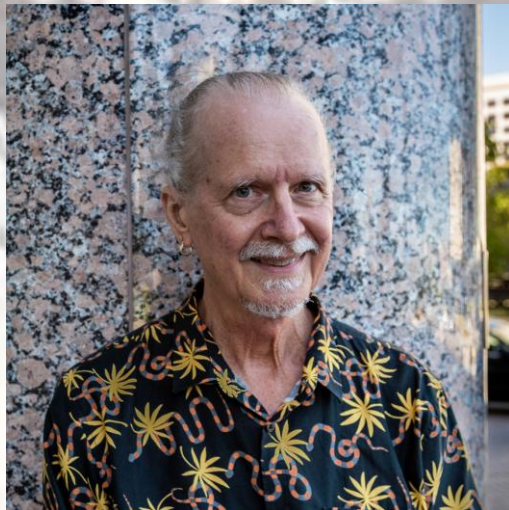


# The Tectonic Origin of Lake Merritt



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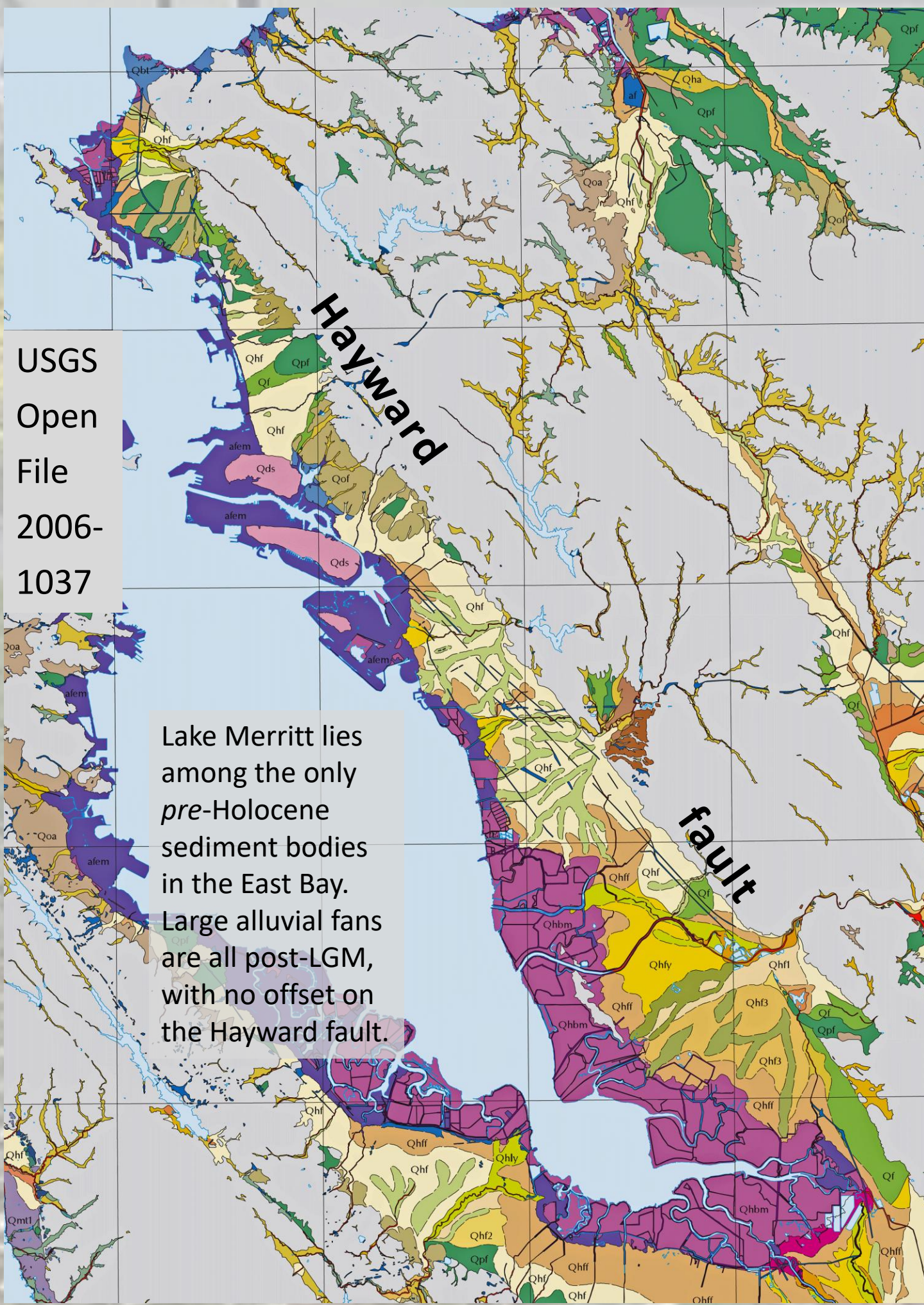
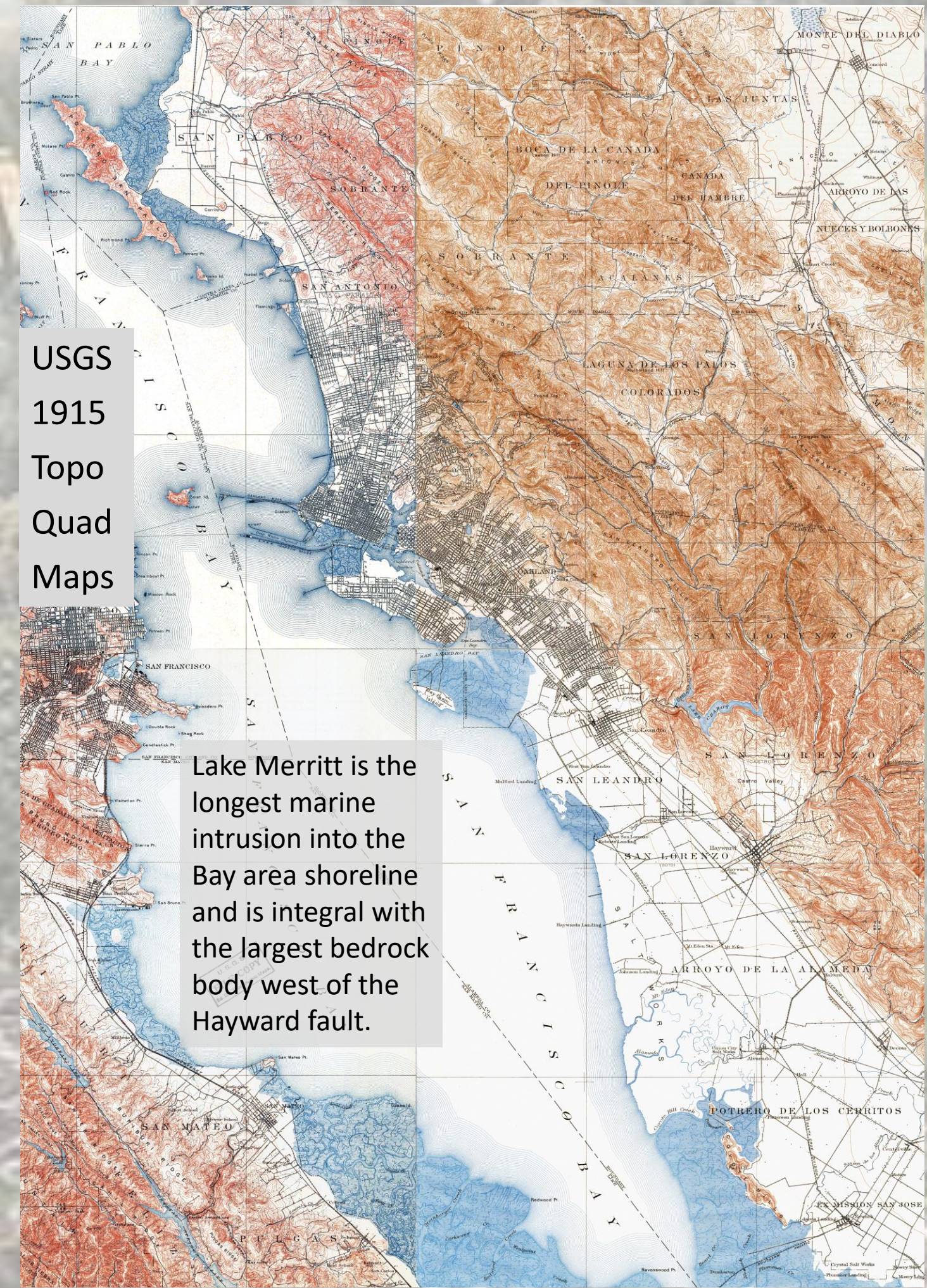
## Abstract

