Appendix 22

Monterey Submarine Canyon Plate Tectonics Puzzle

The San Andreas Fault, considered a long transform fault, passes to the east of Monterey Bay in west-central California, USA. However, it is really a wide fault zone with several different smaller faults starting with the San Gregorio fault offshore of Monterey Bay clear to western Nevada (Figure A22.1). The fault zone in western Nevada is called the Walker Lane, where 25% of the relative plate motion between the North American and Pacific Plates presently takes place.[1] Current relative motion between the Pacific Plate moving northwest and the North American Plate moving west, based on geodetic data, is about 6.5 cm/yr.

Figure A22.1. San Andreas Fault zone in central California. Note that the San Gregorio Fault that passes through the western Monterey Bay (redrawn by Mrs. Melanie Richard from a USGS map).

[1] Surpless, B., 2008. Modern strain localization in the central Walker Lane, western United States: implications for the evolution of intraplate deformation in transtensional settings, *Tectonophysics* 457:239–253.

Monterey Submarine Canyon begins in Monterey Bay. It is 60 miles (95 km) long, and like so many other submarine canyons it continues out to a large submarine fan, called the Monterey Fan. If the westward extending fan valley entrenched on the Monterey submarine fan is included, the total length of the canyon is 295 miles (470 km).[2] Its maximum wall height is 5,575 feet (1,700 m), and its maximum rim-to-rim width is 7.5 miles (12 km). It is similar in depth and width to Grand Canyon. The Monterey Fan covers over 39,400 mi^2 (100,000 km^2) and averages about 1 mile (1.5 km) thick for a volume of 36,600 mi^3 (150,000 km^3). It represents a huge amount of deposition and the northeast part of the fan shows that the fan originated from Monterey Submarine Canyon. The Monterey Submarine Canyon and Fan would have formed late in the Flood by channelized Flood currents during the Dispersive Phase of the Flood.[3,4]

The San Gregorio fault, the boundary between the Pacific Plate to the west and the western San Andreas Fault zone, passes through Monterey Submarine Canyon at about 5,900 feet (1,800 m) below sea level.[5] The fault is delineated by earthquake epicenters and small topographical features within Monterey Canyon. So, the lower part of the canyon and the submarine fan is on the Pacific Plate. Based on measurements on land to the north, the San Gregorio Fault is presently moving 6 mm/yr.[6] At that rate, it would have slipped 4 miles (6 km) in a million years and 112 miles (180 km) in 30 million years, according to the uniformitarian timescale. It has also been assumed that the west side of the San Gregorio fault has moved northwest 44 to 94 miles (70 to 150 km) with respect to the east side since the mid Miocene Epoch within the uniformitarian timescale, but some think the movement less.[5,7] Dickenson recently reanalyzed the fault movement and based on geology, fault movement was claimed to be 98 miles (156 km) since it first developed in the late Miocene.[8]

However, some scientists believe the fault moved much more—that the current ocean crust underneath the Monterey Fan used to be 595 to 780 miles (950 to 1,250 km) south of its current location some 33 million years ago![9] The Monterey Fan is dated to the early Oligocene to early Miocene Epochs at about 20 to 25 million years old.[10,11] So by these uniformitarian dates and

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[2] Greene, H.G., Maher, N.M., and Paull, C.K., 2002. Physiography of the Monterey Bay National Marine Sanctuary and implications about continental margin development, *Marine Geology* 181:55–82.
[3] Walker, T., 1994. A biblical geologic model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburg, PA, pp. 581–592.
[4] Oard, M.J., 2008. *Flood by Design: Receding Water Shapes the Earth's Surface*, Master Books, Green Forest, AR.
[5] McHugh, C. M.G., Ryan, W.B.F., Eittreim, S., and Reed, D., 1998. The influence of the San Gregorio fault on the morphology of Monterey Canyon, *Marine Geology* 146:63–91.
[6] Weber, G.E., 1990. Late Pleistocene slip rates on the San Gregorio Fault Zone at Point Ano Nuevo, San Mateo County, California; in: Garrison, R.E., Greene, H.B., Hicks, K.R., Weber, G.E., and Wright, T.L. (editors) *Geology and Tectonics of the Central California Coast Region, San Francisco to Monterey* , AAPG (Pacific Section) Book GB67, pp. 193–203.
[7] Nagel, D.K., Mullins, H.T., and Greene, H.G., 1986. Ascension Submarine Canyon, California—evolution of a multi-head canyon system along a strike-slip continental margin, *Marine Geology* 73:285–310.
[8] Dickinson, W.R., 2005. Net dextral slip, Neogene San Gregorio—Hosgri fault zone, coastal California: geologic evidence and tectonic implications, *GSA Special Paper 391*, Geological Society of America, Boulder, Colorado.
[9] Gardner, J.V., R.G. Bohannon, M.E. Field, and D.G. Masson, 1996. The morphology, processes, and evolution of Monterey Fan: a revisit. In, Gardner, J.V., M.E. Field, and D.C. Twichell (editors), *Geology of the United States' Seafloor: The View from GLORIA*, Cambridge University Press, New York, NY, p. 198.
[10] Normark, W.R. and C.E. Gutmacher, 1989. Major submarine fans of the California continental rise. In, Winterer, E.L., D.M. Hussong, and R.W. Decker (editors), *The Geology of North America, Volume N, The Eastern Pacific Ocean and Hawaii*, Geological Society of America, Boulder, Colorado, p. 373.
[11] Waters, T., 1995. The other Grand Canyon. *Earth* 4(6):47.

