

Channel Islands National Park, CA

Geologic Highlights • Kirt Kempter (kempter@newmexico.com)

1. There are 8 islands in the Channel Island archipelago. 5 of these islands are part of the national park. The 4 northernmost islands represent the western part of the Transverse Range province in southern California. The four southernmost islands are part of the Peninsular Range province.
2. In general, the northernmost islands are made up of volcanic rocks erupted 15-20 million years ago, overlain by younger marine sedimentary rocks, including organic-rich ocean muds that would later become important for petroleum resources in the region.
3. The origin of the Channel Islands relates to the birth and development of the San Andreas fault, including a new plate tectonic boundary between the Pacific and the North American plates. It's complicated...
4. The Peninsular Ranges represent a crustal block that has rotated ~90 degrees in a clockwise motion over the past 20 million years. This rotation is largely driven by the NNW motion of the Baja California peninsula pushing the western side of the block up (to the north) once it became part of the Pacific plate.
5. The 4 northernmost islands represent an east-west trending anticline which is still forming today, and includes the Santa Monica Mountains on the California mainland. These compressional forces have lifted the islands above sea level as the geologic strata on the islands have been folded and faulted.
6. Since the islands are rising, elevated marine terraces from the past are common. These terraces formed when they were at sea level, with high energy tidal forces beveling a platform along the island shorelines.
7. Some marine terraces, however, also formed in the past as sea level rose and fell during the Ice Age. For example, 20,000 years ago sea level was >360 feet lower than today. So the shoreline marine terrace from this time was inundated by rising seas between 18,000 to 10,000 years ago.
8. With lower sea levels 18,000 to 20,000 years ago the 4 northernmost islands coalesced into a single island called Santarosae.
9. Mammoths were able to swim from the mainland to Santarosae and thrived here. A group of pygmy mammoths evolved as island habitat shrank.
10. Paleo-Indian peoples have occupied the islands in the past 13,000 years.



Figure 1 (Lencer). Location of the Channel Islands (and national park)

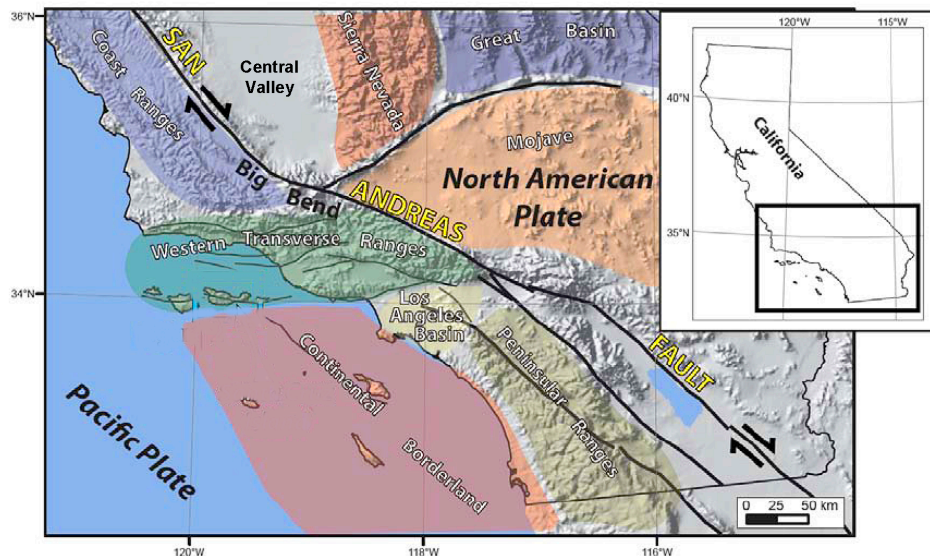


Figure 2 (Jeffrey Mount). Tectonic provinces of southern California, including the Western Transverse Ranges block, which has rotated ~90 degrees in a clockwise fashion. The 4 northernmost Channel Islands are part of this block.

