	0.70787	loc. 9	granodiorite
SANLU5-90	10.1	0.70787	loc. 11	tonalite
SANLU7-90	10.0	0.70787	loc. 14	tonalite
SANLU9-90	9.5	0.70787	loc. 15	diorite
SANLU20-90	10.0	0.70787	loc. 17	tonalite
Quartz diorite of Paraiso Paloma area				
SANLU25-90	10.9	0.70824	loc. 24	quartz diorite
SANLU16-90	10.7	0.70824	loc. 32	granodiorite
Granodiorites in Carmel Valley				
SANLU18-90	10.1	0.70913	loc.39	granodiorite
Charnokitic tonalite of Compton (1960)				
SANLU10-91	9.8	0.71010	loc. 49	garnet foliated granite
SANLU11-91	9.4	0.70660	loc. 50	foliated tonalite
SANLU12-91	8.5	0.70660	loc. 51	foliated tonalite
Gabilan Range, Figure 10				
Quartz diroite ofJohnson Canyon				
DR 570[1]	10.2	0.70880	loc. 3	tonalite
DR 566A[1]	11.0	0.70830	loc. 4	granodiorite
DR 584[1]	10.1	0.70860	loc. 5	granodiorite
Granodiorite of Gloria Road				
G1A[1]	10.0	0.70830	loc. 7	granodiorite
Quartz monzonite of Bickmore Canyon				
DR 576[1]	11.1	0.70860	loc. 8	granite
Quartz monzonite of Fremont Peak				
BR-6-3[1]	9.6	0.70810	loc.10	tonalite
Southern Salinian composite terrane, Figure 11				
Granitic rock of Stockdale Mountain				
DR-145C[1]	10.2	0.70760	loc. 8	granodiorite
Gneiss of Red Hills				
DR-109[1]	7.7	0.7095	loc. 9	gneissic tonalite
Homogenized gneiss at Mount Abel				
DR-745[1]	9.4	0.71640	Loc. 11	gneissic tonalite

[1] Oxygen isotopic data from Masi and others (1981), Sr isotopic data from Kistler and others (1973). All other data from this report

Table 5. Summary of U-Pb, Rb-Sr, ^{40}Ar-^{39}Ar, K-Ar, and fission-track ages of minerals from granitic rocks in the Salinian composite terrane, California

(Map), Spec. No. material analyzed	^{238}U-^{206}Pb age (Ma)	Rb-Sr Age (Ma)	^{40}Ar/^{39}Ar age (Ma)	K-Ar Age (Ma)[2]	Fission-track age (Ma)[3]
BODEGA HEAD (Figure 2)					
Tonalite of Bodega Head					
(1) BH 5-88 wr		>104			
(1	Zir.97 [1]				
	Zir 97 [1]				
	Zir 98 [1]				
	Sph 93 [1]				
	Apa 93 [1]				
(2) BH 8-88 wr		>104			
	(1) Zir.119 [5]				Sph 84
	(1) Zir.143 [5]				Apa 68
	(3) Zir 95 [5]				
(2) BH 8-88 biot.		85.98	88.35± 0.45		
(2) BH 8-88 hbde.		91.8	87.40± 0.63	94.3[4]	
Pegmatite of Bodega Head					
(3) BH 9-88 ksp		91.8			
(3) BH 9-88 pla		91.8			
Granodiorite of Bodega Head					
(4) BH 1-88 wr		100			
(4) BH 1-88 biot.		85.3	89.10±0.84.		
(4) BH 1-88 hbde.		Na	92.31± 0.47		
Porphyritic granodiorite of Bodega Head					
(5) BH 6-90 wr		95			
(5) BH 6-90 biot.		85.6	89.0 ± 0.76		
POINT REYES (Figure 2)					
Granodiorite of Tomales Point					
(7) PR 1-90 wr		94.1			
(7) PR 1-90 biot		86.6			
(7) PR 3-90 biot		85.5			
(7) PR 4-90 biot		89.2	87.34±0.45		
(7) PR 4-90 hbde		89.2	85.10± 0.62		
Tonalite and granodiorite of McClure's and Kehoe Beaches					
(11) PR 5-88 wr		109.6			
(11) PR 5-88	Zir.104 [1]				Sph 91
	Apa 93 [1]				Apa 61
(16) PR 8-88 wr		109.6			
(16) PR 8-88	Zir. 102 [1]				
	Zir. 96 [1]				
	Zir. 98 [1]				
	Sph. 93 [1]				
	Apa. 93 [1]				
(17)PR 10-88 wr		109.6			
(17)PR 10-88 hbde		109.6	91.47±0.46		
(17)PR 10-88bio		84.5	85.7±1.05		
(21)PR 8B-92 wr		88.2±5.2			
(21)PR 8A-92 wr		88.2			
(21)PR8A-92 ksp		88.2			
(21)PR 8A-92 biot		88.2			

