

What is our goal?

Fast & accurate set of routines to calculate phase assemblage and their chemical compositions in the lower mantle conditions. Set is used in StagYY code for planetary geodynamics simulations.

Why we study it?

Realistic numerical model of the solid-liquid equilibrium in the Earth's mantle is vitally important to simulate and understand mantle convection dynamics and formation of lithospheric plates and igneous rocks

Whole geodynamic system behavior (and numerical model results) depends a lot on properties of phases, especially melts.

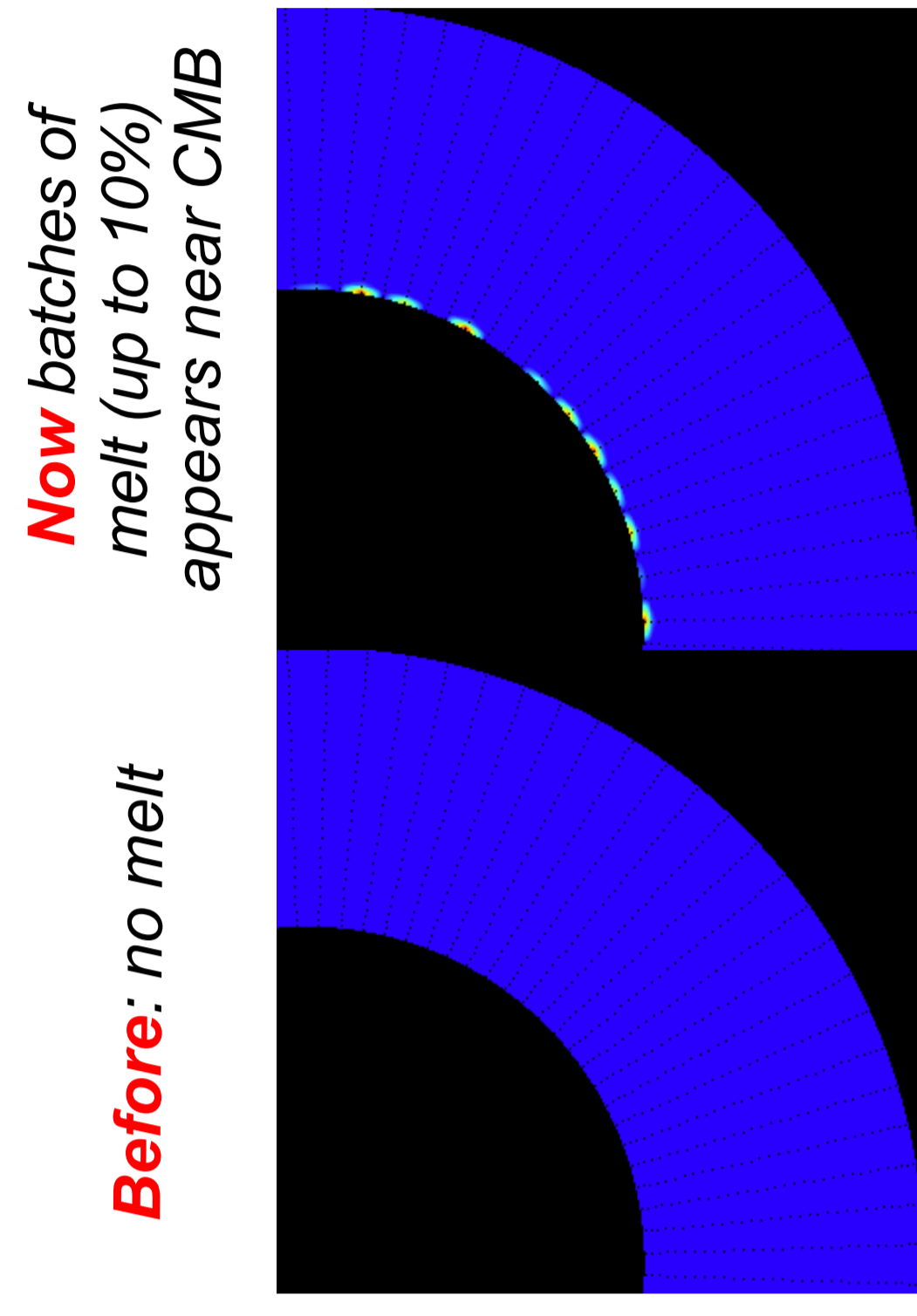
Sinking of dense melt in the lowermost mantle is a hot topic in scientific discussion nowadays.

