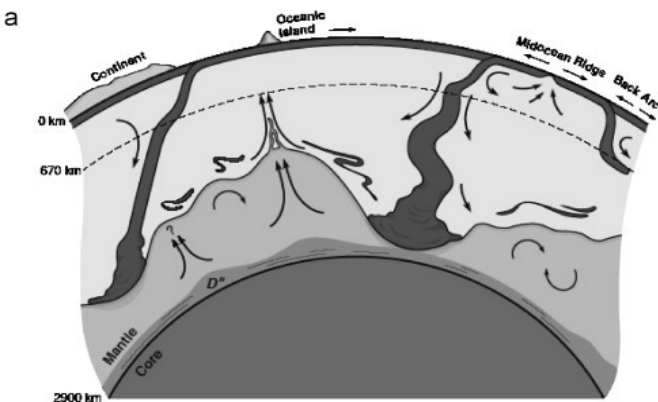


Lower Mantle Mg/Si*: seismic constraints and applications

Cayman Unterborn, Timo Heister, Ian Rose, JiaChao Liu, Yu Huang
Sanne Cottaar, Valentina Magni, Mark Hirschmann, Barbara Romanowicz

Aug 10, 2012



* atomic ratio



Geochemical Answer

	CI Chondrites ^a	U Mantle ^b	BSE(1) ^c	BSE(2) ^d	L Mantle(1)	L Mantle(2)
MgO	16.08	38.73	38.0	31.8	37.8	29.5
SiO ₂	22.82	44.71	45.0	51.6	45.1	53.9
Mg/Si	1.06	1.30	1.27	0.92	1.26	0.82