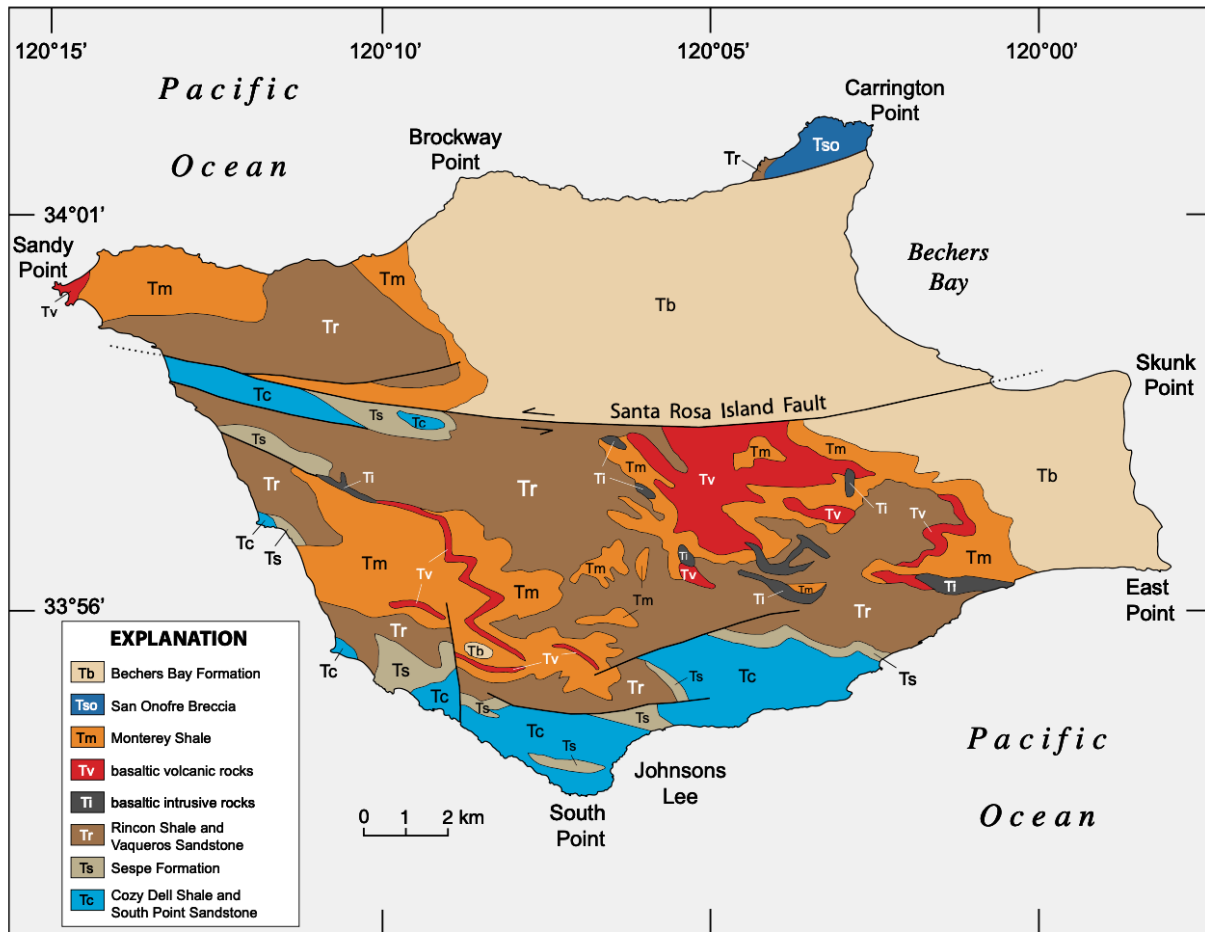


Figure 3. Geologic map of Santa Rosa island, including the Santa Rosa Island fault, a strike-slip fault that trends east-west across the island. The northern part of the island is moving to the west relative to the southern part of the island. A similar fault cuts across Santa Cruz island.



