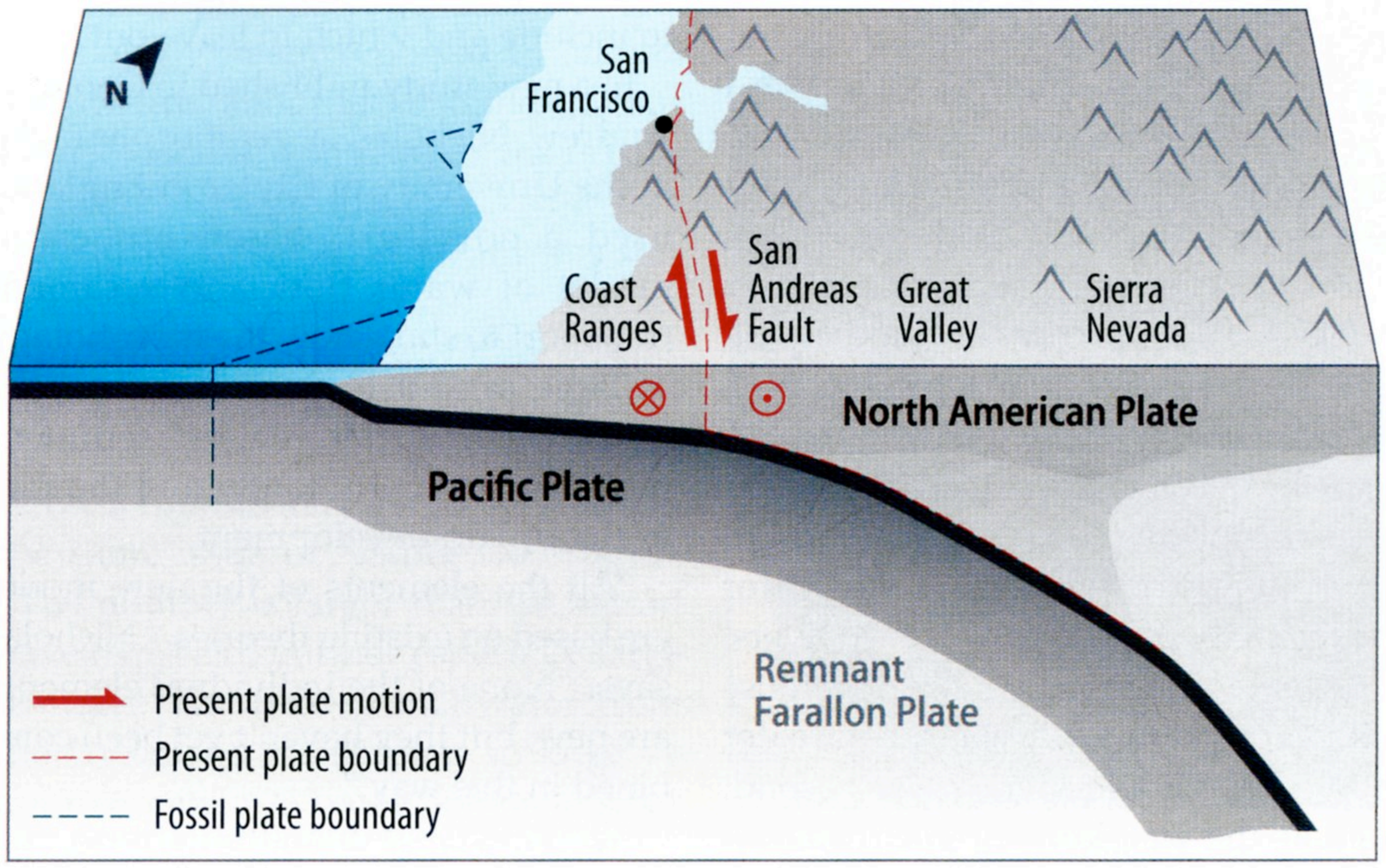
REMAINS OF TECTONIC PLATE FOUND UNDER CALIFORNIA



New imagery suggests that anomalies found beneath Central California and Baja California are remnants of the Farallon Plate.

Remnants of an ancient tectonic plate lingering beneath California might be tempering the region's earthquakes and volcanism, according to new research. Geologists suggest that two seismic anomalies found beneath the Sierra Nevada Mountains and Baja California are shards of the Farallon Plate, which began subducting under North America during the Jurassic period. But some tectonics experts are skeptical that these are actually remnants of the Farallon slab.

Geologists have known for years about these anomalies, so called because sound waves travel about 5 percent faster through them than through the surrounding rock due to their composition. The Isabella anomaly in Central California has a diameter of about 100 kilometers and was discovered in the 1980s. The fragment under Baja California stretches more than 400 kilometers from southeast to northwest and was found only in the last few years. Previously, many considered these anomalies to be parts of the overlying continental crust that are being pulled down into the mantle.

Now, a team of researchers that has developed sharper images of the anomalies using a technique called seismic surface wave tomography, which listens to the sounds of distant earthquakes travelling through Earth, suggests instead that they are leftover pieces of the Farallon Plate.

Don Forsyth, a seismologist and marine geophysicist at Brown University, doctoral student Yun Wang, now at the University of Alaska in Fairbanks, and colleagues drew their conclusions in part from two similar anomalies found farther to the north, beneath Northern California and the Pacific Northwest. These are widely recognized as remnants of the Farallon Plate, and to their west is the Juan de Fuca Plate, an unsubducted piece of the Farallon slab that now lies between the North American and Pacific plates. Two unsubducted microplates that were once part of the Farallon Plate lie to the west of the anomalies Forsyth's group studied. To Forsyth, the similarities in the seismic data suggest a relationship.

The authors also studied lavas above the Baja California anomaly that contain andesite, which is high in magnesium — a characteristic of oceanic, not continental crust. Forsyth says the lava's composition supports the idea that it originated from chunks of oceanic crust on the Farallon Plate.

The composition of the remnant slabs could be tempering the region's seismic activity, according to Forsyth. "In between the Isabella anomaly and the coast where the microplate is, the San Andreas Fault is creeping," Forsyth says. Having a portion of oceanic crust there "could supply water from below that infiltrates into the fault and creates hydrous minerals that lead to creep rather than earthquakes." When the San Andreas Fault creeps — that is, when it slips gradually rather than sticking and rupturing — it doesn't build up energy that might later be released in a violent earthquake.

Another possible benefit of the Isabella anomaly may be in limiting volcanism, the team suggested in Proceedings of the National Academy of Sciences. Unlike other parts of the "Ring of Fire" — the regions of high volcanic activity on plate boundaries surrounding the Pacific Ocean — the part of California between the coast and the anomaly has had comparatively little volcanism over the last 20 million years. Forsyth suggests that the Isabella anomaly serves as a sort of plug, blocking magma from rising to the surface in the area.

Magali Billen, a geophysicist at the University of California at Davis, who has modeled Farallon subduction, disagrees with the authors' conclusions. After activity ceased on the spreading center that drove the Farallon Plate east, Billen says the remnants would have detached from the plate in a few million years. But Forsyth's model requires the pieces to hang on for too long, about 20 million years, she says.

Billen also says that the location of the two anomalies makes it unlikely that they are related. She points out that the anomaly in Baja California is west of the San Andreas Fault, while the Isabella anomaly is to its east. "It means you actually have to drag the slab underneath the plate boundary that's cutting through the lithosphere on top of it," she says. "So I have a harder time with the interpretation of the Isabella anomaly."

Nonetheless, she adds, "I think [the paper] should motivate people like me who are doing geodynamical models to do some different things and try to see if what they're proposing is actually possible."

Sam Lemonick