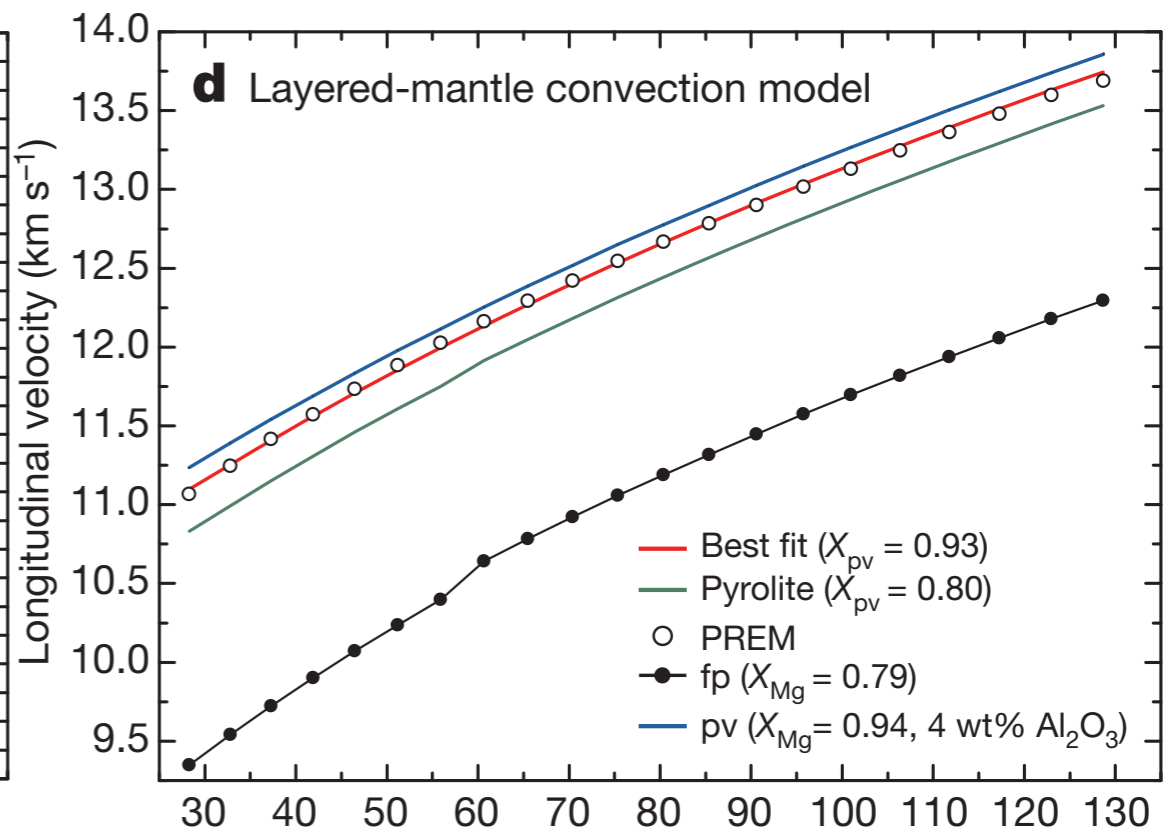
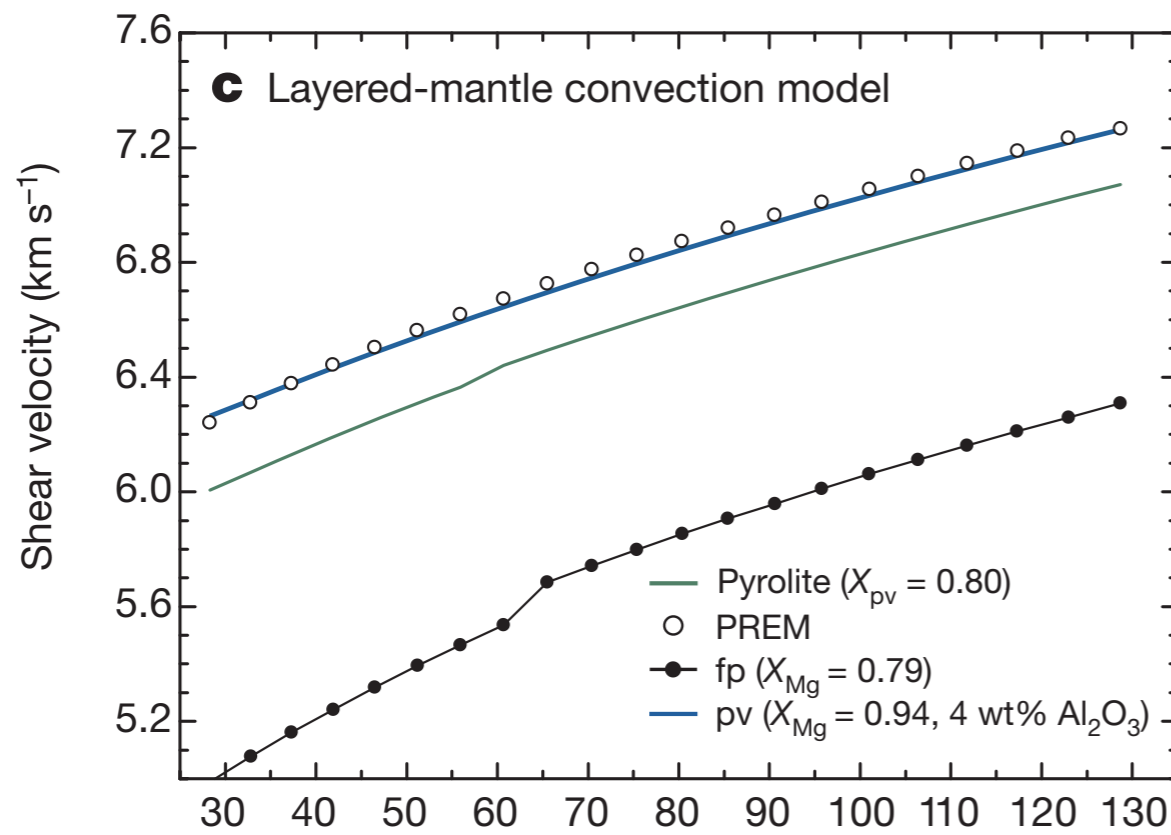
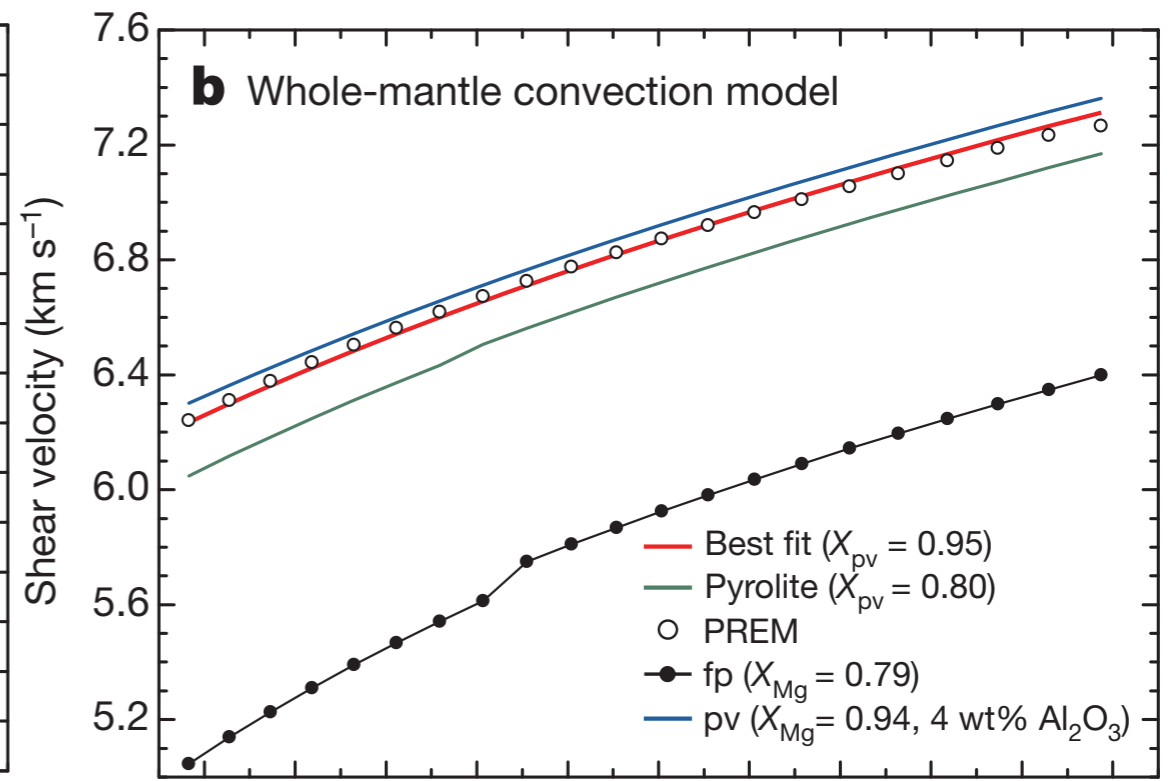
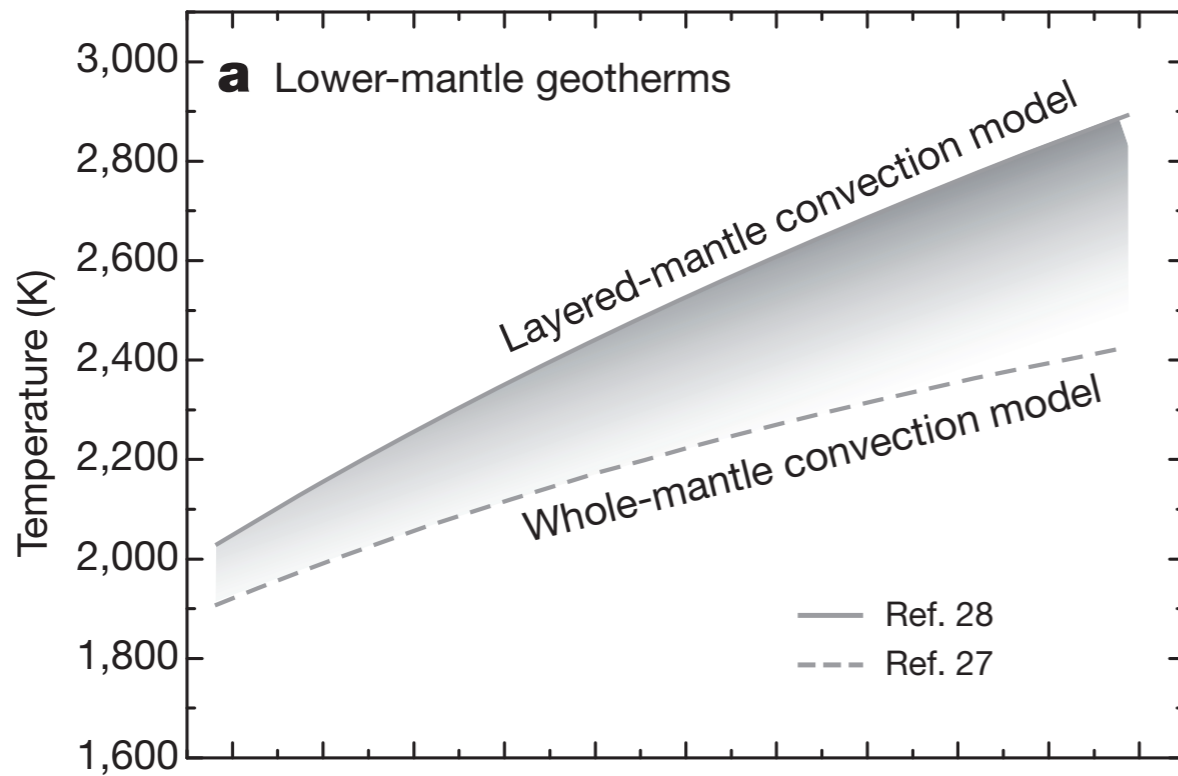
Crust is not included; upper mantle has 25% mass of BSE

