GUANGPU YI

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RESEARCH INTERESTS

I use geodynamic models to explore the evolution of deep mantle structures like the large low shear-velocity provinces (LLSVPs) and ultra-low velocity zones (ULVZs). I am interested in how they interact with subducted slabs, mantle plumes and Earth's outer core. I am also intrigued by topics including subduction process, early Earth geodynamics, and terrestrial planetary sciences.

EDUCATION

Ph.D. student in Geological Sciences, Arizona State University, Advisor: Mingming Li — 2024 - present

M.S. in Geophysics, University of Science and Technology of China, Advisor: Wei Leng — 2021 - 2024

B.S. in Geophysics, University of Science and Technology of China — 2017 - 2021

RESEARCH EXPERIENCES

3D Numerical Modeling of Fossil Ridge Subduction beneath Sumatra — 2023 - Present
Supervisor: Prof. Wei Leng (USTC)

- Aimed at investigating into slab morphology beneath North Sumatra, constraining the existence and detailed structure of previously proposed rupture: is there slab folding, vertical tearing, or a slab window?
- Conducted 3D thermo-mechanical simulations of fossil ridge subduction, in which inactive spreading centers and transform faults are set according to Wharton Fossil Ridge and the Investigator Fracture Zone.
- Found that oceanic plate with fossil ridge that died 30 Ma is hard to break off at its spreading centers during subduction, and vertical tearing happens late when the slab detachs as a whole.

Dynamics of Slab Tearing Caused by Trench's Dramatic Retreat and Bending — 2022 - Present
Supervisor: Prof. Wei Leng (USTC)

- Aimed to explore the process of slab tearing in a geodynamic context where the trench has experienced dramatic retreat and bending, which may contribute to the subducting slab's lateral tension.
- Performed a series of 3D finite-element models of strongly-bended-trench subduction, in which we varied the trench geometry, the initial friction coefficient, the age, and the velocity of the oceanic plate.
- Suggested that a dramatically curved trench can cause thinning of the subducting slab, and that vertical tearing happens where the orientation of the trench changes by $\sim 60^\circ$ in ~ 200 km. The process is mainly controlled by the trench geometry and can be widely observed in regions like Mariana and Caribbean.

Earth's Thermal Evolution Constrained by Geodynamo's Power Requirements 2019 - 2021

College Student Innovation Program

Supervisor: Prof. Jinshui Huang (USTC), collaborated with Cichao Xie

- Gained a basic understanding of self-excited homopolar geodynamo, in which the magnetic field of either sign can be sustained equally well after the seed field is removed.
- Modified the calculation for variation of magnetic Reynolds number with core's heat flow based on mixing length theory and magnetostrophic regime theory. The results still supported the conclusion that the criterion for a dynamo may not differ greatly from the criterion for core's thermal convection.
- Re-estimated the thermal history of deep Earth based on the power requirements for the geodynamo with newly constrained core-mantle boundary heat flow of 5-13 TW, which implied lower mantle's cooling from ∼3100 K to ∼2600 K after inner core's formation at ∼1 Ga.

PROFESSIONAL SKILLS

Geodynamic Simulation: Citcom
Programming Languages: C, MATLAB, Python, Fortran, IDL, Bash
Softwares: Generic Mapping Tools (GMT), GPlates, Paraview, LaTeX

HONORS & AWARDS

Scholarship for Postgraduate Studies	2021, 2022, 2023
Outstanding Student Scholarship	2020
Outstanding Freshman Scholarship	2017

CONFERENCE ABSTRACTS

Yi, G. & Leng, W., 2023, Slab tearing beneath Sumatra: Insights from 3D numerical modeling, Annual Meeting of International Professionals for the Advancement of Chinese Earth Sciences (IPACES), Hefei, China Poster

Yi, G. & Leng, W., 2023, Slab tearing caused by trench's dramatic retreat and bending, Annual Meeting of Chinese Geoscience Union (CGU), Zhuhai, China Abstract PowerPoint

FIELDWORKS & ACTIVITIES

Volunteer work in International Conference of Deep Space Sciences (ICDSS)	2023
Volunteer work in the "Science Popularization Week" activity	2019, 2022
Observation of rocks and terranes at Chao Lake and Ta-pieh Mountains	2020, 2021
Involvement in the installation of GNSS stations in Chuzhou	2020
Study tour to seismic monitoring stations in Fuzhou	2018
Measurement of water quality in Tongling	2018