Geological Society of America
Structural Geology & Tectonics Division

2018
Outstanding Publication Award

Presented to Craig Jones, Heidi Reeg, George Zandt, Hersh Gilbert, Thomas Owens, and Josh Stachnik

C. H. Jones, H. Reeg, G. Zandt, H. Gilbert, T. J. Owens, and J. Stachnik (2014), P-wave tomography of potential convective downwellings and their source regions, Sierra Nevada, California: *Geosphere*, v.10, p. 505-533

Citation by Peter Molnar

Structural and tectonic geologists like seismic tomography. It serves up maps and cross sections, which are grist for the structural and tectonic mill. Seismic tomography is also an excellent example of faith-based science. Resulting from solutions to thousands of equations with hundreds of terms, tomography attracts those eager to believe what they cannot understand, and simultaneously instills fear into those eager to worship the unknown.

It follows that most of us rely on two criteria for deciding what tomography to believe, or not believe. First, we trust work of only some individuals, those whom we have come to trust for whatever reasons. Unfortunately, we cannot use this criterion in publications. Second, we eagerly believe tomographic results that agree with what we already think. The application of this criterion strengthens our faith, but limits opportunities to learn from tomographic results.

Let me now introduce the paper by Craig Jones, Heidi Reeg, George Zandt, Hersh Gilbert, Tom Owens, and Josh Stachnik, published in Geosphere in 2014. Jones and his colleagues relied on seismic tomography to quantify both the extent of high-speed zones beneath the ends of the Sierra Nevada, and the degree to which P-wave speeds are high. By exploiting interactive figures that Geosphere offers, but enabled by few other journals, they showed what the data really look like. For the first time ever, we readers can actually visualize all of the data used; we can see what arrival times at which stations require a localized high-speed region. Jones et al. then showed how resulting tomograms depend on assumed initial structures, what might be called devils so disguised to be details that are commonly overlooked in seismic tomography. Tomography is like most mazes; where one ends depends on where one starts. With the interactive figures, we readers can compare how tomograms depend on assumed initial structures, and then watch blue change to red, or red to blue, as we pan through the plots for 12 different initial structures, at 9 depths or along 11 different cross sections. They provide us more than 200 color plots, at no extra cost to libraries. Indeed some blue stays blue regardless of who is president, and some red would remain red even if Frog News croaked. Elsewhere, depending upon whom we believe to have a good preliminary model structure, red can change to blue or blue to red. Body-wave tomography is one step ahead of the "world's greatest democracy," however, for gerrymandering is disallowed. The amount of red must equal the amount of blue. So, if Jones et al. had included a corrupted starting model structure, published perhaps by Feknuzovich and Vikiliksof, and your favorite blue region became red, no worries; some red region must turn blue to maintain the balance.

Perhaps not quite for the first time, but surely with much better ability that ever before, we readers can make objective decisions about what in tomography to believe. If one tomographic study deserved an A grade, it would be theirs. It is no wonder that Craig was instrumental in enabling Geosphere to develop the capabilities that allowed him and his co-authors to do what they have done.

Consistent with the traditions of these authors, the paper does not stop with the multitude of color plots, but follows with an in-depth assessment of what it all means. Blobs of blue mantle lithosphere have coalesced into drips dropping through the red asthenosphere. Moreover, by integrating wave-speed anomalies over volume, they could quantify not only the amount of material in the drips, but also match it to the volume from which the drip has come. The drips have not yet reached a depth of 250 km.

If you are among the many who categorically disbelieve most tomography, this paper might change your mind. If you among the many who categorically do believe most tomography, this paper should change your mind.

Response by Craig Jones

Thank you, Peter for the nomination and that exceptional citation, and thanks to the members of the awards committee and the Division at large. When you look at the previous winners and this paper, you appreciate that this committee takes the time and effort to look at thick and difficult papers, which must be a time-consuming task.

This paper represented a couple of firsts, and I'd like to acknowledge those. We presented results from the very first Flex Array deployment made in concert with the Transportable Array component of EarthScope. Although this was not the first paper out of that experiment, it was one of the more voluminous consumers of the data that were laboriously acquired. I think it is important to acknowledge NSF's support of Earthscope as well as our particular project. I think it gratifying that this major initiative of the earth science community has produced a best paper in the view of this division. But it is also important to not overlook the 21 non-coauthors who spent weeks or even months in the field helping to acquire this data, not to mention the dozens of land owners and land management agencies that worked with us.

The second first is that this paper contains three unusual figures, figures I like to call dynamic figures, that Peter highlighted in his citation. Although including stuff like this in Geosphere had been part of the motivation for launching the journal in the first place, actually placing such creatures within a paper and not burying them in supplemental materials had proven to be a difficult barrier to clear. So when we submitted this to Geosphere, it took considerable work bythose behind the scenes to get the paper to move through the submission system and then through the publication process so that dynamic figures could take their rightful place as proper figures within a paper. So in addition to editor Carol Frost and theme guest editor Jason Saleeby, we want to thank GSA folks Bridgette Moore, Eric Christensen, Matt Hudson and Jeanette Hammann for making this possible. And we hope that this paper inspires others to take advantage of the unique opportunities now possible in Geosphere.

Last, I must thank the community of Sierran researchers who met with us in workshops, at meetings or collaborated on other aspects of the SNEP experiment or the associated Sierran Drips CD project with us. The wide-ranging discussions on different facets of the tectonic problems in the Sierra helped to hone our analysis to this level.

Once again, thank you all.