(1) Pyrolite model

(2) Enstatite model



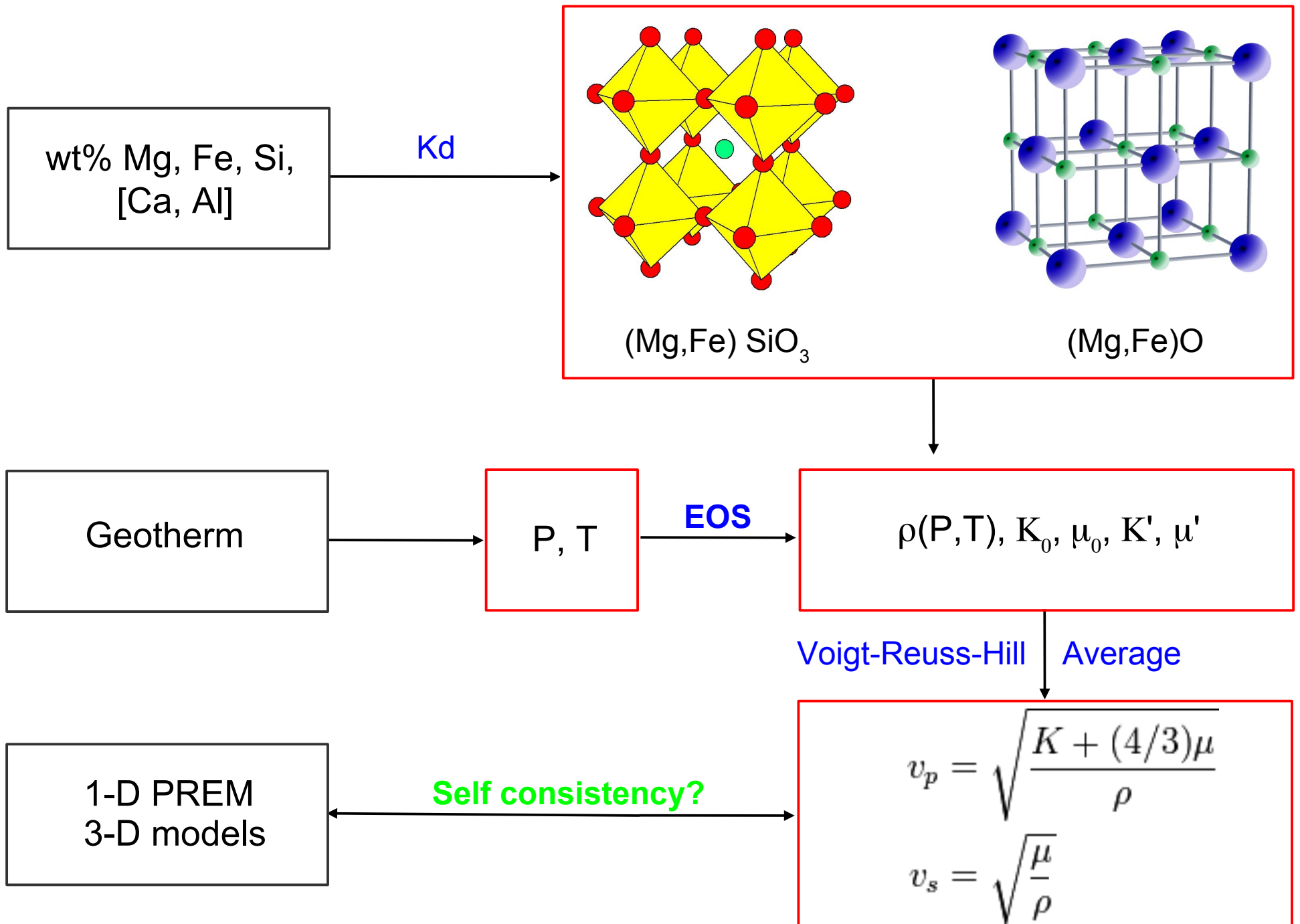
^aWasson&Kallemeyn 1988; ^bWorkman&Hart 2005; ^cMcDonough&Sun 1995; ^dJavoy et al. 2010



Pressure (GPa)