Figure 4 (Muhs et al). Santarosae island 18,000 to 20,000 years ago when sea level was > 360 feet lower than today. The island(s) represent an east-west trending anticline (dashed red line) as ongoing compressional tectonics impact the Transverse Ranges block. East-west trending mountains north of Santa Barbara form another anticline. Mammoths were able to swim the ~7 km distance between the mainland and Santarosae.

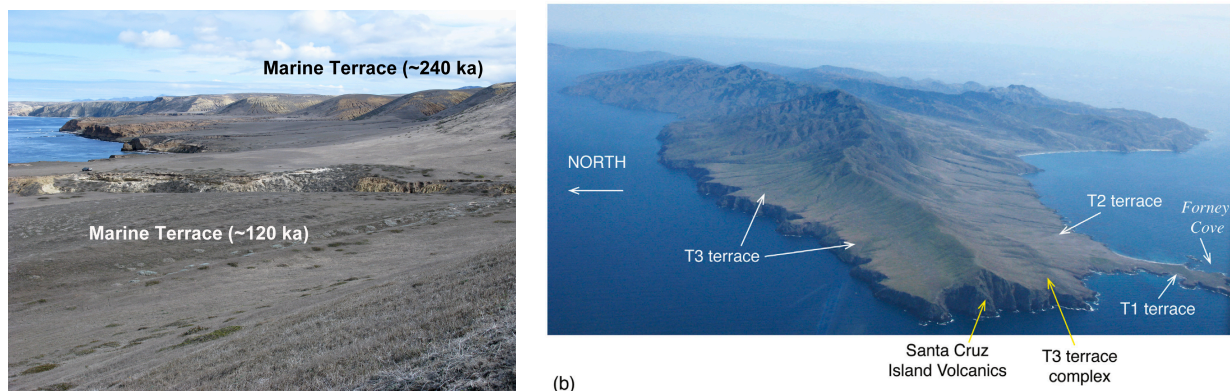


Figure 5 (Muhs et al). Elevated terraces on the islands represent shoreline environments from the past, as wave-cut benches eroded into the islands – and later uplifted due to ongoing compressional tectonics.

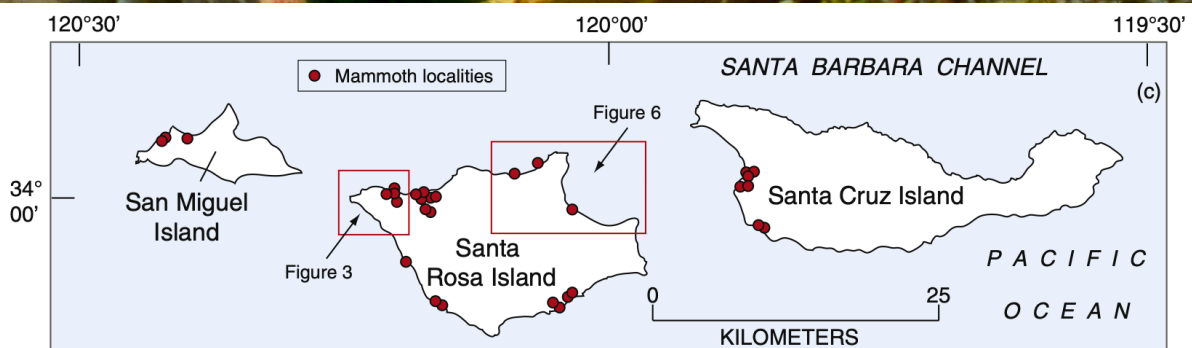


Figure 6 (Muhs et al). Pygmy mammoth fossil (above) and location of fossil mammoth sites on 3 of the Channel Islands (below).