American Mineralogist, Volume 107, page 991, 2022

Presentation of the Mineralogical Society of America Award for 2021 to Chenguang Sun

Yan Liang[1,*]

[1]Department of Earth, Environmental and Planetary Sciences, Brown University, Providence, Rhode Island 02912, U.S.A.

It is a great pleasure to present to you this year's MSA Award recipient Chenguang Sun. Chen, as everybody calls him, did his undergraduate study at China University of Geosciences in Beijing. He earned his Ph.D. from Brown University and did his postdoc work at WHOI and Rice University before taking on his current position as an assistant professor at the University of Texas, Austin.

The MSA Award recognizes Chen's fundamental contribution in advancing our knowledge in quantifying trace element partitioning in major rock-forming minerals and in developing new interpretation tools for understanding the thermal history of mafic and ultramafic rocks and for carbonatite melt and peridotite interaction.

Chen came to Brown in the Fall of 2008. He was quiet but curious and exceptionally talented. His first project was originally focused on trace element fractionation during mantle melting. In the Spring of 2010, we got frustrated by pyroxene-melt REE partitioning: there were many partitioning studies in the literature, but we were not sure how to pick the right ones for our melting model. To get to the bottom of this problem, Chen developed a new generation of parameterized lattice strain models for REE partitioning between major rock-forming minerals (clinopyroxene, orthopyroxene, olivine, garnet, and plagioclase) and basaltic melts. Although REE partition coefficients for pyroxene vary significantly as functions of temperature and pyroxene composition, he showed that the temperature and composition effects practically canceled out during adiabatic mantle melting. One can, therefore, use a set of constant partition coefficients for REE in the two pyroxenes in geochemical studies of mantle melting. This is good news for geochemical modeling.

During the course of Chen's mineral-melt partitioning studies, we became worried if the parameterized lattice strain models were consistent with each other. To test internal consistency, Chen calculated mineral-mineral REE partition coefficients by taking the ratio of his two mineral-melt partitioning models. He then carefully compared his model-derived mineral-mineral REE partition coefficients with those directly measured REE partition coefficients for orthopyroxene-clinopyroxene, garnet-clinopyroxene, and olivine-clinopyroxene pairs in well-equilibrated mantle xenoliths and found excellent agreements between the two sets of data. This not only gave added confidence to Chen's mineral-melt partitioning models but also led to a new set of mineral-mineral REE partitioning models for studying REE fractionation during subsolidus re-equilibration. Most trace element studies of peridotites, eclogites, and mafic cumulates have focused on clinopyroxene and garnet. Chen's subsolidus work has stimulated new geochemical studies of REE in orthopyroxene and plagioclase in mafic and ultramafic rocks.

Chen also played a pivotal role in the development and applications of a class of new thermobarometers that are based on the temperature, pressure, and mineral composition dependent REE partitioning between two minerals in a rock. Since REE diffusion in pyroxene, plagioclase, and garnet are considerably slower than Ca, Mg, and Fe diffusion in the respective minerals, the closure temperatures of REE are higher than closure temperatures of Ca-Mg-Fe in the mineral systems. Hence the REE-in-two-mineral thermobarometers have the potential to record high-temperature events and can be used to unravel the thermal history of mafic and ultramafic rocks. This opens up new research opportunities in igneous and metamorphic petrology.

Chen's work is not limited to trace elements. He made an important contribution to understanding the interaction between slab-derived carbonatite melt and peridotite in the upper mantle and transition zone. Based on results from his multi-anvil experiments and published phase equilibria data for CO_2-bearing peridotites, he developed parameterized models that quantify mineral modes, melt fraction, and melting reaction in the system peridotite + $CO_2 \pm H_2O$. What makes Chen's work stand out is its quality in laboratory experiments, its rigor in the statistical treatment of experimental data, and its creativity in process-orientated interpretation. This is a hallmark of Chen's research, whether it is trace element partitioning, thermobarometry, geospeedometry, or melt-rock interaction. This thread of scientific inquiry will carry him further, and I look forward to seeing where his talents and curiosity take him next.

Chen has been incredibly generous. He taught his fellow graduate students how to implement global or simultaneous inversion of mineral-melt partitioning data. He made considerable efforts converting his original MATLAB codes to more accessible Excel spreadsheets, even though he did not need these spreadsheets in his own research. Now anybody can download his Excel calculators for mineral-melt partition coefficients, REE-in-two-mineral thermobarometers, two-element coupled speedometer, and melting phase relations in peridotite + $CO_2 \pm H_2O$ systems from his website. This is above and beyond for an early career scientist in community service. Mr. President and members of the Society, I take great pride and pleasure to present you Chenguang Sun as the recipient of the 2021 MSA Award.

* E-mail: Yan_Liang@brown.edu

0003-004X/22/0005–991$05.00/DOI: https://doi.org/10.2138/am-2022-AP10756