Murakami et al. 2012

Forward Flow Chart

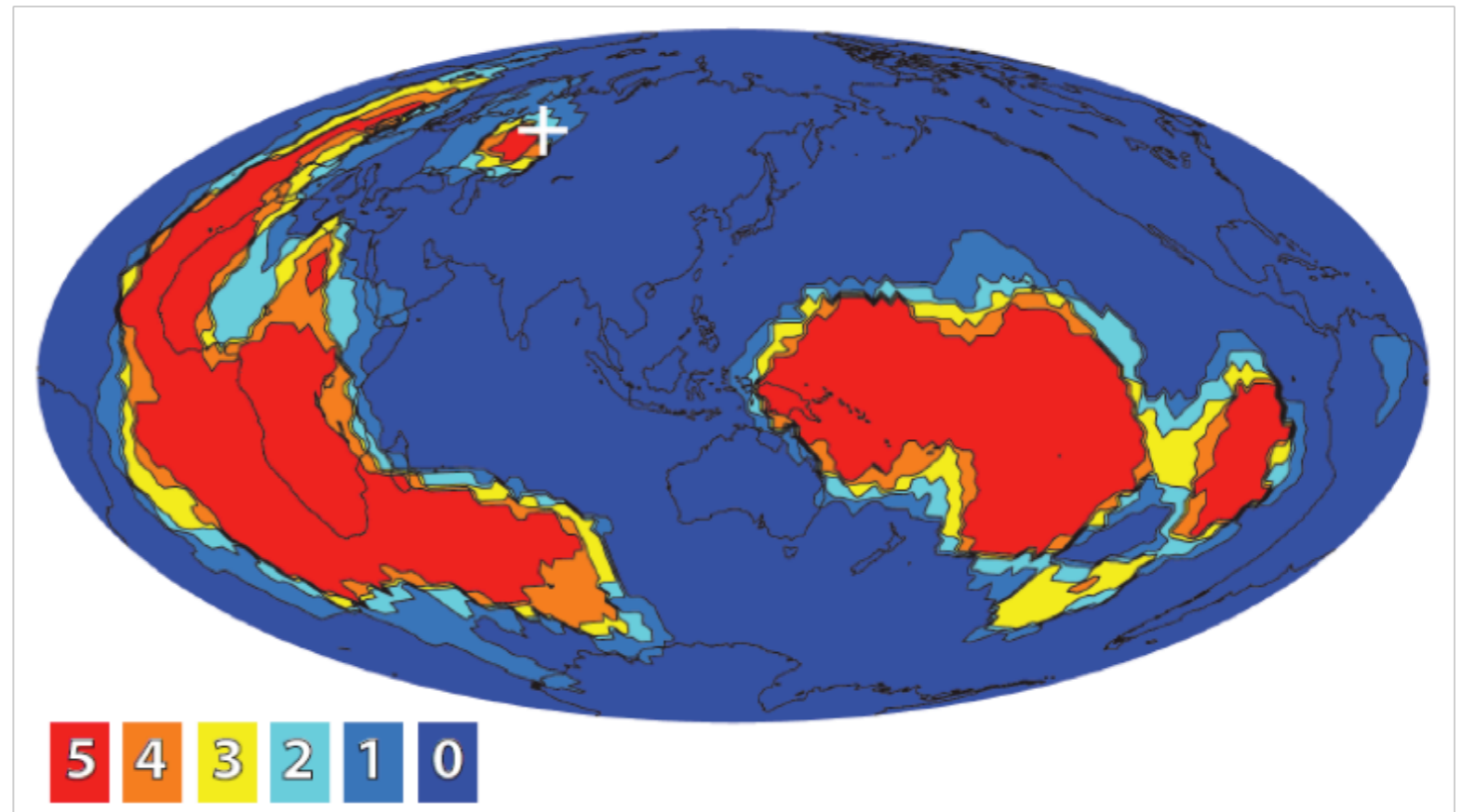


Seismic Reference Models in BurnMan

S-wave clustering

Lekic et al. 2012

includes 5 models

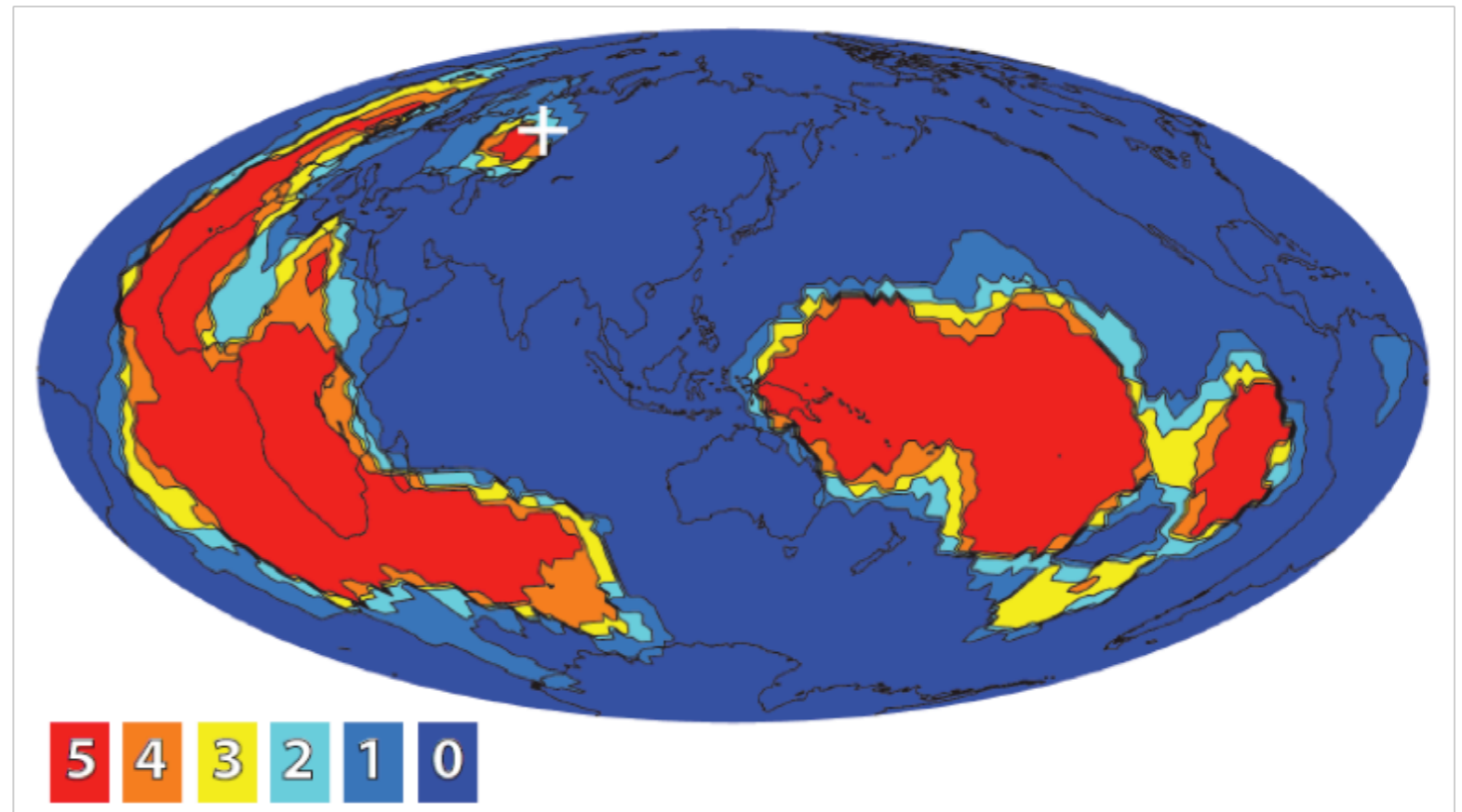


- cluster each 3D model into two families, one 'fast' and one 'slow'
- count for each location how many models are 'slow'

