



**Geological Society of America
Structural Geology & Tectonics Division**

**2015
Career Contribution Award
Presented to Tanya Atwater**

Citation by Joann Stock

I am honored to write this citation for Tanya Atwater as she receives the 2015 Career Contribution Award from the GSA Structural Geology and Tectonics Division. Throughout her career she has made numerous distinguished contributions that have clearly advanced the science of tectonics. The nomination of Tanya for this award was a group effort, because Tanya's work is so well recognized and respected by so many earth scientists. So as I provide this citation, I share it in spirit with many others, including scientists of her generation and the younger scientists who she has inspired throughout her career as a faculty member at UC San Diego, MIT, and then UC Santa Barbara.

Tanya is an expert on the tectonics of western North America and on the plate kinematics of the northeastern Pacific. She made major discoveries linking these two topics together, starting with the seminal papers she wrote when she was in graduate school. By her own account, she always liked hiking, landscapes, geometry, and maps. When she found out about field geology during her junior year at MIT, she found her calling. Being in at the start of the plate tectonics revolution, she was fascinated by all its possibilities, and by the data sets that were begging for re-interpretation to yield up their secrets. So she went to do her PhD in marine geophysics at Scripps Institution of Oceanography, studying the magnetic anomalies and bathymetry of the northeastern Pacific Ocean. Working with Bill Menard during grad school she discovered how changes in spreading direction can be deduced from magnetics and seafloor bathymetry, and she realized the potential of using this information to determine past plate motions even for plates that have now vanished.

With her unique ability to combine the geological history with details of the plate motions, and while she was still a graduate student, Tanya produced a transformative change in the geological thinking about western North America. Tanya was the first person to relate Pacific-North America plate boundary development to its geological consequences in western North America. She presented this concept to a group of geologists at a Penrose Conference at Asilomar, California, in 1969 and published an accompanying paper in GSA Bulletin in 1970. As one of her letter writers described it, "In a single, all-encompassing stroke, Tanya explained the simple reason why the geology of coastal California was so structurally and stratigraphically complicated and what the San Andreas fault was all about."

Subsequently, as the Pacific Ocean floor was better studied, and its plate tectonic history was better understood, Tanya synthesized further marine geophysical observations to map the seafloor features of the northeastern Pacific. The maps she made for GSA's Decade of North American Geology are still used as a standard now, more than 25 years later. Tanya interpreted the plate and microplate history revealed by the maps, to detail the geological consequences of

this plate motion history, and wrote a seminal paper for the GSA Decade of North American Geology volume on the Eastern Pacific Ocean and Hawaii (Atwater, 1989). She also did more geophysical cruises including numerous ALVIN dives. She wrote more papers on the geometry of the slabs that must have been present beneath North America, and on the relationship of the slabs, and the passing Pacific plate, to the tectonics of the overlying continent. This explained such things as the plate tectonic controls on the rotation of the Transverse Ranges. I had the great privilege of being a coauthor with Tanya on one of these papers. Tanya continues to be involved in this type of work up to the present time.

In parallel with her research work, Tanya made animations to show the history of plate motions and the related tectonic deformation. She founded the UCSB Educational Multimedia Visualization Center where her animations have become a very valuable resource for everyone all the way from K-12 to the professional level. The animations include the plate tectonics of the NE Pacific derived from her publications, and broader geological themes such as ice ages and sea level changes, global tectonics, basic concepts of subduction, tectonic history of the North American continent, and formation and

migration of petroleum in the Santa Barbara Channel. Tanya produces numerous insightful educational materials, and, true to her geological roots, continues to present results at geology conferences and lead geology field trips.

I didn't meet Tanya until the late 1970s when she taught the Plate Tectonics class at MIT. She taught us how much geometric sense plate tectonics makes, and how fascinating it is to do research in tectonics. She showed by her example that women could be professors, have families, do fun things in their free time, and be really nice people. Back then, I didn't know other details about her life: that Tanya's choice of seagoing work led to Scripps Institution of Oceanography changing its policy to allow women go out to sea; and that Tanya was the first female chief scientist of a Scripps cruise. In Tanya's continued work in Tectonics, as well as for all these more personal aspects of her career, she has served as an inspiration to all of us. I am delighted that the SG&T Division is recognizing the lasting impact of Tanya's scientific contributions in the field of Tectonics, by making her the recipient of this year's Career Contribution Award.

Response by Tanya Atwater

Thanks so much for this honor. I can't imagine an award that I could treasure more. Structure and tectonics are right at the center of my geological excitement. I've spent my life's work in plate tectonics, and it has been a fantastic, exciting and fun adventure! I feel blessed that I have had a life so full of good luck!

I was lucky to grow up in a family that was passionate about wilderness and natural world adventures and who infected me, my siblings, and all of our friends with those same passions. My parents viewed every child as a bundle of wonderful potential and they let us all know it. They respected us and trusted us, and they encouraged us to follow our hearts.

I've always loved visualization. I thought I'd be an artist until my high school geometry teacher gave me a great gift of self-confidence in technical visualization. In my junior year of college, I accidentally stumbled into a geology intro course and I was immediately hooked. It's a good

reminder of the importance of those big intro service courses that we teach to the seemingly unengaged masses.

I was lucky in timing to have been in on the early days of the Plate Tectonic revolution. Indeed, I arrived at Scripps a couple of weeks after Fred Vine had been there and laid out the data for sea floor spreading. The place was in a total uproar, with all the world's ocean basins waiting to be reinterpreted. I happily leapt into the thick of it – a perfect situation for an eager young student. It was perfect for me, to be able to combine my love of geometry and visualization, my love of maps, and my love of big ideas. I especially love the outrageous ideas. They often don't work out, but it is so crazily fun when an outrageous idea turns out to be true!!

And I feel especially lucky in the close colleagues I've had. In graduate school, my advisor, John Mudie, both supported me and gave me the freedom to explore whatever excited me most. Among other things, this enabled me to have a wonderful collaboration with Bill Menard, as well, who freely shared his excitement, his love of geometric problems, his large data sets, and his great store of personal knowledge of the oceans.

I owe a special debt to Bill Dickenson for the series of meetings he organized, each one going right for the center of the geological questions of the day, and for his insistence that every meeting facilitate the participation of students. I was there, eagerly lapping it up!

Warren Hamilton, Allan Cox, and Walter Pitman were generous mentors and Peter Molnar and Joann Stock have been wonderful close collaborators. The various big picture stories of Western North America could never have come together without the jamming, sharing, and enthusing with many colleagues all over the west, individually, on field trips, and in meetings. So many ideas start as sketches on napkins over lunch!

I have to thank UCSB for allowing my geo-animations to be counted as publications during promotion decisions. This was hugely important for me and for many visualizers, for whom the written word is, at best, an imperfect medium for communication. Hands-on visual communication will certainly play a much larger role in our digital future.

Thanks to the students, undergrads and grads, who have inspired me in many ways, whose enthusiasm regularly rekindled mine and, of course, who set me straight when I needed it. And thanks to workshop teachers and regular citizens who, with such attention and delight, keep reminding me of how much I love our planet.

And, of course, thanks most of all to planet Earth, so full of beauty, mysteries, adventures and surprises.