GEORGE P. WOOLLARD AWARD

Presented to
Eugene D. Humphreys

Eugene D. Humphreys
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Citation by Alan Levander

Many of us in Earth sciences were attracted to the field by a love of the outdoors, and I think in this regard Gene Humphreys is no exception. In his youth, Gene made several extended bike trips around the western U.S. that sparked his interest in Earth science and his curiosity about how the west became the way it is. Listening to Gene describe his bike trips, my impression is that he had experiences that combine Jack Kerouac's "On the Road", John Steinbeck's "The Grapes of Wrath", and John McPhee's "Basin and Range", against an aesthetic backdrop of Ansel Adams.

Many other things about Gene seem to be the exception rather than the rule. As an example, he's apolitical in the broadest sense of the word, in my opinion this is an essential part of a scientist's character: Gene comes to any Earth science problem interested in what is true, and although he gives credit for the provenance of ideas, his interest in the more social aspects of science are confined to the pleasure of having interesting friends and colleagues to work with. A self-taught, and gifted amateur photographer, Gene can see multiple scales, tones, facets, and dimensions, and has a keen sense of motion and time, in any scene that he sets his eye and his mind to. These qualities have served him well as an Earth scientist.

Few geophysicists have made as many, or as diverse, contributions to understanding geology using geophysical methods as Gene. Among them is the development of the tomographic method for imaging with seismic waves. Seismic tomography was developed for different purposes almost simultaneously by several academic groups in the US and Europe, as well as by a large research team at one of the US oil companies.

As a graduate student at Caltech, Gene Humphreys, with his advisor Rob Clayton, developed regional teleseismic tomography, and applied it to data from the southern California seismograph array. They presented their results, which included the Transverse Ranges high velocity mantle drip and the Salton Trough low velocity mantle upwelling, at an historic session at the 1984 Fall AGU meeting. The meeting room was packed, the questioning was lively and at times heated, and the audience left with a sense that our field of science had been fundamentally altered: The upper mantle, until then, had been largely *terra incognita*. The discussions continued, radiating out in all directions, as the session adjourned and the audience dispersed. Gene continued this early work in tomography as a young professor at the University of Oregon with a group of talented students, producing tomographic models for many parts of the western U.S. upper mantle, in fact almost every part that had permanent seismograph arrays.

Gene was one of the early proponents of USArray. The first P-wave velocity anomaly map of the entire western U.S. was a compilation of results from many different seismic arrays produced by Ken Dueker and Gene. This image became one of the selling points for USArray, because of the surprisingly high degree of upper mantle heterogeneity it exhibited. I think Gene was startled by how popular the image became, and a bit disappointed at how little people actually tried to understand it.

A great photograph not only has technical brilliance it has some element of beauty and soul, which, translated to Earth science, is what Gene extracts from his seismic images:

As examples: Gene and Ken Dueker interpreted their upper mantle images for physical state, invoking global and regional convection systems to produce the compositional, thermal, buoyancy, and rheologic variations that explain the character of the large tectonic provinces in the western U.S. Gene proposed the "Folded Taco" model for removal of the Farallon slab from beneath the western U.S. to explain the early Cenozoic ignimbrite flare up. He and his colleagues proposed that flat Farallon slab dehydration mechanically weakened the lithosphere leading to the Laramide uplifts, and he and other colleagues developed an upper mantle corkscrew flow model in the wake of the Yellowstone hotspot. Gene and Karl Karlstrom first documented the importance of inherited Precambrian mantle structures in modulating Phanerozoic tectonics in western North America. In the shear wave split map of the western U.S., Gene and George Zandt have identified toroidal asthenosperic flow around the southern edge of the subducted Farallon plate. Gene has also developed a force balance model, or a stress balance model, if you prefer, for the entire North American plate, because he wants to understand how the western orogenic belt came to be the way it is.

As an Earth scientist I think that it's impossible to think about the western U.S. as a geologic entity without thinking of the works of Clark Burchfiel, George Thompson, Tanya Atwater, and Gene Humphreys. Their papers are essential reading for understanding the western US orogenic plateau.

It gives me great pleasure to see Gene receive this year's George P. Woollard award.

Response by Eugene D. Humphreys

Thank you, Alan, for the nice words. And also, I'd like to acknowledge the GSA and the Geophysics Division for keeping geophysics alive within the GSA. It is at the GSA that a geophysicist can best keep up with the geological observations that place so much constraint on our mutual effort to understand the Earth.

I would also like to thank the succession of Earth scientists who I've had the good luck to encounter. My progress in Earth sciences has been largely a consequence of their talents and efforts. This includes Shawn Biehler and Tien Lee at UC Riverside, who each demonstrated deep interest in understanding the Earth and integrity in this endeavor (excellent lessons for a young student). At Caltech I was blessed when two new faculty, Rob Clayton and Brad Hager, arrived full of enthusiasm. I benefited greatly from their creativity and insight, and by having these two for advisors and friends. Since coming to the University of Oregon, Harve Waff's spontaneous honesty and Doug Toomey's persistent pursuit of quality in science and all facets of life have provided a good perspective as well as the basis of good friendship. And working with Alan Levandar has been both a joy and a good example of

one who sets his mind on achieving and then doing so. Also essential to me have been many outstanding students, who number too many to mention here. However, I am compelled to mention Ken Dueker for his insistence on getting to the bottom of an issue, with little regard for dogma. And, of course, my wife Monica deserves a special thanks for not only enriching my life, but for putting up with the demands of my work.

Finally, I acknowledge the geologic and geophysical community at large; this is an unusual group of people who share freely of ideas, enjoys the effort to understand the Earth, and appreciates each other. I have not seen this in other professions, so I think we must consider ourselves fortunate.

To conclude, I think it is remarkable that I have been given chance to simply do what I enjoy, the financial and moral support to do so, and the opportunity to contribute to the field and those involved. To be acknowledged for this is a surprise and a pleasure.