Seismic Reference Models in BurnMan

S-wave clustering

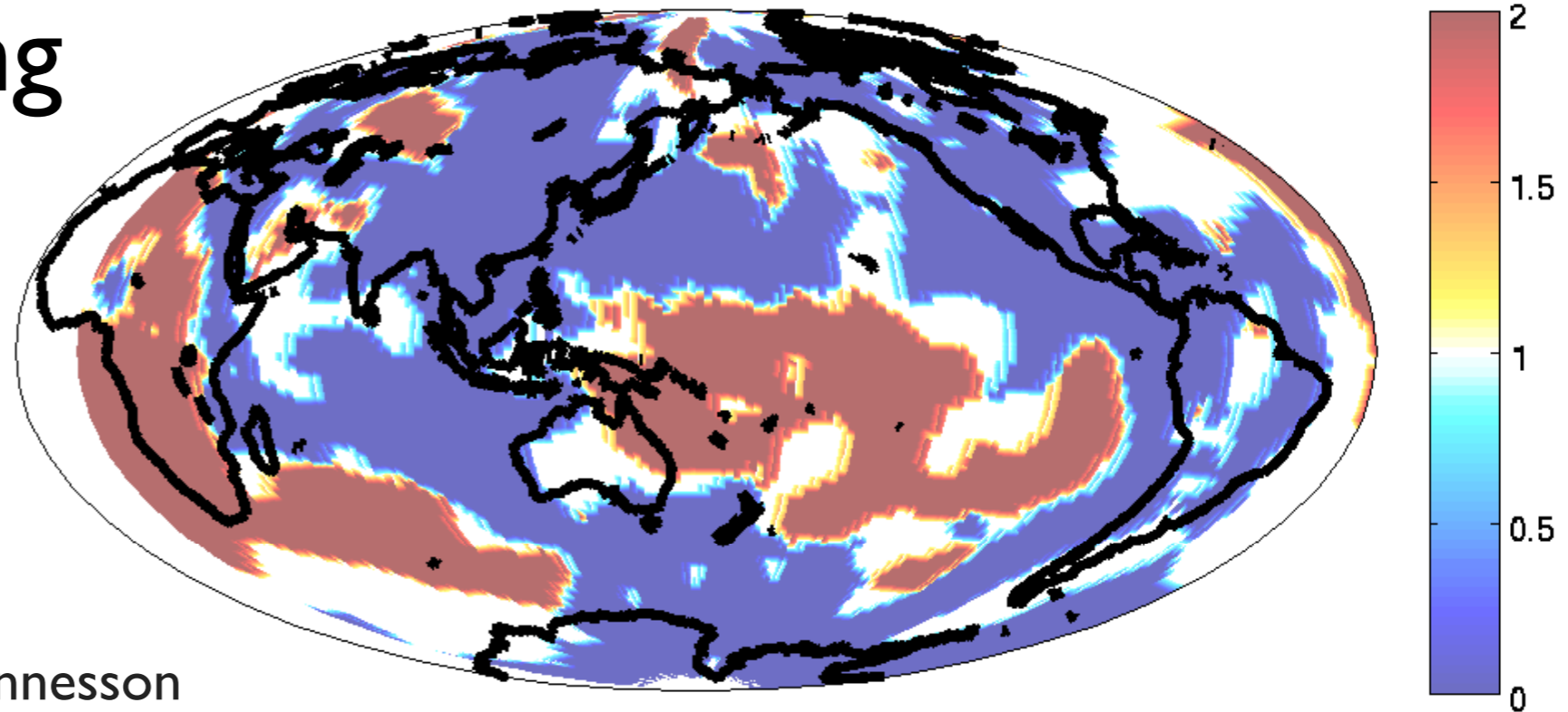
Lekic et al. 2012



P-wave clustering

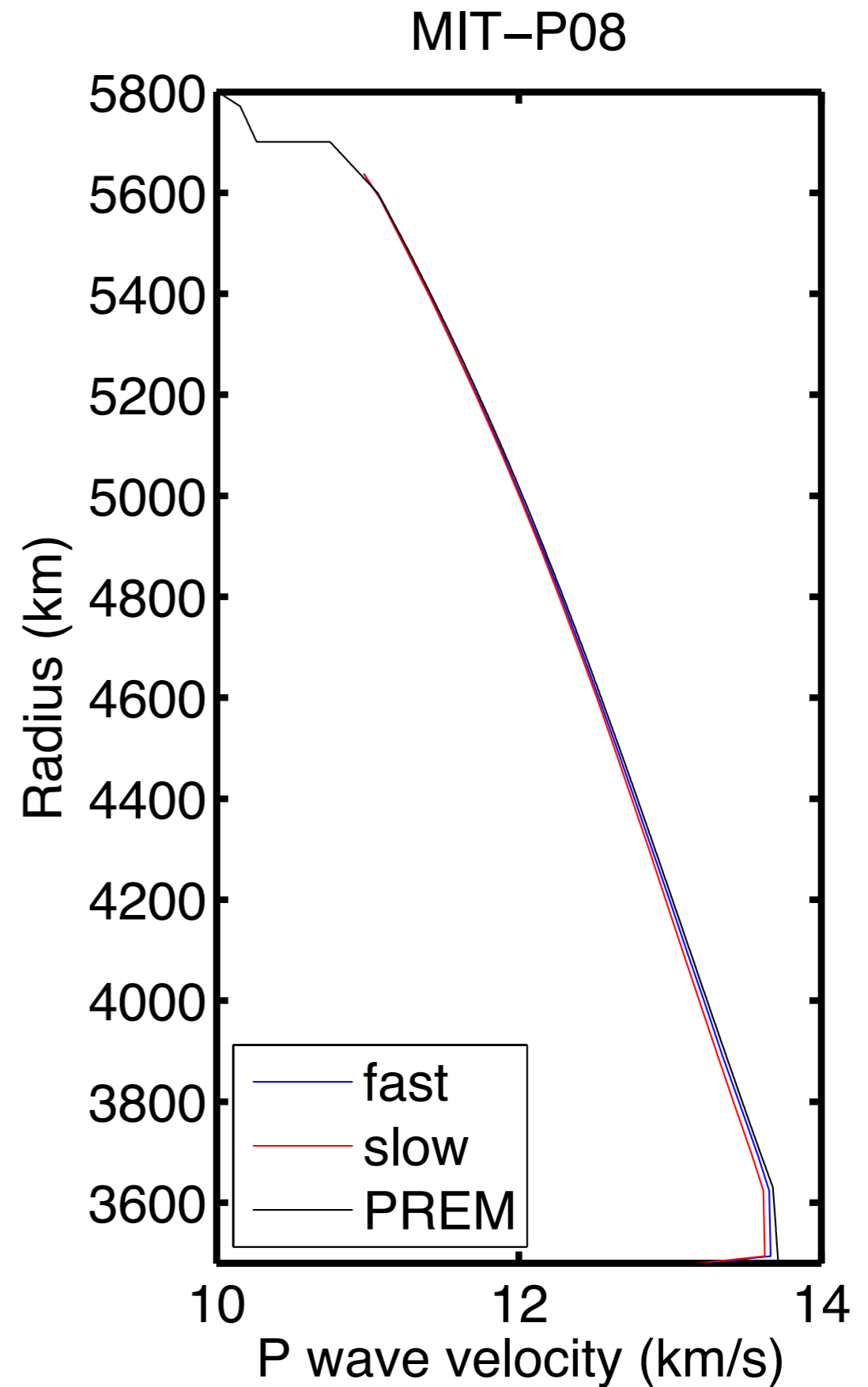
P-MIT08 (Li et al. 2008)

P-LLNL (Simmons, Myers, Johannesson and Matzel (2012, Accepted to JGR))