Who will use it?

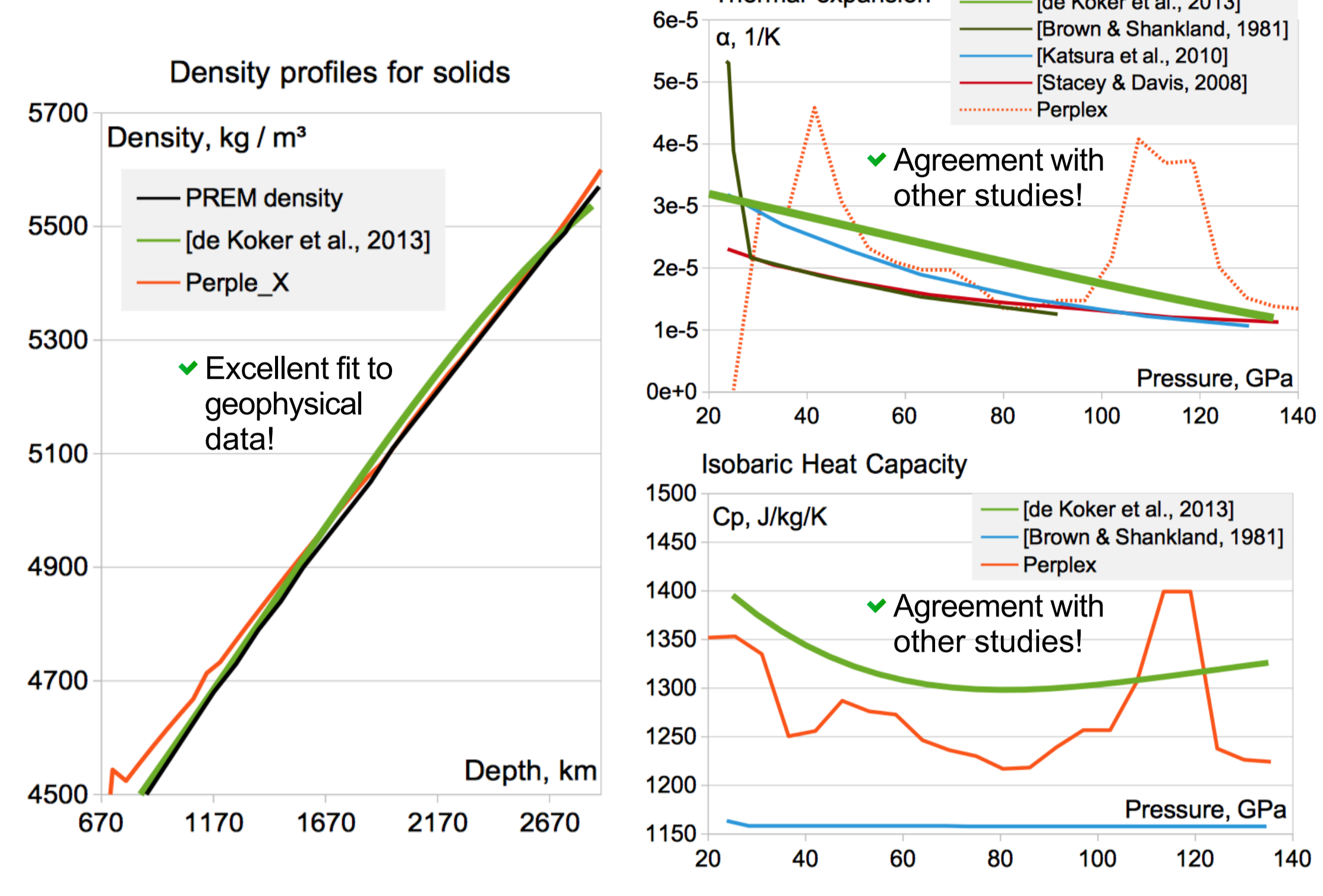
- ✓ **Geochemistry:** Formation and composition of deep magmas
- ✓ **Geophysics:** Ultra-Low velocity zones origin
- ✓ **Planetology:** core formation, magma ocean crystallization etc.