Lake Merritt is a striking example of a drowned river valley incised into the East Bay alluvial plain, an erosional anomaly in an aggrading landscape. It owes its persistence to a relatively high gradient stream network (Pleistocene Merritt Creek), nearer to the shore than neighboring streams, that drains a tilted crustal block (Piedmont block) lying on the seaward (west) side of the Hayward fault. Whereas other East Bay streams are regularly beheaded where they cross the fault, Merritt Creek's watershed is not disrupted by fault motion.

Geomorphic and geodetic evidence suggests that uplift and tilting of the Piedmont block occurred about 1 Ma when transcurrent displacement carried it northward past a salient in the fault at the San Leandro Gabbro. A prominent water gap in the block, Dimond Canyon, corresponds to the position of San Leandro Creek at that time. Today the canyon holds an underfit stream, Sausal Creek. For about 1 million years, or 8-10 glacial cycles, rainfall on the Piedmont block supported an integrated stream network on resistant rock with the power and persistence to repeatedly incise deeper channels at sea-level lowstands than other East Bay streams.

Lake Merritt, with its entourage of Pleistocene landforms, exists today because of events that began a million years ago.

## Odd lake: "Lake" Merritt is an estuary in a drowned stream valley

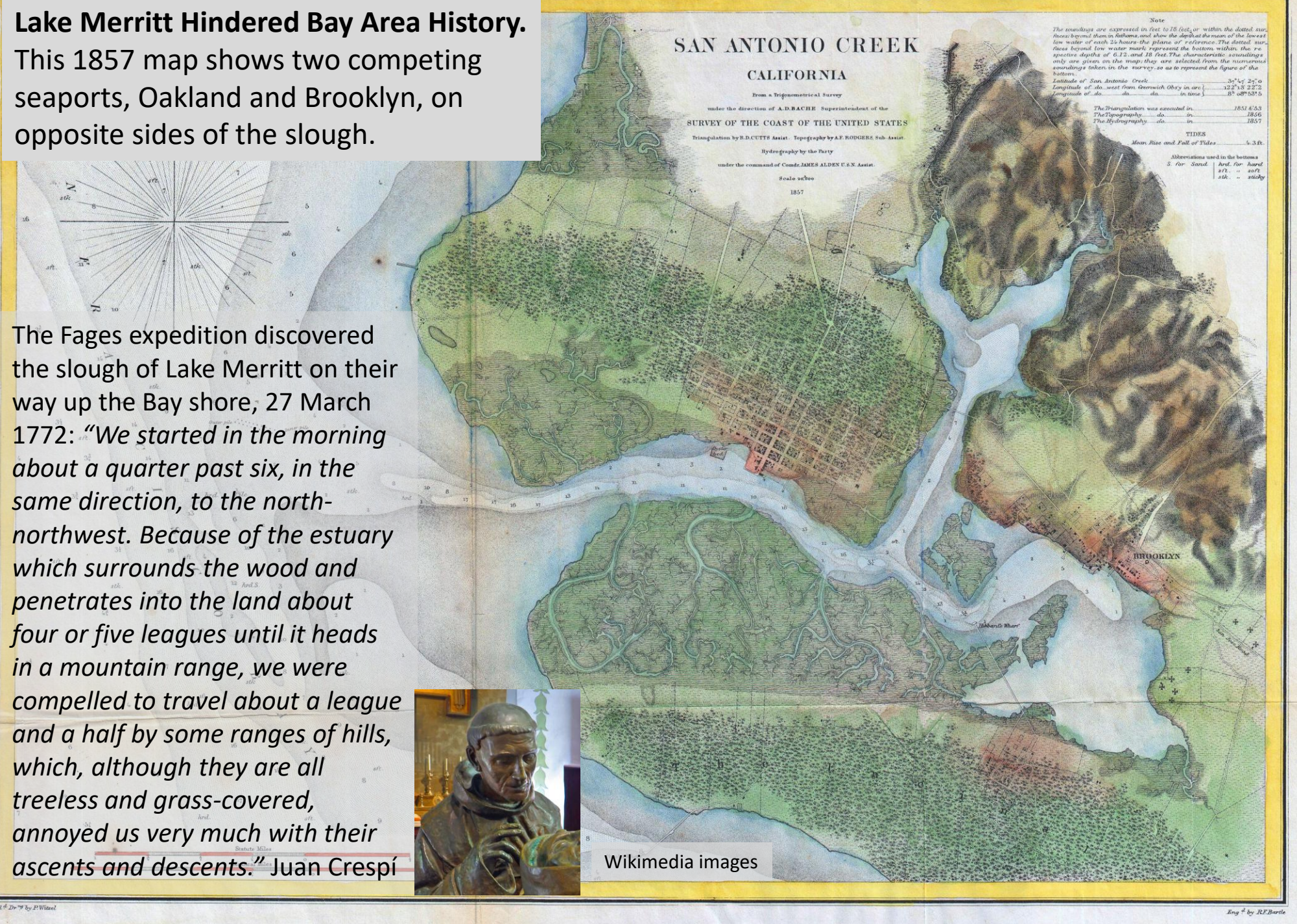


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The Fages expedition discovered the slough of Lake Merritt on their way up the Bay shore, 27 March 1772: "We started in the morning about a quarter past six, in the same direction, to the north-northwest. Because of the estuary which surrounds the wood and penetrates into the land about four or five leagues until it heads in a mountain range, we were compelled to travel about a league and a half by some ranges of hills, which, although they are all treeless and grass-covered, annoyed us very much with their ascents and descents." Juan Crespi