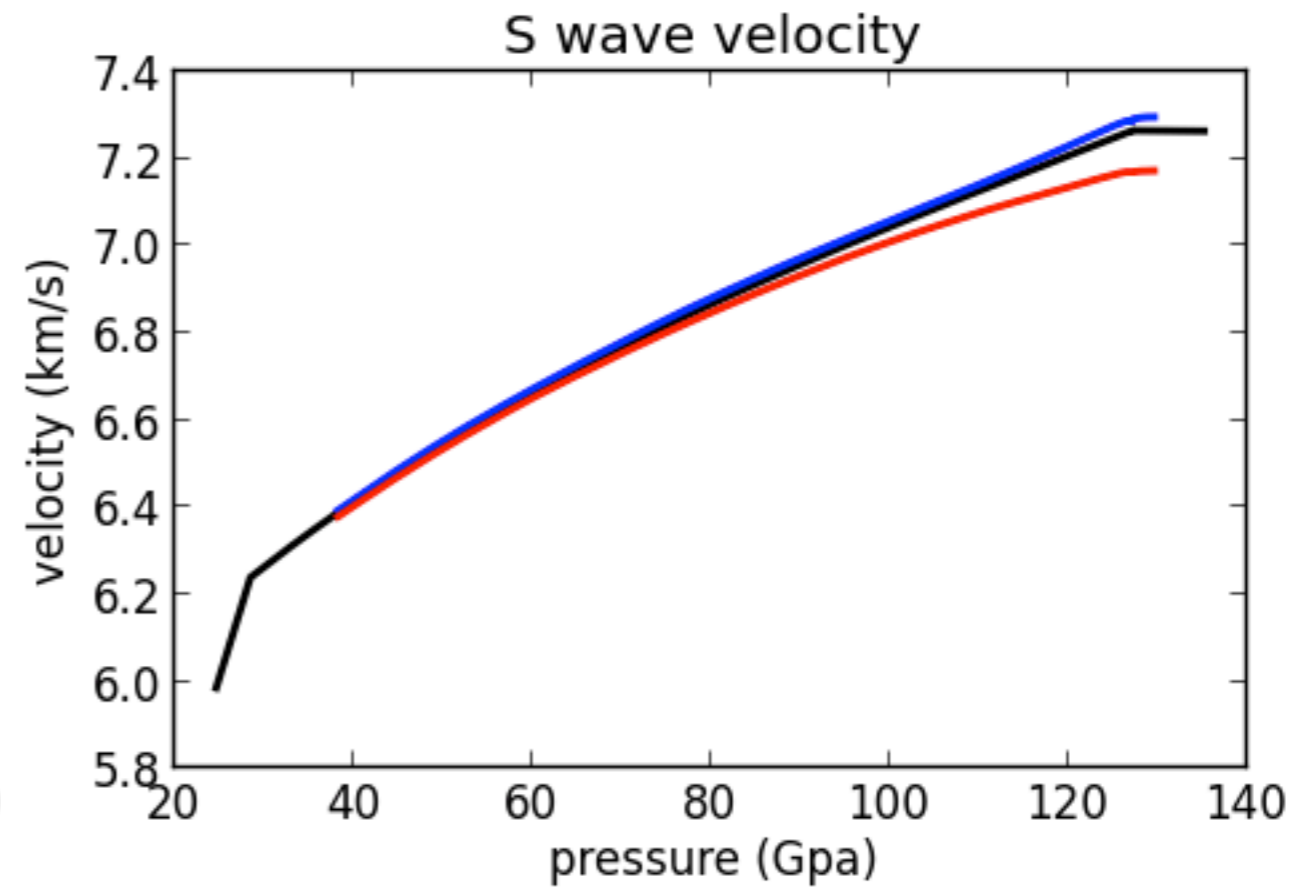
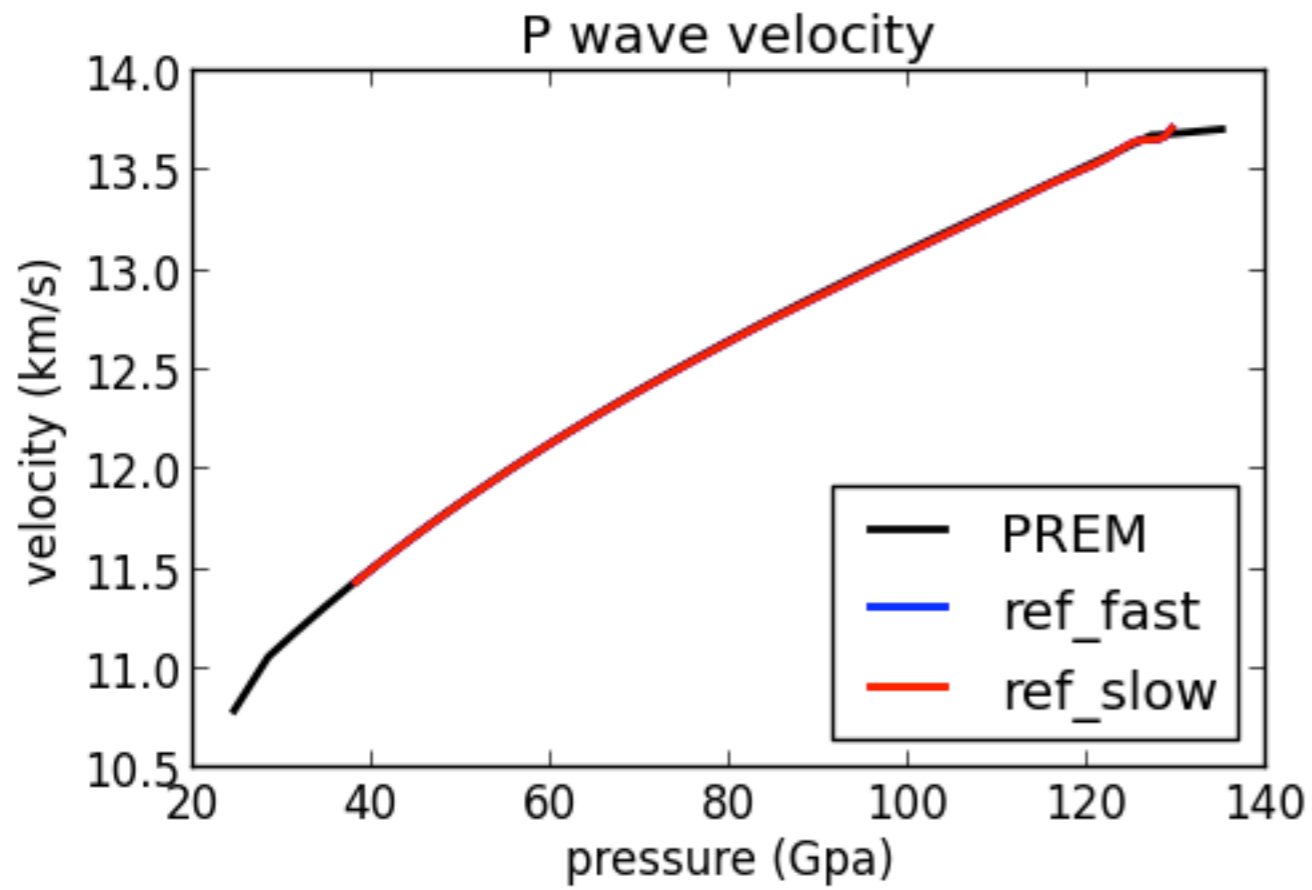


Seismic Reference Models in BurnMan

- Variations in P wave velocities are very very small
- 3D models are slower than PREM