extrapolating backwards to the southeast, the Monterey Fan could have been *adjacent to the San Joaquin Basin* about 5.5 million years ago.[12] It was at this point that the fan supposedly grew rapidly from sediments shed from the rising southern Sierra Nevada Mountains. This would mean that the fan is not composed entirely of sediment input through upper Monterey Canyon. I suppose that in this uniformitarian scenario the coastal mountains west of the San Joaquin Basin were nonexistent. Otherwise, how would Sierra erosion reach the ocean?

I am not sure whether the lower Monterey Canyon has moved with the Pacific Plate, or whether it formed when the area moved northwest to be adjacent to the upper Monterey Canyon. These plate tectonics scenarios can get complicated. If the lower Monterey Canyon moved with the Monterey Fan, where are all the old *upper* portions of the canyon along the continental slope west of the San Joaquin Basin?

Other complications arise if there was significant movement on the San Gregorio fault. North of Monterey Bay, there are eight small canyons called the Ascension Canyon system. Some investigators have pointed to these eight canyons as being at one time part of the lower Monterey Canyon.[13] But, there should then be another fault between the mouth of Monterey Canyon and its downslope fan. Also, since these eight canyons start high on the continental slope, they must have been elevated as they migrated to the northwest.

Newer data fails to support such large lateral movement of the Monterey Canyon and Fan. Slip appears to have been much less along the San Gregorio fault, especially for the past few million years.[14] There is little if any evidence of significant fault movement from sonar images and topographical relief on the upper continental slope and shelf north of the canyon.[15] The fault is delineated by earthquake epicenters and small topographical features within Monterey Canyon. The linear Carmel Canyon that runs into Monterey Canyon from the south, as well as the meander where the fault crosses Monterey Canyon, is thought to be manifestations of the fault. So, it seems likely that there is a fault that runs through Monterey Canyon, but the bulk of the evidence suggests that there has been little horizontal movement on the fault, contrary to the extensive movement predicted by the plate tectonics model.[16] It appears that the meander offset is only about 2 miles (3 km). Thus, it is likely that *all* the Monterey Fan is a depositional product of sediments cascading down Monterey Canyon. Furthermore, the meander in Monterey Canyon continues to the southwest after passing west of the fault, as if the Pacific Plate moved southeast instead of northwest.

Another piece of evidence for minimal movement on the San Gregorio fault is that there are two canyon systems west of the Carmel fault canyon that *connect* with canyons to the east of the Carmel fault canyon on the upper slope and shelf around Carmel Bay.[2] The northern canyon is Isolated Canyon and the southern canyon is called Point Lobos Canyon. Sea bottom imaging provides evidence that the Cypress Point Canyon high on the continental slope once connected to Isolated Canyon lower on the slope. The canyon that starts in the middle of Carmel Bay once was connected to the Point Lobos Canyon on the lower slope, before the uplift of the San

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[12] Klaucke, I., D.G. Masson, N.H. Kenyon, and J.V. Gardner, 2004. Sedimentary processes of the lower Monterey Fan channel and channel-mouth lobe. *Marine Geology* 206:181–198.
[13] Normark and Gutmacher, Ref. 10, pp. 373–382.
[14] McHugh *et al*., Ref. 5, p. 67.
[15] Eittreim, S.L., R.J. Anima, and A.J. Stevenson, 2002. Seafloor geology of Monterey Bay area continental shelf. *Marine Geology* 181:3–34.
[16] Martin, B.D., 1992. Constraints to major right-lateral movements, San Andreas fault system, central and northern California. In, Chatterjee, S. and N. Hotton III (editors), *New Concepts in Global Tectonics*, Texas Tech University Press, Lubbock, TX, pp. 131–148.

Gregorio fault, forming Carmel Submarine Canyon, cut them off.[17] If this is true, this is further evidence of little movement on the San Gregorio fault. This minimal movement of the San Gregorio fault is contrary to plate tectonics expectations.

Thus, it is likely that *all* the Monterey Fan is a depositional product of sediments eroded during the formation of Monterey Canyon and the area to the east late in the Flood and afterwards. This would imply that there was no 94 mile (150 km) of horizontal movement between the Pacific Plate and the San Andreas fault zone, and probably the North American Plate.

Advocates of CPT could claim either that the San Gregorio Fault is a very new fault (a post-Flood fault) or its movement has been much less than uniformitarian scientists claim. But in so doing, they would be going against the "calculated" claims of movement by the uniformitarian scientists.

[17] Martin, Ref. 16, p. 139.