Harry Fielding Reid Medal Citation for Kerry Sieh

It is my great pleasure, and privilege, to present the citation for Kerry Sieh, recipient of the 2014 Reid Medal of the Seismological Society of America, the society's highest honor.

Kerry's budding fame had reached my ears long before our first encounter. In the summer of 1979, on my first, lonely trip to the People's Republic of China, the only reading I brought with me was the 1978 JGR volume that contained Kerry's long "Pallett Creek" paper. I have admired his work ever since. We met 3 years later, at a conference on Continental Earthquakes in Beijing, where he presented another memorable study, with Clarence Allen, of offset drainages along the Red River fault. This initiated a decades-long scientific friendship, punctuated by travels to Caltech or Paris, walks along the San Andreas, and lively discussions about faults - the cornerstones of our common geological interests.

In his now century-old elastic rebound model, Harry Reid demonstrated that elastic strain builds up in the crust over long periods of time and is cyclically released by sudden fault slip in earthquakes when the accumulated stresses exceed rock strength. No geologist has contributed more to understand and constrain seismic cycles on faults than has Kerry Sieh in the past 35 years.

In the now famous Pallett Creek exposure, from an exquisitely, archeologically documented, stratigraphic record of 9 successive fault ruptures, he was the first to determine quantitatively earthquake return times on the San Andreas fault. The impact of that seminal study was huge. It triggered a frenzy of similar trenching efforts worldwide, provided a basis to estimate probabilistic seismic hazard in California, and marked a quantum leap in the use of geology to understand earthquakes. It opened the possibility to look back hundreds or thousands of years into the past, well beyond the bounds of written history. At the same time, Kerry published the first graph of co-seismic slip on the fault, quantifying the along-strike slip function of the 1857 earthquake. From the non-uniform distribution of such slip, he proposed two of the still most plausible models of recurrent earthquake rupture, now dubbed "characteristic earthquake" and "characteristic slip" models. The twin papers heralded the birth of both microstratigraphic and microgeomorphic paleo-seismology, changing once and for all our ways to observe seismogenic faults.

In following years, with students and post-docs, Kerry continued to lead in the study of California's active faults, be it the San Andreas, determining for instance the first direct, modern geological slip-rate at Wallace creek, pioneering 3D trenching, etc…, or thrusts and folds in the Los Angeles basin. He contributed to document ever more accurately contemporaneous Californian earthquake ruptures and teamed up with colleagues to start the Southern California Earthquake Center.

Progressively however, impatient with the slow pace of progress, hampered by radiocarbon dating uncertainties, along the San Andreas fault Kerry expanded his research to active faults under more distant horizons, reaching out of the Californian realm. He sometimes jokingly credits my frequent teasing about his California-centric work to have contributed to that expatriation.

The great Sumatran strike-slip fault initially attracted him to Southeast Asia. But, inspired by F. Taylor's use of corals to measure near shore vertical movement and by the >10 precision gain of Edwards and Wasserburg's U/Th dating technique, he focussed on the Sunda mega-thrust, historical source of giant earthquakes in Sumatra. He realized that the offshore islands, located on a culmination of the accretionary wedge, would be ideally positioned to record not only sudden, co-seismic uplift/drowning of coral microatolls but also slower interseismic vertical motions above the locked subduction plane.

That, indeed, proved to be the case. Beyond all expectations! His careful, detailed analysis of the cm/yr growth of corals, involving a fresh crop of students and Post-docs, led to a second salvo of ground-breaking results, and to the development of another novel field: "paleogeodesy". Not only did coral growth anomalies allow to determine the calendric dates of past great events, back to the 12^{th} century AD, but they also afforded to peer into the interseismic phases of ancient super-cycles. In 2004, that work was boosted by the serendipitous onset of a bicentennial sequence of great/giant earthquakes, which is still in progress. Furthermore, just before that sequence started, Kerry had begun installing an array of cGPS stations (SuGAr) - funded by Caltech's newborn Tectonics Observatory - above the mega-thrust. This unique concurrence of scientific approaches, helped by Nature's hand, continues to yield unprecedented insight into coupling, patch failure, and afterslip along the subduction interface. Beyond the impressive collection of milestone papers, an important outcome of that endeavor was the forecasting of a giant earthquake in the Mentawai gap, which led the Indonesians and their collaborators to initiate tsunami mitigation plans in the onshore area around Padang, home to over 1 million people.

Last but not least, Kerry Sieh engaged in 2008 into the creation of the Earth Observatory of Singapore, dedicated to fundamental research on natural hazards, towards safer and more sustainable environments in SE Asia. In just 5 years, this now 12 faculty strong, Nanyang Technological University research center has grown into a unique cluster of closely interacting scientists working on faults, earthquakes, tsunamis, volcanoes and climate, with a reach extending from Indonesia and the Philippines to China and Nepal. It is well on its way to achieve world-recognized excellence, a daring challenge given the previous dearth of Earth Sciences in Singapore.

Throughout his stellar academic career, Kerry trained and mentored generations of PhDs, PostDocs and colleagues. To a degree, it may be said that every paleo-seismologist in the world today is a student of Kerry Sieh. Beyond academic circles, Kerry also relentlessly directed his energy towards outreach applications impacting society and public safety. He is a Member of the National Academy of Sciences, a Fellow of both the American Geophysical Union and Geological Society of America, and has been awarded several other distinctions. As founder and Director of the Earth Observatory of Singapore, he became 2 years ago the recipient of an AXA Foundation Professorship at NTU, first chair of the kind created in Asia.

From his early days walking or biking much of the 360-km length of the Fort Tejon earthquake rupture to his present leadership of a pioneer institute at the bow of SE Asia, Kerry Sieh has transformed the way we think about earthquakes and earthquake hazard more than any geologist in recent decades. In this regard, one may say that he stands in direct line to Darwin and Gilbert, the prescient geomorphology giants of 200 and 100 years ago. With his sharp eye for selecting the most revealing sites and his fastidious attention to stratigraphic detail, he has been able to fully promote the importance of looking at the traces of earthquakes in a discipline owned mostly by scientists who listen to them and unravel elastic waves wiggles. Metaphorically, one might say he helped connect past geological engravings with present geophysical sounds.

No geologist at this time is more worthy of the Harry Fielding Reid medal.

Paul Tapponnier

15 April 2014

(1164 words of text)