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URANIUM-SERIES DATES ON OYSTER SHELLS FROM MARINE TERRACES OF SAN PABLO BAY, CALIFORNIA

by

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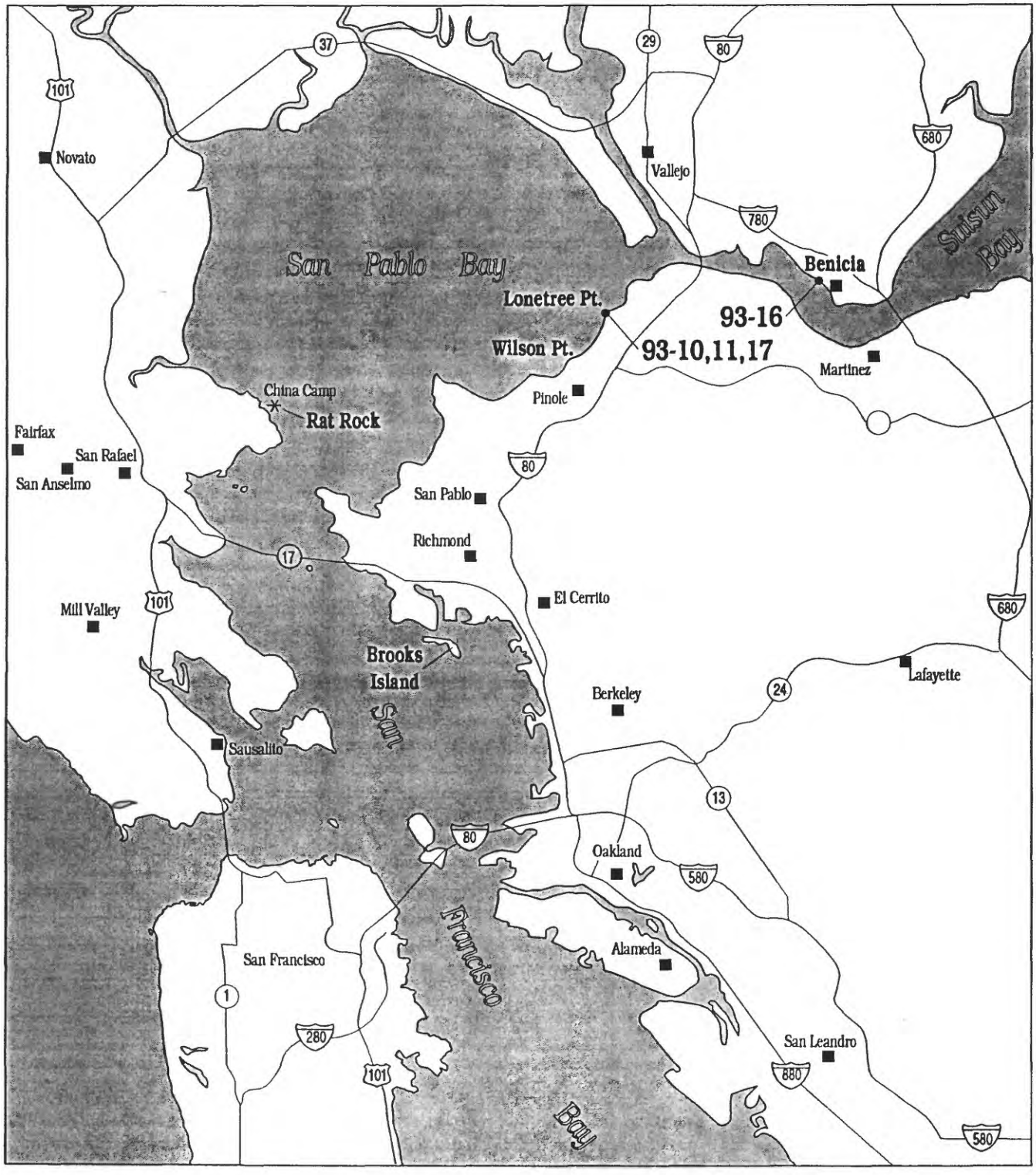
INTRODUCTION

While mapping Quaternary deposits for the San Francisco Bay Region project, samples of *Ostrea lurida* were collected in 1993 by Ed Helley and John Nakata from terrace remnants along the south shore of San Pablo Bay. The oysters comprise a coquina approximately one-third of a meter thick which overlies a 4 m thick deposit of estuarine mud. The mud, in turn, rests unconformably on deformed, north-dipping Cierbo Sandstone of upper Miocene age.