RESULTS

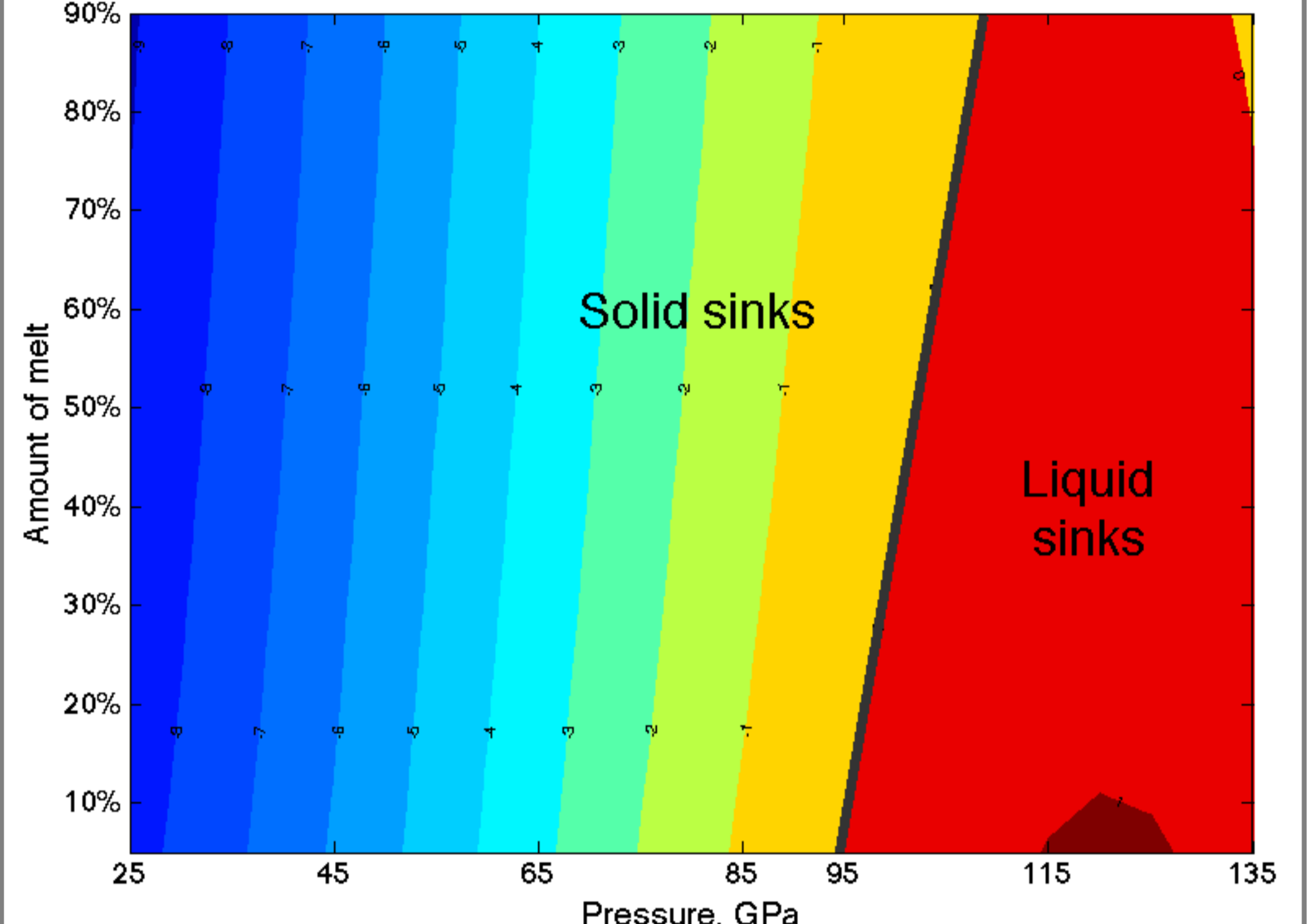
Melting at CMB