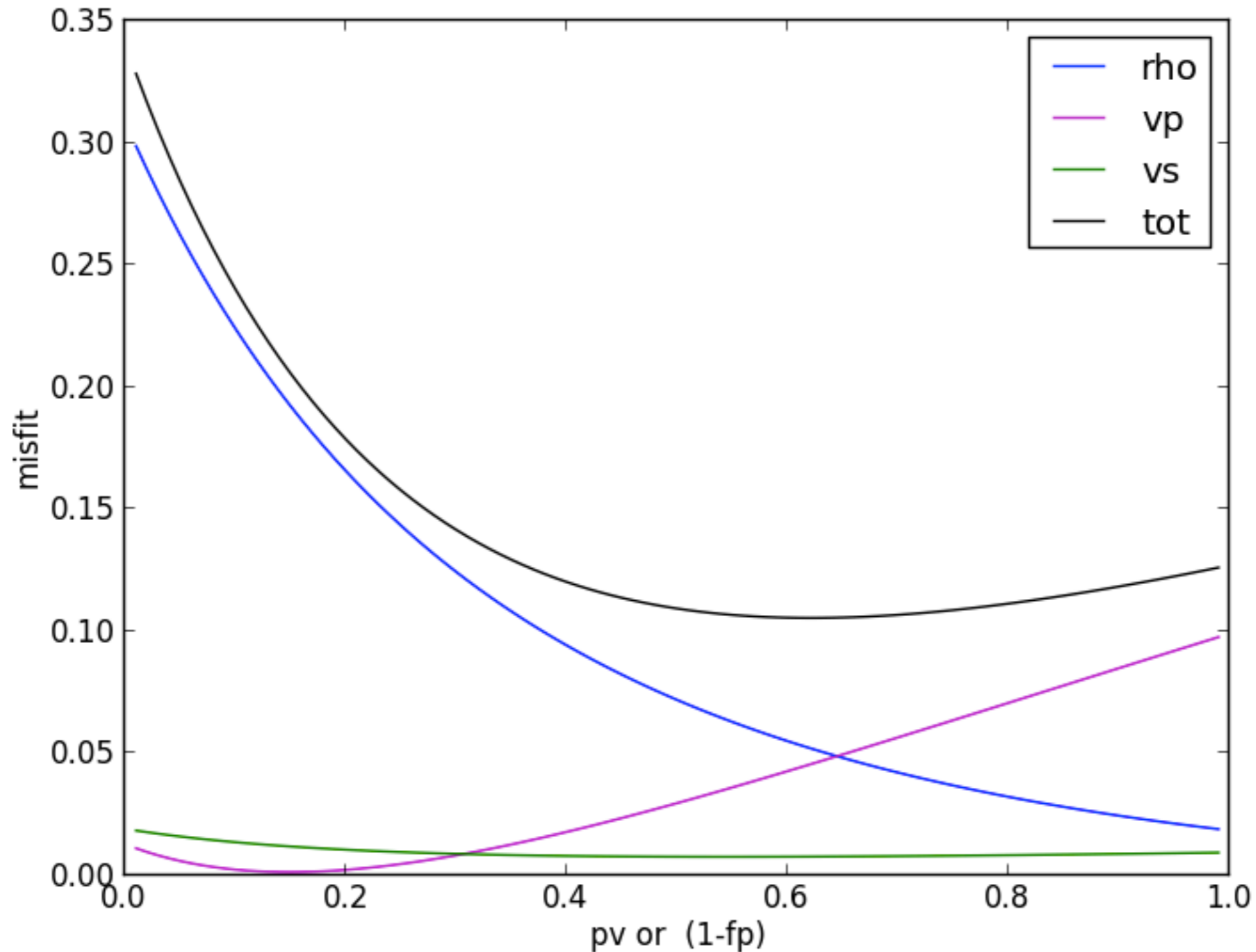


Seismic Reference Models in BurnMan



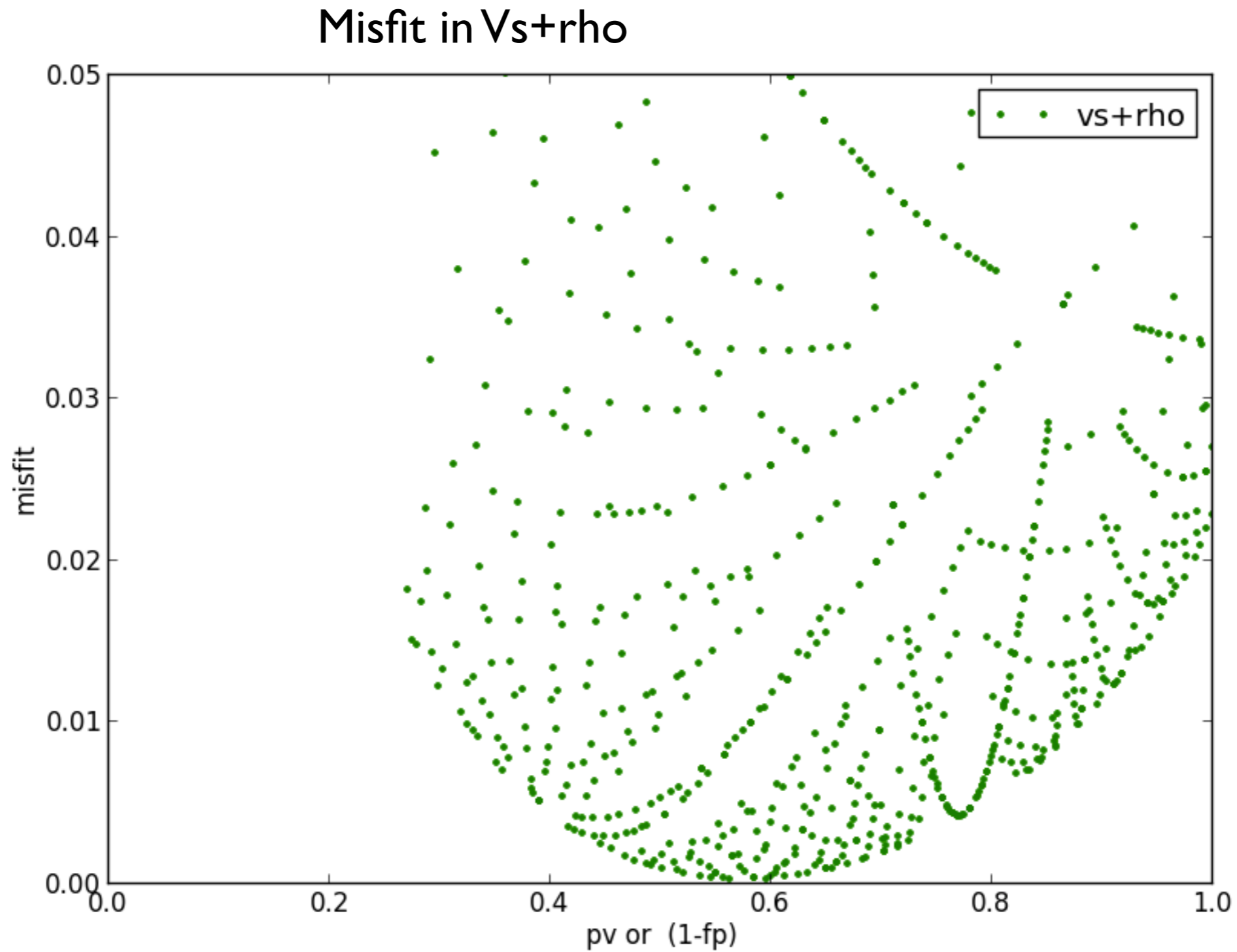
GridSearch in BurnMan

- Fits in V_s , V_p and ρ searching over mixtures of pure mg-perovskite and periclase
- Without iron density is too low, so none of them fit