Table 5. Summary of U-Pb, Rb-Sr, ^{40}Ar-^{39}Ar, K-Ar, and fission-track ages of minerals from granitic rocks in the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	^{238}U-^{206}Pb age (Ma)	Rb-Sr age (Ma)	$^{40}Ar/^{39}Ar$ age (Ma)	K-Ar Age (Ma)[2]	Fission-track age (Ma)[3]
POINT REYES (Figure 2)_continued					
Porphyritic granodiorite of Point Reyes					
(24)PR 13-88 wr		85.2			
(24)PR 13-88 hbde		85.2	83.46± 0.70		Sph 83, 87
(24)PR 13-88 biot		79.8	81.3±0.42	82	Apa 60
Biotite granite of Tomales Point					
(29)PR 4-93 wr		82.0			
(29)PR 4A-93 ksp		82.0			
(27)PR 1-88 biot.		82.0			
Pegmatite in undifferentiated granitic rocks of Inverness Ridge					
(31)PR 5A-93 wr		86.2±3			
(31)PR 5A-93 ksp		86.2			
(31)PR 5A-93 biot.		86.2			
FARALLON ISLANDS (Figure 3)					
granodiorite of the Farallon Islands					
FAIS1-88 wr		94.0			
FAIS1-88	Zir. 95 [9]				Sph88,84,93,87
FAIS7AK-91 ksp		94.0			Apa 15,15,21
FAIS6AB-91biot		89.2			
FAIS5-88 hbde		94.0	88.76±0.56		
FAIS5-88 biot		84.9	88.72±0.46	87.4	
CORDELL BANK (Figure 3)					
Sheared biotite granodiorite at 140 feet depth on northern Cordell Bank					
COBA2-92	(8)Zir.100 [5]				
Tonalite of Cordell Bank from dredge samples broken from ledge at depth of 210 feet					
COBA6-90-2	Zir. 99 [6]				
	Sph.97.8 [6]				
COBA6-90-2hbde		99	89.09±0.55		
COBA6-90-2biot		88.3	91.33±0.51		
MONTARA MOUNTAIN (Figure 5)					
South tonalite of Montara Mountain					
(8)MON14-87wr		106			
(8)MON14-87 biot		86.1	89.10±0.58		Sph 82,
(7)MON13-87 biot		86.1	88.07±0.66		Apa 18
(8)MON14-87hbde		na	89.95±0.56		
(7)MON13-87hbde		na	90.32±0.48		
North tonalite of Montara Mountain					
(14)MON6-88	Zir.103 [7]				
	Zir. 102 [7]				
	Zir. 102 [7]				
	Sph. 94 [7]				
	Apa. 93 [7]				
(15)MON12-88 wr				89.5	
BEN LOMOND MOUNTAIN_SANTA CRUZ AREA (Figure 6)					
Northern tonalite of Ben Lomond					
(2)K2-87 wr		109.4			
(2)K2-87 hbde		109.4	89.95±0.56		Sph 87

Table 5. Summary of U-Pb, Rb-Sr, ^{40}Ar-^{39}Ar, K-Ar, and fission-track ages of minerals from granitic rocks in the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	^{238}U-^{206}Pb age (Ma)	Rb-Sr age Age (Ma)	$^{40}Ar/^{39}Ar$ age (Ma)	K-Ar age (Ma)[2]	Fission-track age (Ma)[3]