Wikimedia Images

## Its compact stream network lies on the uplifted Piedmont block . . .

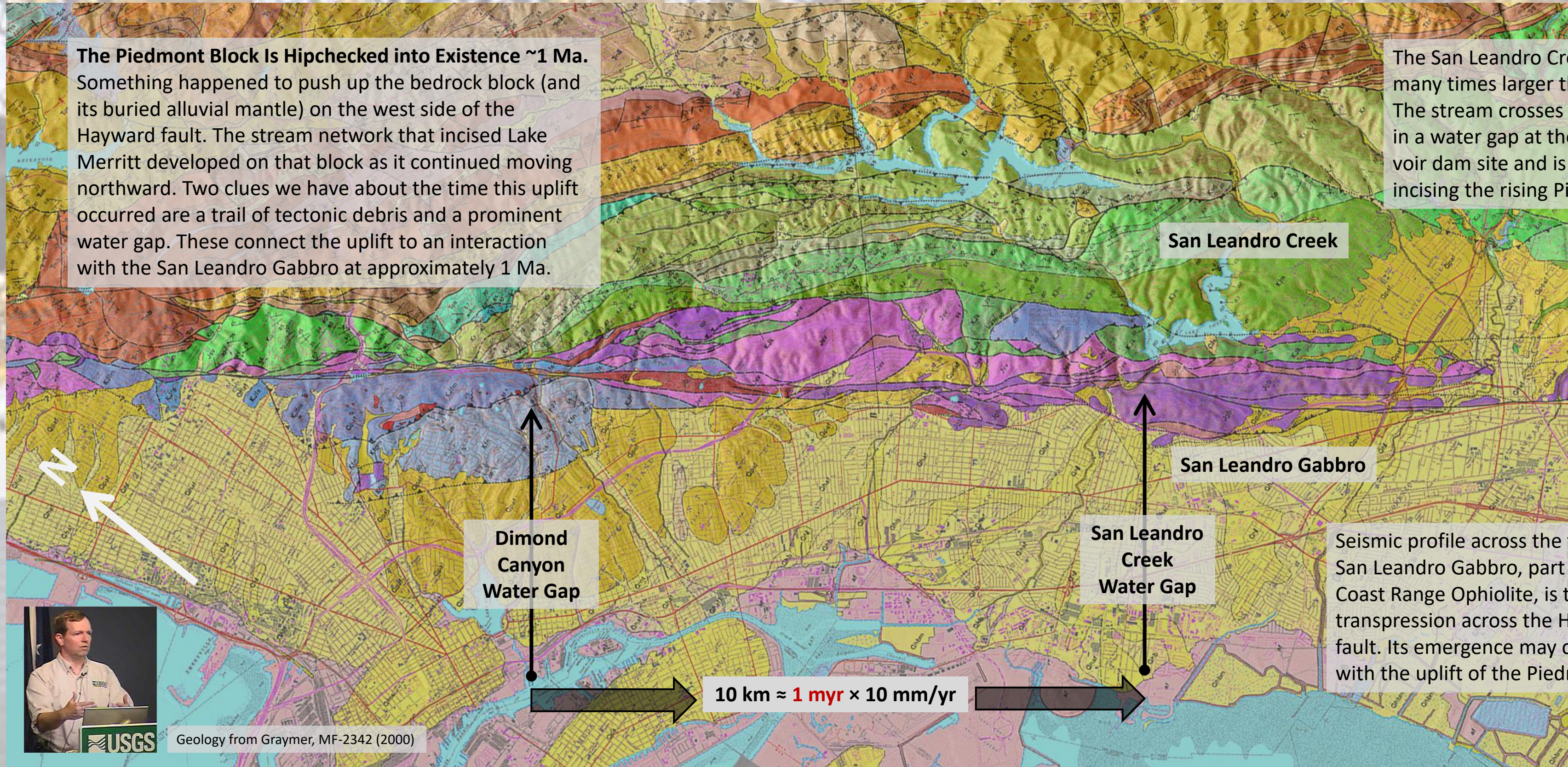