GridSearch in BurnMan

search over Mg, Si, Fe weight %

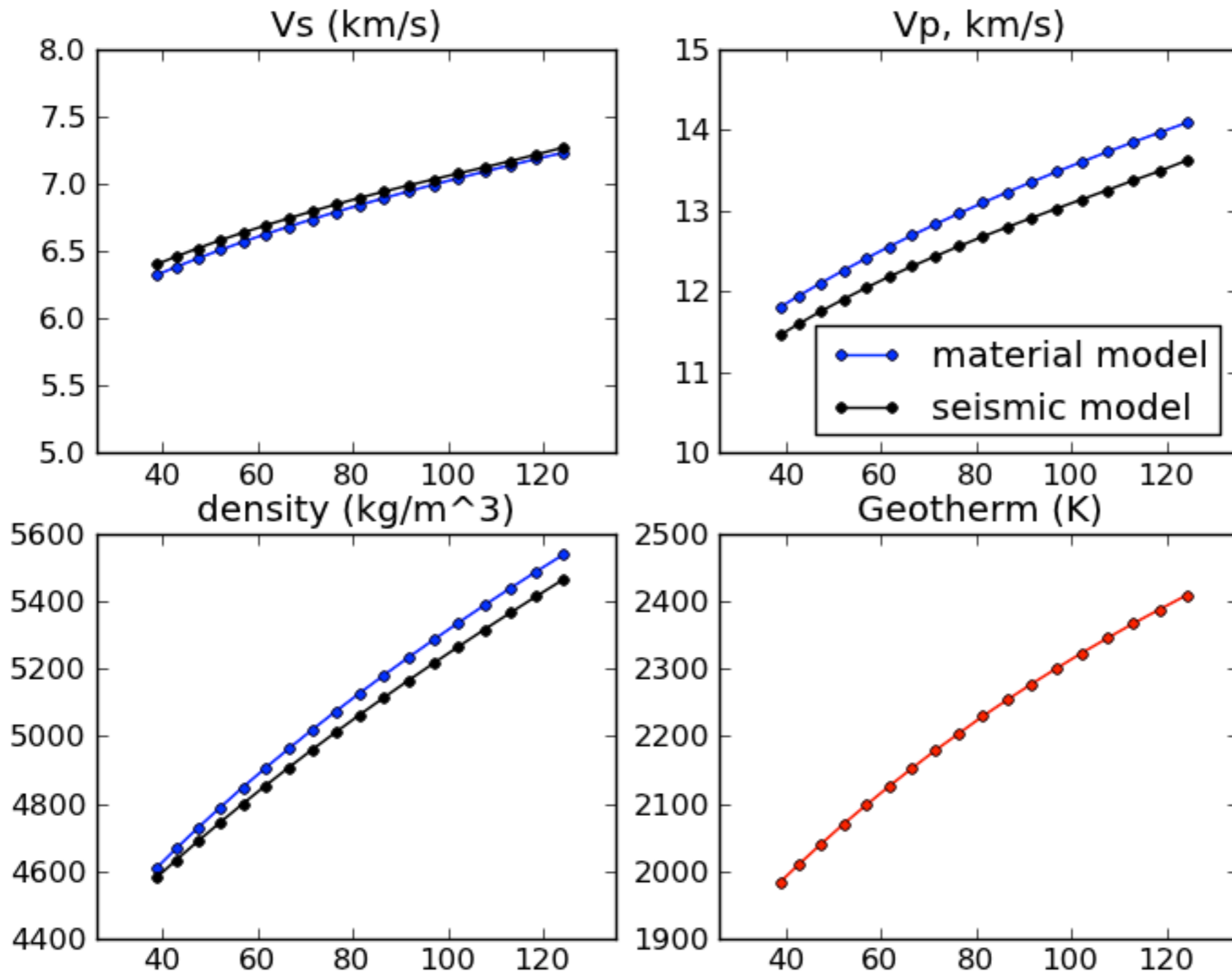


GridSearch in BurnMan

28% Mg, 22% Si, 7% Fe

69% perovskite 31% periclase

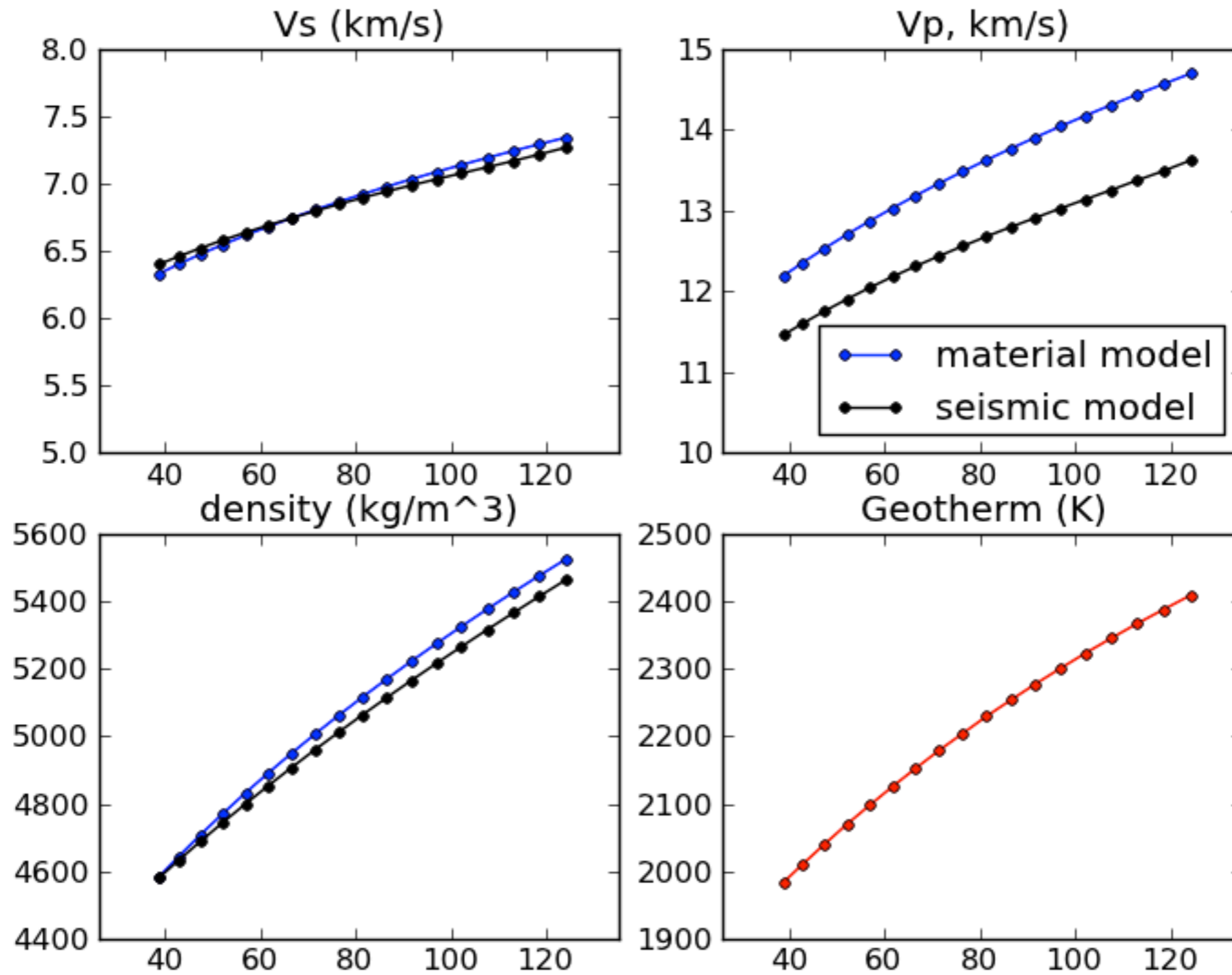
Mg/Si > 1



Stishovitic lower mantle in BurnMan

50% SiO₂, 50% ferro-periclase(25% Fe)

Mg/Si < 1



Future Plans with BurnMan

- Add in Al, Ca
- Finish the code to make it available to all
- AND find the Mg/Si ratio of the lower mantle