

**Student questions: SESE Graduate Student colloquium:
Qian Yuan: A "Lunatic" View in Earth's Interior and Beyond**

4/13/22

If the LLSVPs are truly fragments of Theia's mantle, is there a possibility that similar structures/materials are present within the Moon's interior as well?

QY: Great question! It is definitely likely, there is a study by Chuan Qin et al. (2012) in Icarus suggests similar structure in the lunar mantle, while their study does not particularly relate that structure to Theia. The point is we really know so little about the interior of the Moon, while if our study may indicate similar giant impact remnants may occur in other rocky planets (e.g, Mars) because giant impact is predicted to be very common in the early solar system.

Do you think Theia's impact had other effects on the evolution of Earth besides the anomalies that you explained?

QY: Nice questions. Yes, all giant impact simulations show the core of Theia quickly merged with that of the proto-Earth. Thus, this impact should change the composition of Earth's core, which may influence geodynamo that accounts for Earth's magnetic field.

Can we predict where Theia would have struck proto-Earth based on the distribution of the LLSVP (e.g., African and Pacific LLSVP's) around the outer core?

QY: Fantastic question. There is a consensus in the community that Earth's solid mantle will convect in Earth's history, so the current position of two LLSVPs is less likely to tell where Theia have struck proto-Earth. But the viscosity of lower mantle is poorly constrained, thus there might be possible ways to say more about this question if the viscosity is very very large and well constrained.

What seismic waves are used to map the 3D model of the low-velocity zone?

QY: Shear-wave in my model, but many studies using another body wave, P (compressional) wave also show these two low-velocity zones.

Can better seismic data of the moon constrain the chemical density or is it well established?

QY: Better seismic data will definitely help us to understand the structure and density property of the Moon and Earth, and I have to say the community seems to agree Moon's mantle is denser than Earth's as lunar mantle has more FeO.

The concept of possibly having Theia's mantle inside of earth is amazing, but what impact would that have on our planet?

QY: Thanks, as I mentioned in the second question, it would have influenced the magnetic field, and other possible effects would be on the surface as this impact substantially changed the chemistry and structure of atmosphere and upper mantle, which may eventually lead to the habitable surface condition on Earth.