## . . . unlike others warped by the Hayward fault

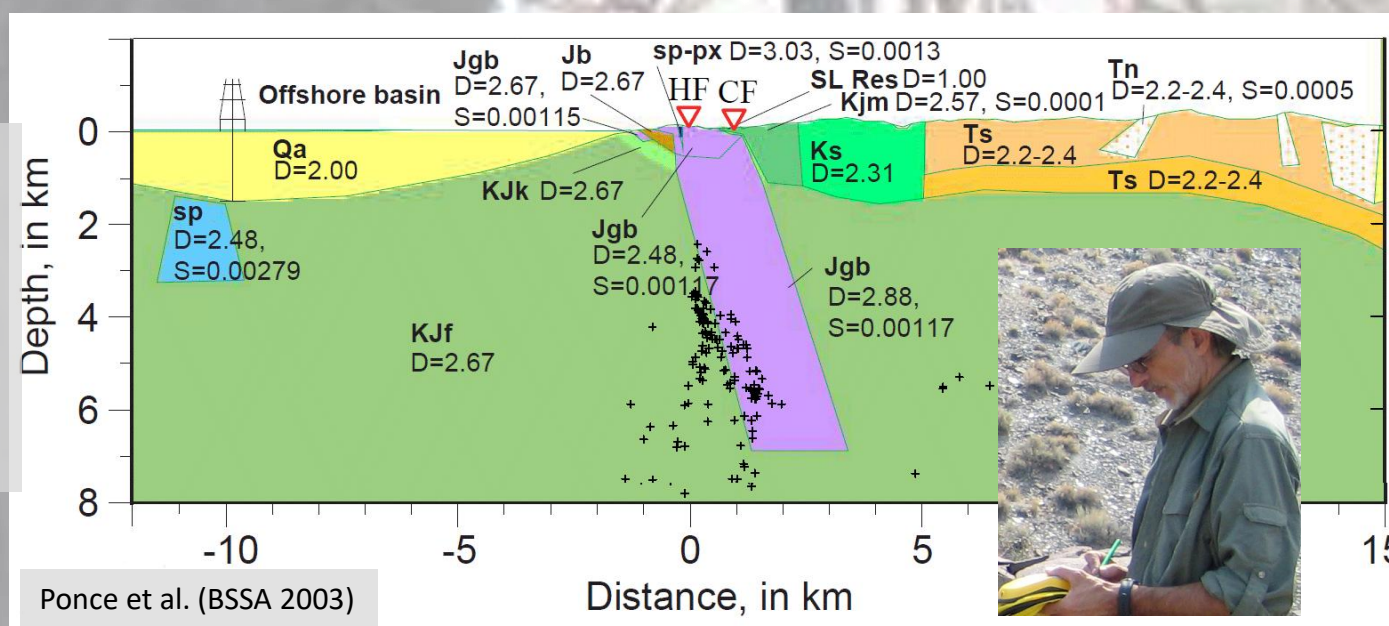
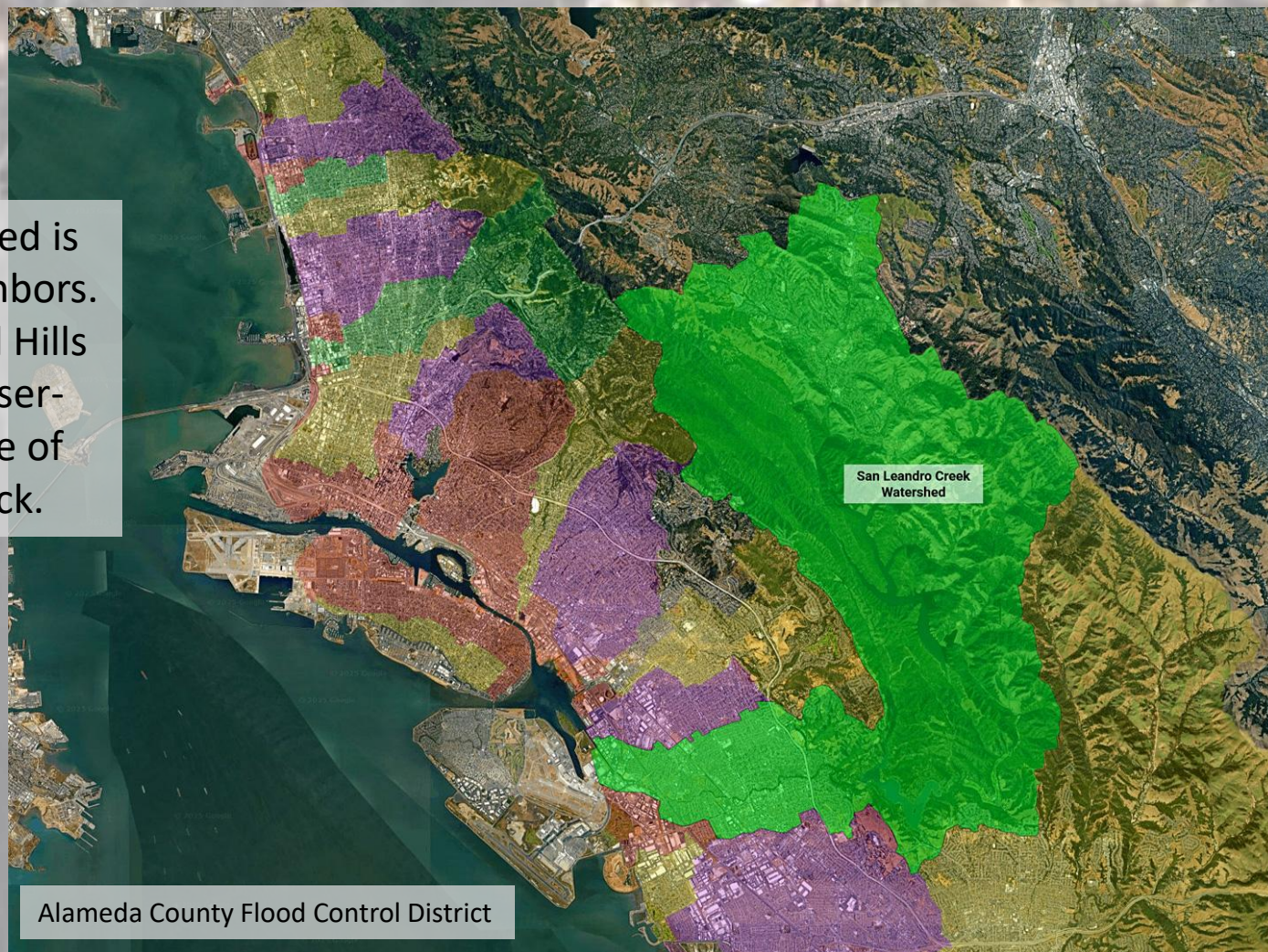