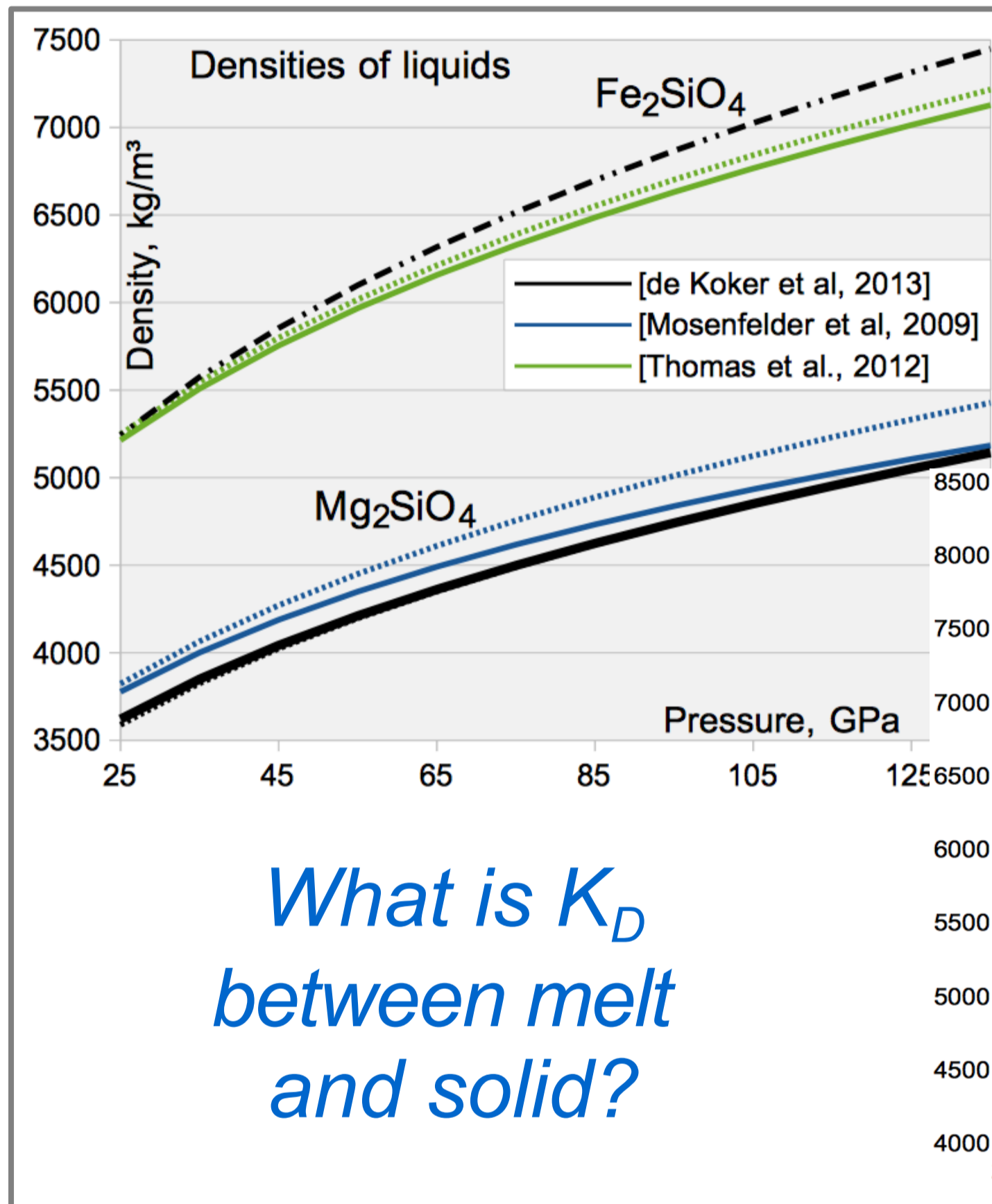
Fitting the properties



