

ESS 502: Mid Term Project

Investigate an aspect of the “Standard Model.” Develop an understanding of the geophysical tools used to gather evidence supporting the “Standard Model” and identify anomalies or weaknesses with these interpretations.

The following effort is requested:

1. Initiate your study as a team effort. 2-3 people can work together to discuss the issues and to develop the understanding of the background material. (ungraded – just a check off that the group discussion occurred)
2. The final (individual) written report will be approximately 4 pages of double-spaced text that must include the following (due on Wednesday, Feb 21) :
 - a. An abstract
 - b. The use of 2 or more geophysical tools in the analysis
 - c. Identification of data (observations) used to support your interpretations and the inherent weaknesses.
 - d. Identification of an alternative model and assessment of the success or failure of the alternative view to “explain the data.”
 - e. Summary of situation and suggestion concerning possible “next steps.”
 - f. Reference list
3. An oral presentation (Tuesday, Feb 20)

A few interesting papers:

The Dynamics of Cenozoic and Mesozoic Plate Motions Carolina Lithgow-Bertelloni, Mark A. Richards *Reviews of Geophysics*, 36, 27, 1998 (this is work within the “Standard Model” but they identify problems and weaknesses)

Top-Down Tectonics; Don L. Anderson, *Science*, 293, 2016, 2001 (Don is the consummate contrarian in geophysics. He knows all the facts.)

Compositional Stratification in the Deep Mantle , Louise H. Kellogg, Bradford H. Hager, Rob D. van der Hilst, *Science*, 283, 1881, 1999 (a fluid dynamic modeler, a geodynamist, and a seismologist “stirring the pot” with an alternative idea).

Whole-mantle convection and the transition-zone water filter, David Bercovici & Shun-ichiro Karato , *Nature*, 425, 39, 2003
(A modeler and a laboratory experimentalist “stirring the pot” with the suggestion of a very water rich transition zone)

An Alternate Earth, Warren B. Hamilton, *GSA Today*, Nov. 2003 (an effort to reinterpret all the geophysical and geochemical data – a contrarian “full court press.”)

Subducted slabs stagnant above, penetrating through, and trapped below the 660 km discontinuity, Fukao and Obayashi, *JGR*, 2013.

Invitation to give a Keynote Lecture

Congratulations! On the basis of your outstanding scholarship, we invite you to deliver a featured talk at the 47th annual MAD (Mantle Activists for Dynamics) meeting. We would like to hear your perspectives on the state of efforts to understand mantle processes and dynamics.

Lectures will begin at 7:00 on Tuesday, February 20. Please send me your talks by email or bring it on a jump drive. Powerpoint or .pdf work best.

You should clearly state your views on the scale/style of mantle convection as well as the primary evidence supporting your views.

Once stated simply and succinctly please present the relevant details, identifying what we know (and don't know), and what directions of future research might provide the answers to the outstanding problems in the field.

Finally conclude with a precise statement of your views and the primary evidence supporting them.

Each group will have 20 minutes to speak, followed by questions.

Each group will then have 5 minutes to point out the primary flaw(s) in the other group's ideas regarding the style of mantle convection.

We will then take a 5 minute recess for each group to discuss their response to the "flaws" exposed in their views to be followed by a brief time for rebuttals and further discussion.

Each of you should ask at least one question during the session.

Each of you will be asked to write down and turn in the main message you heard from the other students.

Sincerely,

The MAD Organizing Committee