The oyster coquina is about 5 m above sea level. Three remnant terrace sites along the southern shore of San Pablo Bay from Wilson Point to Lone Tree Point are also at this elevation and are all underlain by estuarine mud. All three sites are overlain by an upward fining sequence of locally derived sediments. A fairly well-developed paleosol with a good B2t horizon is developed on these overlying sediments and along with their erosion and dissection suggest some degree of antiquity to the deposits containing the oyster beds. Could these oyster beds be related to the last interglacial climatic period described by Shackleton and Opdyke, 1973? (Oxygen Isotope Stage 5e). Atwater and others, 1981, used amino acid stereo-chemistry to correlate these same oyster beds with fossil oysters retrieved from bridge borings under south San Francisco Bay. They concluded from stratigraphic relations and amino acid racemizations that the oysters and other associated molluscs were deposited during the last interglacial period, 80 to 140 ka ago.

The buried oysters beneath San Francisco Bay are as much as 40 m below present level indicating that the south bay has subsided that much in the last 125 ka (.03 mm/yr).



Sample Localities Map

PROCEDURES

We selected three composite samples from the Lone Tree Point site and one from the Benecia site, each consisting of about 5 to 10 shells hand selected from the sandy matrix for good preservation. Samples were mechanically and ultrasonically cleaned of residual detrital material. All samples were lightly ground and dissolved in $HN0_3$, uranium and thorium isotopes were isolated by ion-exchange chromatography, using procedures described in Bischoff and others, 1988, and were then analyzed by alpha spectrometry.

RESULTS

Results are shown in Table 1, errors (±) refer only to 1σ error propagated from the counting statistics and do not reflect the more important "geological" errors caused by contamination, isotope migration, and translocation. The dates range from 112 to 142 kyrs. Thorium ratios ($^{230}T/h^{232}Th$), the indicator of detrital contamination, are generally favorable against contamination (5 to 36) and uranium contents range from 1.42 to 8.04 ppm. Mollusks are notorious for being open systems to uranium migration (Kaufman and others, 1971). In the present case the uranium contents of the fossil oysters are considerably higher than for living oysters (generally <0.5 ppm), suggesting that the uranium is secondary. Nevertheless, the general agreement among the dates indicates the time period of uranium uptake was short compared to the age of the deposit and argues for their reliability within the range of apparent dates. Thus, it can be concluded that the age of the deposit is within the range 125±17 kyrs, close to the Milankovitch age for Marine Isotope Stage 5e, or maximum Sangamon (Shackleton and Opdyke, 1973).

Table 1

Uranium-series analyses of oysters from Lone Tree Point and Benecia, California

lab no.	U ppm	$^{234}U/^{238}U$	$^{230}Th/^{232}Th$	$^{230}Th/^{234}U$	date kyrs
		Lone Tree Point			
93-10	8.94±0.30	1.16±0.02	36.13±2.18	0.75±0.03	142±13
93-11	5.76±0.20	1.19±0.02	29.78±2.12	0.66±0.03	114±9
93-17	2.83±0.04	1.15±0.02	15.84±0.76	0.72±0.02	132±6
		Benecia			
93-16	1.42±0.03	1.17±0.02	5.29±0.25	0.66±0.02	112±5

DISCUSSION

The ages reported here strongly support the conclusion that the oyster beds along southern San Pablo Bay represent deposits of the last interglacial period and imply that this part of the tectonically active San Francisco Bay region has not undergone vertical deformation. Possibly we see little vertical deformation here because it is a purely strike-slip tectonic regime.

Further field work is planned to seek additional oyster beds especially around the perimeter of San Pablo and central San Francisco Bay. A few sites have already been observed, for example, at Rat Rock just off China Camp and Brooks Island near the mouth of Richmond Harbor; these suggest that a "bathtub" ring may exist providing a datum plane from which to measure tectonic deformation for this part of the San Francisco Bay region.

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