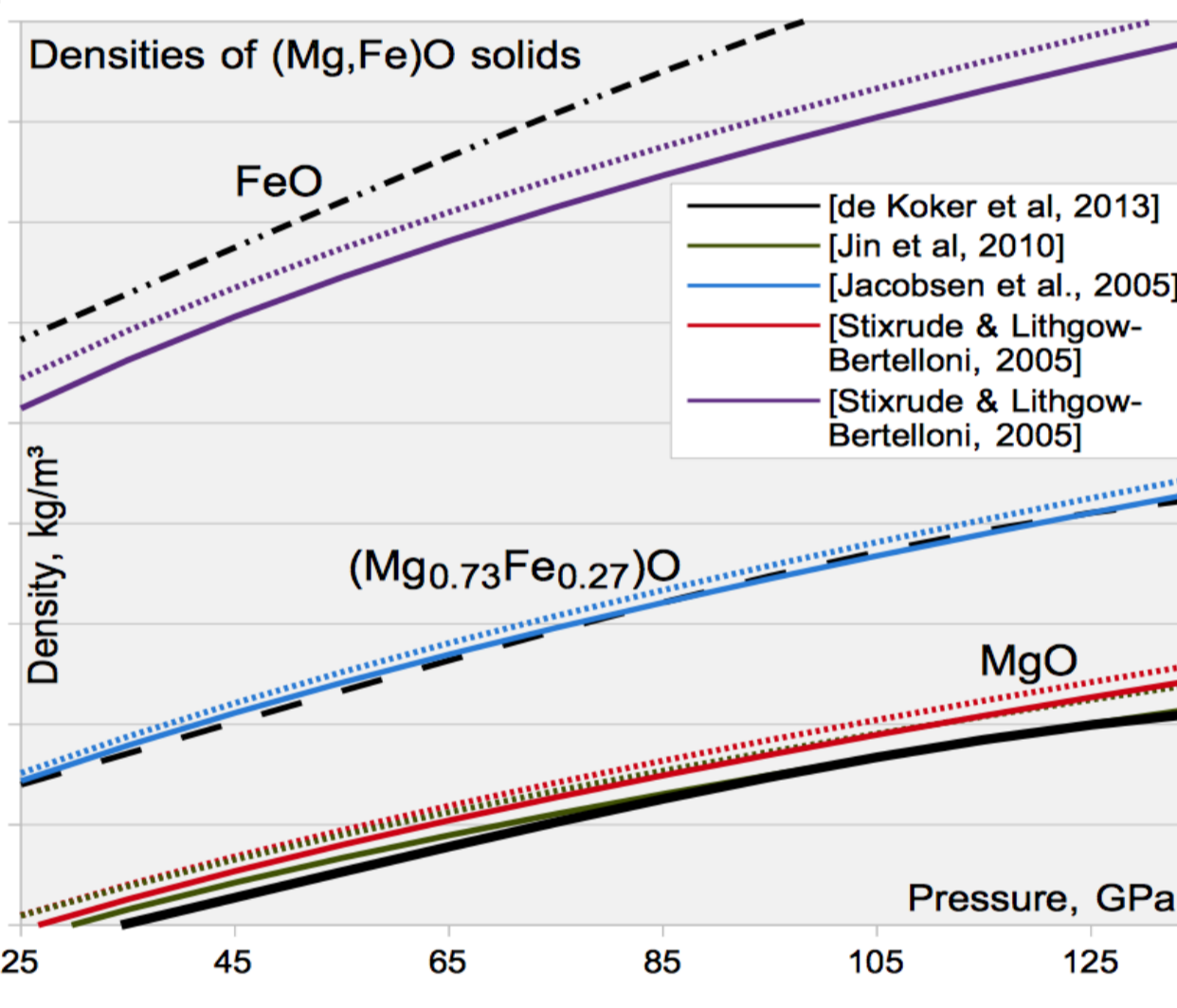
Predicting solid-liquid density inversion



