# YOUNG SCIENTIST AWARD (DONATH MEDAL)

**Presented to Cin-Ty A. Lee**

Cin-Ty A. Lee
*Rice University*

### *Citation by Roberta L. Rudnick*

Cin-Ty Lee is a Renaissance man — the breadth of his interests is astonishing, not even considering his books, articles and paintings focused on birds. Cin-Ty is making a major impact in our understanding of how the Earth works; he has written on topics as diverse as the origin and evolution of the continents, the oxygen fugacity of the mantle through time, chemical fluxes between the solid Earth, hydrosphere and atmosphere, soil development in tropical weathering environments, thermodynamics of trace element partitioning in the mantle and even detecting nucleosynthetic processes through analyses of meteorites. Equally important, he has been an outstanding mentor of young scientists, who have flourished under his tutelage.

Cin-Ty has made important contributions to the study of the continents –for example, understanding why the continental crust is not made up of basalt and how it attained its average andesite composition. Using the Mesozoic arcs developed in the western US as natural laboratories, he has been able to determine the processes (arc accretion, suturing, partial melting, crystal fractionation and density foundering) by which arcs become continents. He has quantified the rate of mafic/ultramafic cumulate recycling to the mantle via density foundering and, in combination with the chemistry of rivers, the degree to which the bulk composition of the continental crust is influenced by weathering.

Cin-Ty has also made major contributions to understanding the origin of the strength of continental lithosphere. Archean cratons are generally considered to have strong lithosphere, likely due to the thick, viscous mantle keels that underlie them. By determining the age of lithospheric mantle beneath different portions of the southwestern US using Os model ages for peridotite xenoliths, Cin-Ty was able to show that Archean lithosphere underlies some regions (e.g., Mojavia terrane) that have not been particularly strong. Other regions, such as the Colorado Plateau, which consists of Proterozoic lithosphere, are stronger. The difference in strength is attributable to the degree of melt depletion experience by the lithospheric mantle, with more refractory lithosphere being stronger, irrespective of the age. His work on continental lithospheric strength continues with an investigation of the water contents of mantle peridotites from diverse areas, in order to deduce the influence of water on lithosphere strength.

Unraveling the effects of composition from those of temperature on the seismic velocity of mantle peridotite has always been a problem. Cin-Ty has demonstrated that the composition of mantle peridotite can be gleaned, independently from temperature, by examining the velocity ratio of compressional (P-wave) to shear (S-wave) seismic waves and in this way, seismic velocities can be used to infer composition of cratonic keels. Most recently, he has published what is sure to be a seminal paper that demonstrates how basalt chemistry can be used to infer pressure and temperature of origin.

Cin-Ty began his career as an undergraduate at UC Berkeley, working with George Brimhall on the Sierra Nevada, a place near and dear to his heart and where he returns even today to unwrap their mysteries. I was lucky to attract him to work with me at Harvard for his Ph.D.; a trip to Tanzania helped me seal the deal, where he racked up over 400 life-birds in a brief three weeks. During his Ph.D., Cin-Ty built on his experiences in Tanzania to investigate continental mantle lithosphere underlying diverse regions of the continents and how this lithosphere affects the ultimate strength of the continents. After a one-year post-doc with Gerry Wasserberg at Cal Tech (where he still made beautiful paintings of birds), Cin-Ty took up a faculty position at Rice in 2002. Here he flourished, interacting with a wide cross-section of faculty, publishing at a prodigious rate and, most importantly, becoming a superb mentor to a remarkable array of young scientists (undergraduates, graduate students and post-docs) who have gone on to their own great accomplishments. The young scientists Cin-Ty has mentored have gone on to graduate study or postdoc positions at Columbia, Harvard, Princeton, CalTech, Stanford, Brown, UT Austin, Peking University and Yale. I think, more than anything, Cin-Ty has the ability to bring out the fun in science and instill this in his collaborators and students.

Based on his creativity, his cross-disciplinary collaborations and his focus on the "big picture", Cin-Ty is a clear leader among young Earth Scientists. He has received recognition for his creativity in the form of a Packard Fellowship, was chosen for the inaugural Kuno award of the AGU's Volcanology, Geochemistry and Petrology section and was this year's Clarke Medalist of the Geochemical Society. It seems fitting that Cin-Ty's work is also recognized by the Geological Society of America, as he is one of the best and brightest of the new generation of multi-disciplinary geoscientists whose work embraces geophysics and geochemistry but is fundamentally pinned in geology.

### *Response by Cin-Ty A. Lee*

I am incredibly honored to be receiving the Donath medal. However, the reason why I'm here is that many people helped me along the way. High school was a tough time for me, but my parents and my brother provided the emotional and intellectual support to get me through. I was also blessed to have Doug and Robyn Morton and John and Karen Bolm take me out on geology and birding trips as a teenager, infesting me with the love of nature and giving me something that I desperately needed to focus on. As a freshman at Berkeley, I wandered aimlessly, but then I took two classes, mineralogy from Wenk and intro petrology from Brimhall. Berkeley's impact on me was profound as to some extent, much of what I do now had its spores in Berkeley: Brimhall introduced me to the Sierra Nevada and xenoliths; DePaolo – crust and geodynamics, Carmichael – oxygen fugacity and silica activity, Manga – the art of making simple models, Helgeson – thermodynamics. As for grad school, I actually thought I was going to be a geophysicist, but in my last year at Berkeley, two things happened: (1) I was studying Sierran xenoliths with Brimhall, and

(2) Ducea and Saleeby came out with a paper on xenoliths and delamination. I realized then that what I wanted to do was work on xenoliths and study the deep lithosphere. One of few afflicted with xenolithic tendencies was Roberta Rudnick at Harvard. She was going to study the Tanzanian craton. I was hooked. Of course, when we landed in Tanzania, I was distracted by the birds. Don DePaolo had given me a piece of advice that I've never forgotten, "when you begin your Ph.D., it's monkey-see, monkey-do. Eventually, you'll develop your own twist." Well, to make a long story short, Roberta trained me, let me cut my teeth on the petrology of the Tanzanian cratonic peridotites, and encouraged me to focus both on details and the big picture. I couldn't have asked for a better adviser. Since then, it's been one fun journey to where I am now. Of course, many other people have also influenced me. Yin, McDonough, Jacobsen, O'Connell, Hoffmann, Dziewonski, Grove, and Frey at Harvard/MIT were role models. Gerald Wasserburg took me on as a post-doct and taught me how to think. At Rice, I had the opportunity to pick Bill Leeman's mind, interact with Lenardic, Niu, Levander, Gordon, Morgan, J. Anderson, Don Anderson, Albarede, Blichert-Toft, and finally our two newest faculty, Dasgupta and Gonnermann. I also had the chance to re-connect scientifically with Doug Morton, develop collaborations with Terry Plank, Dante Canil, and many others. Most importantly, I have been lucky enough to work with many students and post-docts, Mark Little (who is now a GSA Congressioal Science Fellow), Li, Horodyskyj, Turner, Thiagarajan, Harbert, Agranier, Young and presently Dyer, Luffi, Höink, Shen, Le Roux, Dalton, and Chin. Last but not least, the one who really made all this happen is my wife, Yu-Ye.