**What uplifted the Piedmont block—and when?**

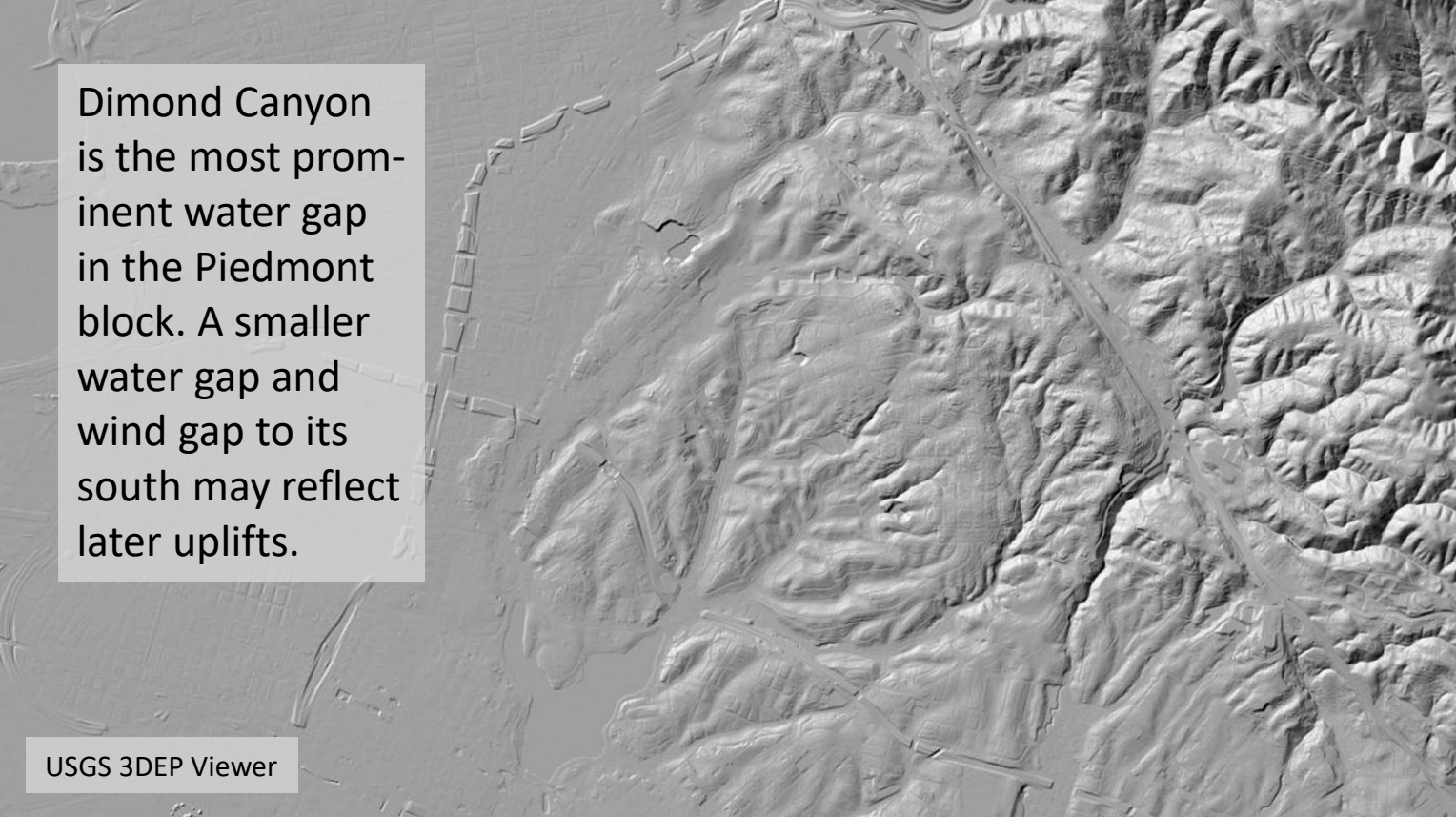
## The Piedmont block: Born in a tectonic wrestling match ~1 million years ago