BEN LOMOND MOUNTAIN_SANTA CRUZ AREA (Figure 6)_continued					
Northern tonalite of Ben Lomond continued					
(2)K2-87 biot		83.6	86.54±0.44		Apa 18
(3)K3-87 hbde		109.4	91.02±0.47		
(3)K3-87 biot		83.9	87.26±0.44		
Granodiorite of Glen Canyon					
BL5-89	Zir.>108 [7]				
BL4-89 wr		121			
K13-87 biot		88.5			Apa 67.3
(6)K11-87 biot		88.9			Apa 61.2
(5)K10-87 biot		87.4	88.16±0.44		
(7)K12-87 biot		72.2			
Alaskite of Smith Grade					
(8)K6-87 wr		109.4			
	Zir.>108 [7]				
	Mon. 101[7]				
Southern tonalite of Ben Lomond					
(9)BL10-89 wr		102.2			
	Zir.~92 [7]				
(1)K1A-87 wr		102.2			
	Zir 99 [7]				
	Sph 96 [7]				
	Apa 92 [7]				
Granitoid rocks in the Bonny Doon, Felton and Santa Cruz area of the Santa Cruz Mountains					
(20)BL3-88 wr		117			
(20)BL3-88 biot		85.14			
SANTA LUCIA MOUNTAINS (Figure 7)					
Porphyritic granodiorite of Monterey, granodiorite of Cachagua, quartz diorite of Sobaranes Point					
(8)SANLU2-90 wr		83.5			
(8)SANLU2-90 biot				79.7	Sph 69
(11)SANLU5-90 wr		83.5			Apa 12
	Zir. 94 [1]				Sph 74
	Zir. 90[1]				Apa 60
	Sph. 78.3[1]				
	Apa. 78.3[1]				
(17)SANLU20-90 biot		75.8	77.75±0.40		
(17)SANLU20-90 hbde		75.8	79.90±0.45		
(11)SANLU5-90 hbde		78.73	80.18±0.47		
(11)SANLU5-90 biot		78.73	78.03±0.40		
(2)SANLU11-90 biot		75.5			
Quartz diorite of the Paraiso Paloma area					
(22)SANLU23-90wr		117			
(22)SANLU23-90 biot		72.9	74.41±0.38		Sph 76, 74
(22)SANLU23-90 hbde		72.9	76.53±0.43		Apa 74, 40
(25)SANLU26-90 biot		72.9			

Table 5. Summary of U-Pb, Rb-Sr, ^{40}Ar-^{39}Ar, K-Ar, and fission-track ages of minerals from granitic rocks in the Salinian composite terrane, California_continued

(Map), Spec. No. material analyzed	^{238}U-^{206}Pb age (Ma)	Rb-Sr age (Ma)	$^{40}Ar/^{39}Ar$ age (Ma)	K-Ar age (Ma)[2]	Fission-track age (Ma)[3]
SANTA LUCIA MOUNTAINS (Figure 7)_continued					
Charnokitic tonalite of Compton (1960)					
(49)SANLU10-91wr	Zir.98 [1]				

	Zir. 99[1]				
	Apa 78.2[1]				
	Sph 78.2[1]				
(50)SANLU11-91 hbde		83.8	82.19±0.42		
(50)SANLU11a-91 biot		83.8	79.50±0.40		
(50)SANLU11a91 hbde		83.8	78.91±0.46		
(51)SANLU12-91 hbde		83.8	83.46±0.44		
GABILAN RANGE (Figure 10)					
Quartz diorite-granodiorite of Johnson Canyon					
(16)#24	Zir 83[9]				Sph 75
(18)#27	Zir 85[9]				Apa 17
(20)#29	Zir 84[9]				
Biot				82.2	
Biot				81[8]	
Hbde				84[8]	
Biot				76[8]	
hbde				85[8]	
Granodiorite of Gloria Road					
(15)#23	Zir 91[9]			72	Apa 24
(19)#26	Zir 80[9]				Apa 22
Quartz monzonite of Fremont Peak					
(12)#14	Zir 105[9]				
biot				81[8]	
biot				72[8]	Sph 74
biot				80[8]	Apa 3
SOUTHERN SALINIAN COMPOSITE TERRANE (Figure 11)					
LaPanza Range					
(12)#31	Zir 80[9]				
(10)BR6-3					Sph 86, 89
(12)SLO-5B				82[4]	Apa 63,70
Gneiss of Red Hills					
(9) DR-109[2]					Sph 68
(9)#32	Zir 82[9]				
homogenized gneiss and felsic intrusions at Mount Abel					
(11) #144 hbde				70[4]	
(11) #144 biot				70[4]	
(11)#146 hbde				67[4]	
(11)DR-745wr		180[10]			
(11)DR-745wr		180[10]			

References and notes.

1.Mattinson (1978) **2**.Curtis and others (1958) **3**.Naeser and Ross (1972) **4**. Evernden and Kistler (1970) **5**. J. Wooden, written communication (2000) **6**. Kistler and Wooden (1994) **7**.James (1992) **8**. Huffman (1972) **9**. Mattinson (1990) **10**. Kistler and others (1973) **11**. Burgmann and others (1994)

Minerals: Zir=zircon, Sph=sphene, Apa=apatite, hbde= hornblende, biot=biotite, Mon=monazite, pla=plagioclase, ksp=K-feldspar, wr=whole-rock.