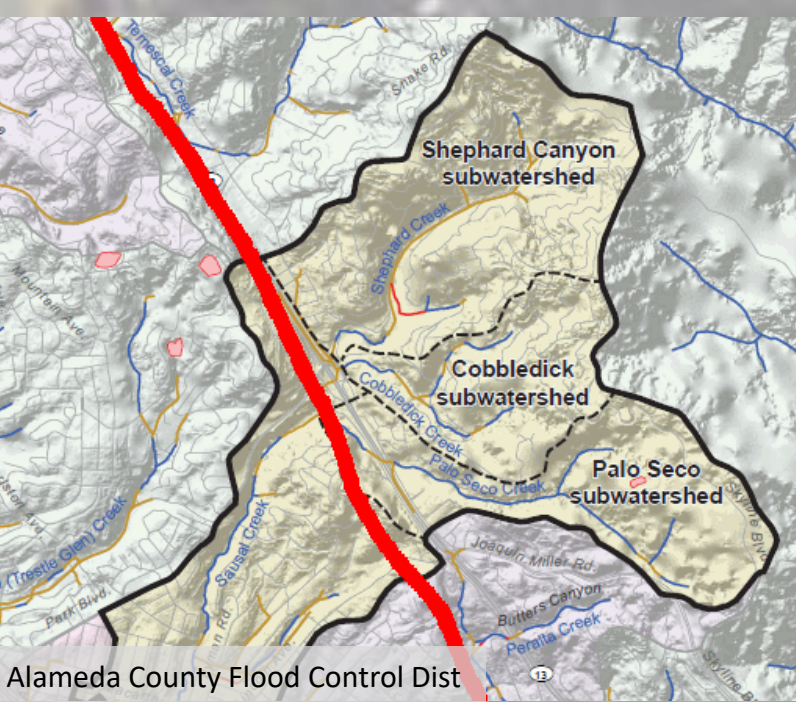
The San Leandro Creek watershed is many times larger than its neighbors. The stream crosses the Oakland Hills in a water gap at the Chabot Reservoir dam site and is fully capable of incising the rising Piedmont block.



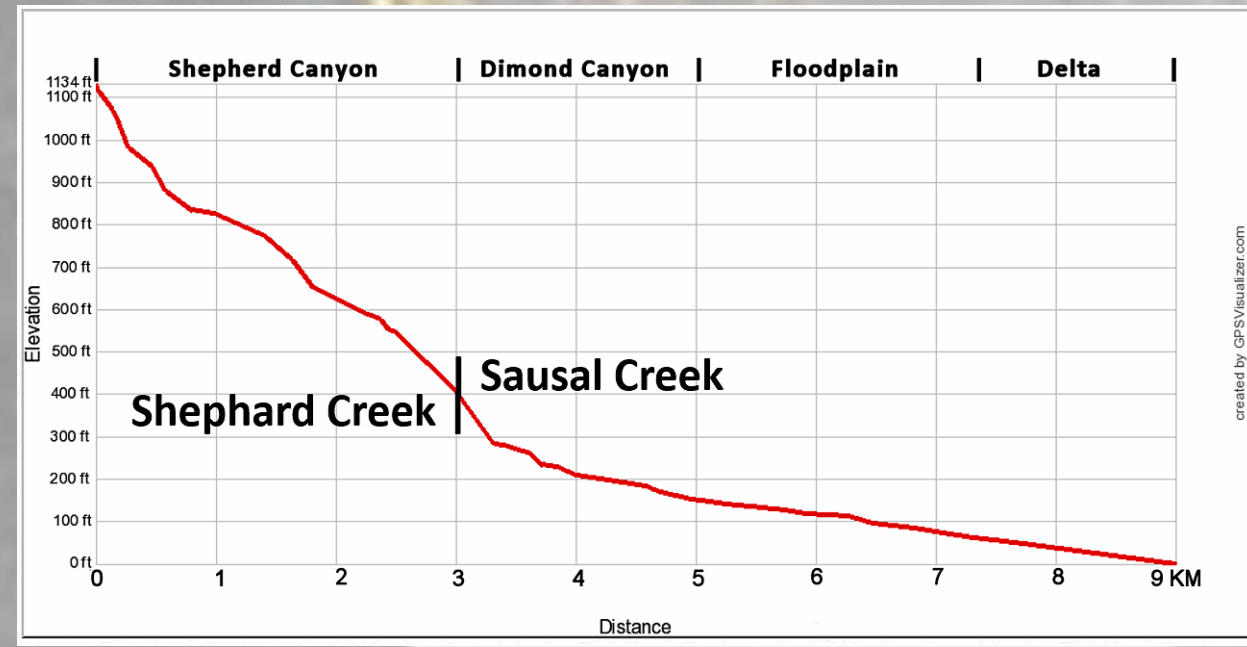
## Geomorphic evidence: Water gaps



Sausal Creek, formed by the union of three small tributaries, now occupies Dimond Canyon as an underfit stream.



Sausal/Shepherd Creek's longitudinal profile shows a knick-point. Coarse early Holocene alluvium is mapped beneath its delta. Both may reflect the stream finding a new base level as the Hayward fault carried Dimond Canyon past its headwaters.



## San Francisco Bay from 1 Ma to today: Constraining the history of temporarily Lake Merritt

For over 90% of its history, Lake Merritt has been not a lake, but a ravine incised by Pleistocene Merritt Creek. Before ~650 ka, the Bay area was a continental basin filled by local alluvium (Santa Clara formation) isolated from Lake Clyde, which occupied the Central Valley.

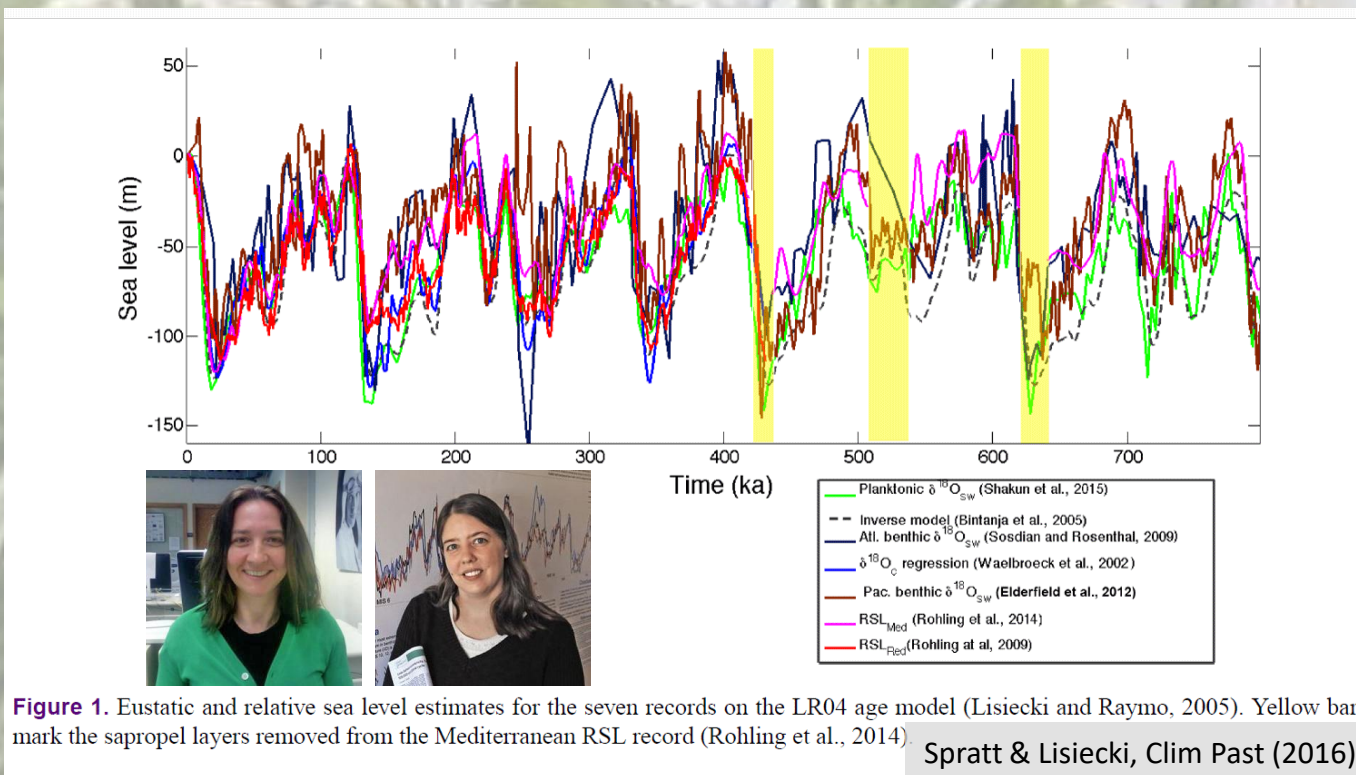
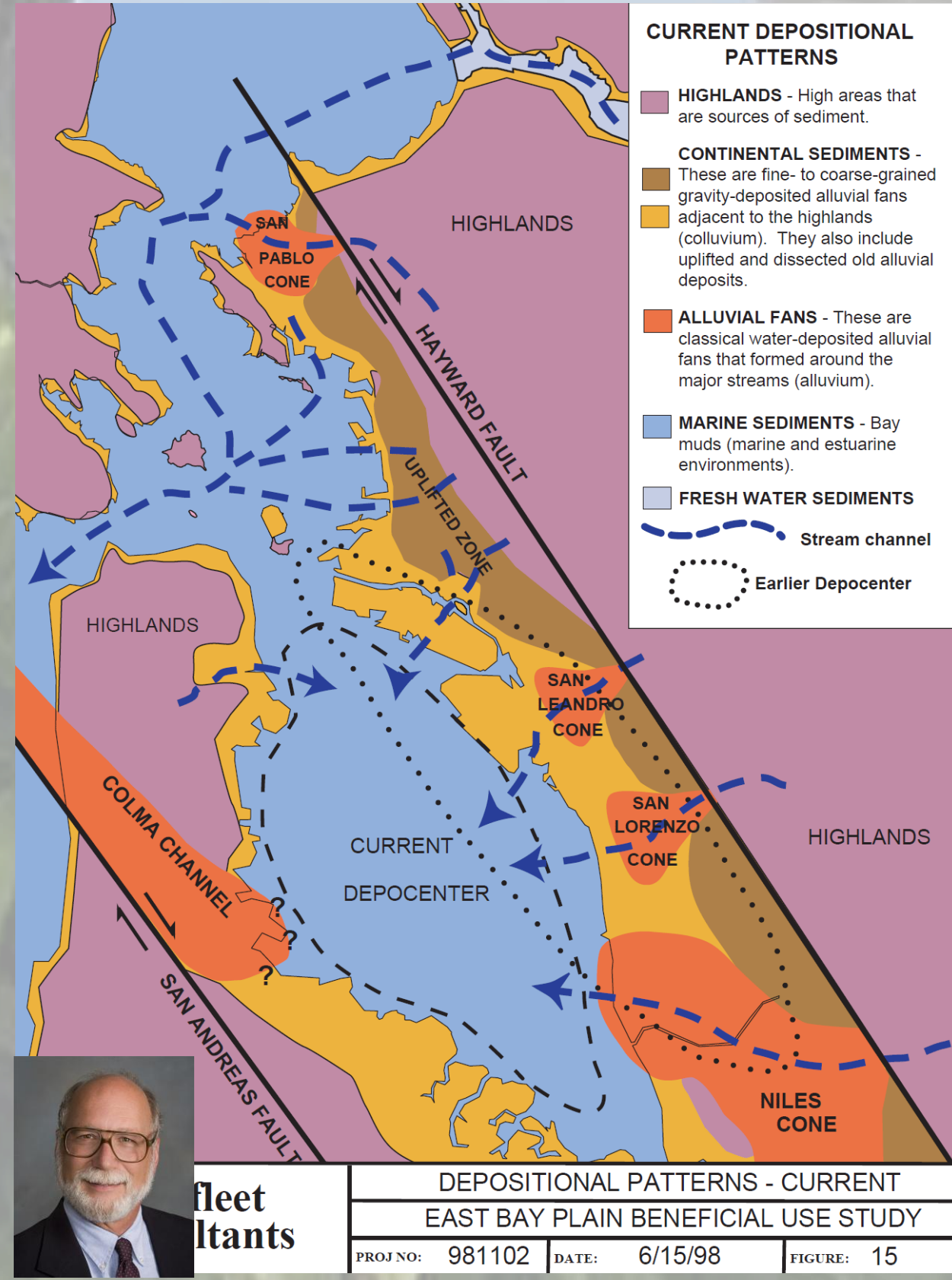
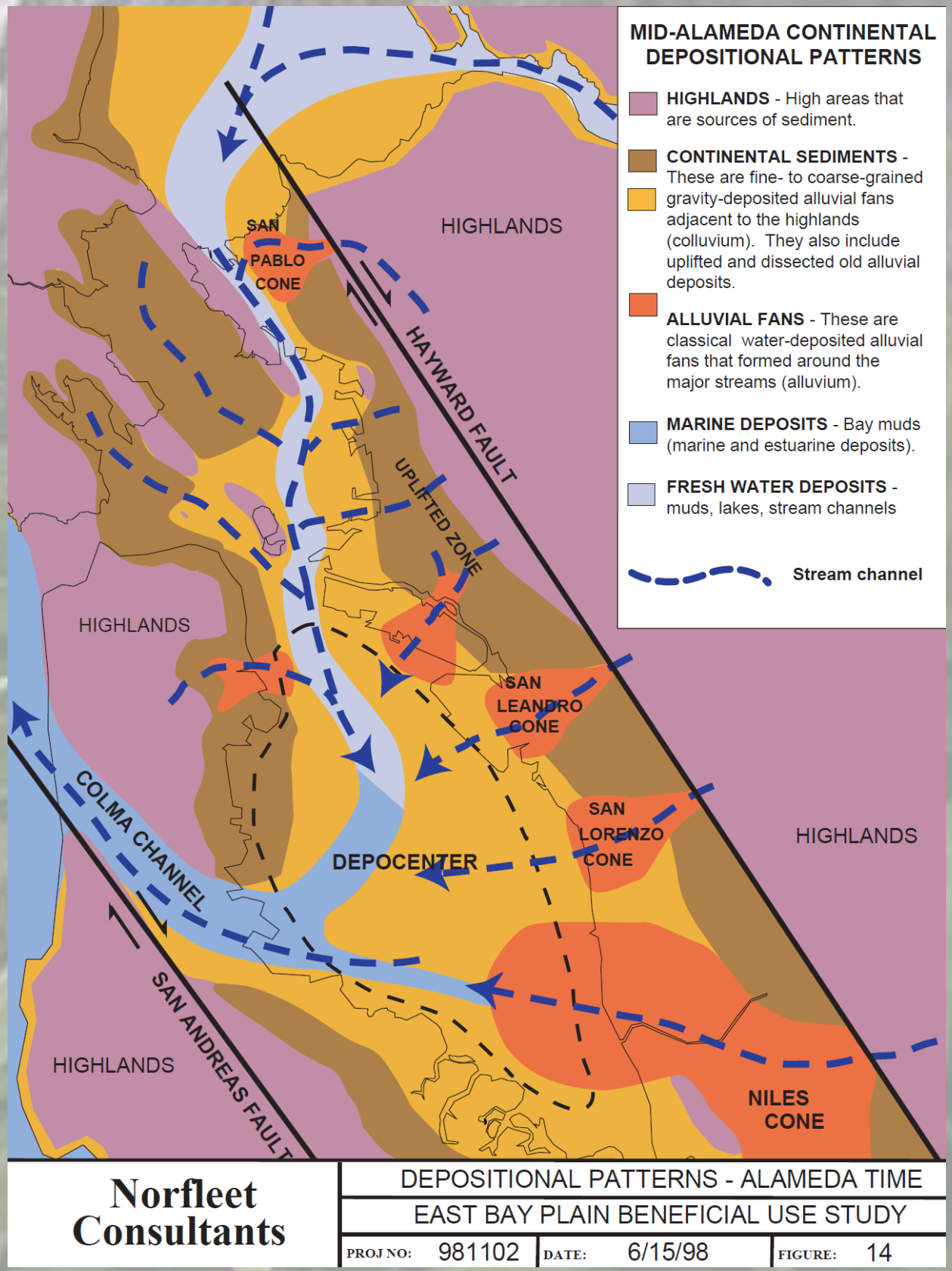


Figure 1. Eustatic and relative sea level estimates for the seven records on the LRM4 age model (Lisiecki and Raymo, 2005). Yellow bars mark the supported layers removed from the Mediterranean RSL record (Rohling et al., 2014). Spratt & Lisiecki, Clim Past (2016)

## Lake Merritt Today

The land around Lake Merritt bears imprints of the last glacial cycle, starting with terraces deposited during the last highstand in Marine Isotope Stage 5e, the Sangamon Interglacial. There's also the eolian dunefield underlying downtown Oakland, laid down during the Last Glacial Maximum, and on the northeast side of the lake are low hills made of the mantle of ancient alluvium on the uplifted Piedmont block. In sum, today's jewel of Oakland has been a million years in the making. Previous glacial cycles must have left their mark on the East Bay, but they now lie deeply buried beneath today's landscape.



**deft Consultants**