DISCUSSION

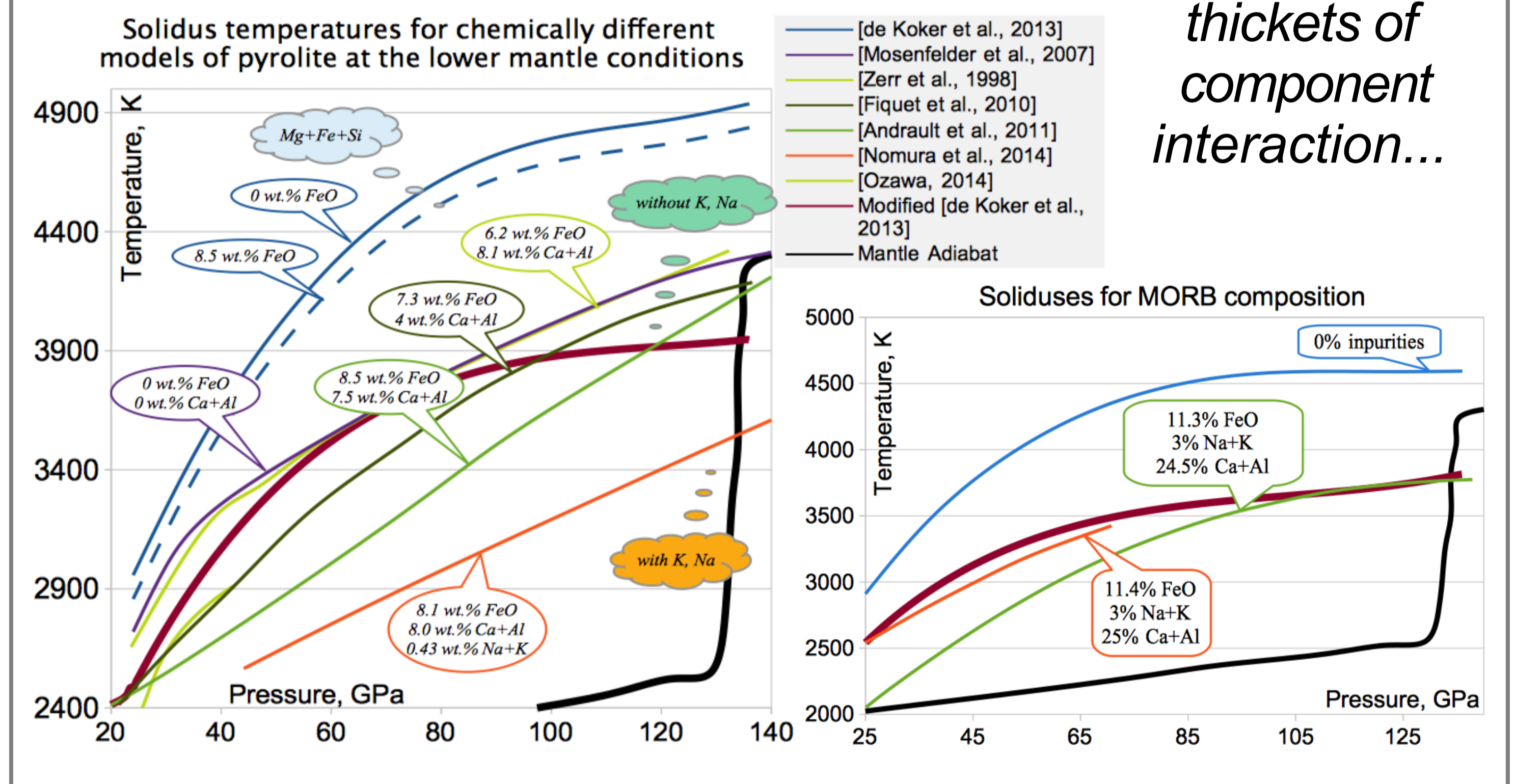


Is simple linear model of density (& other properties) reliable?



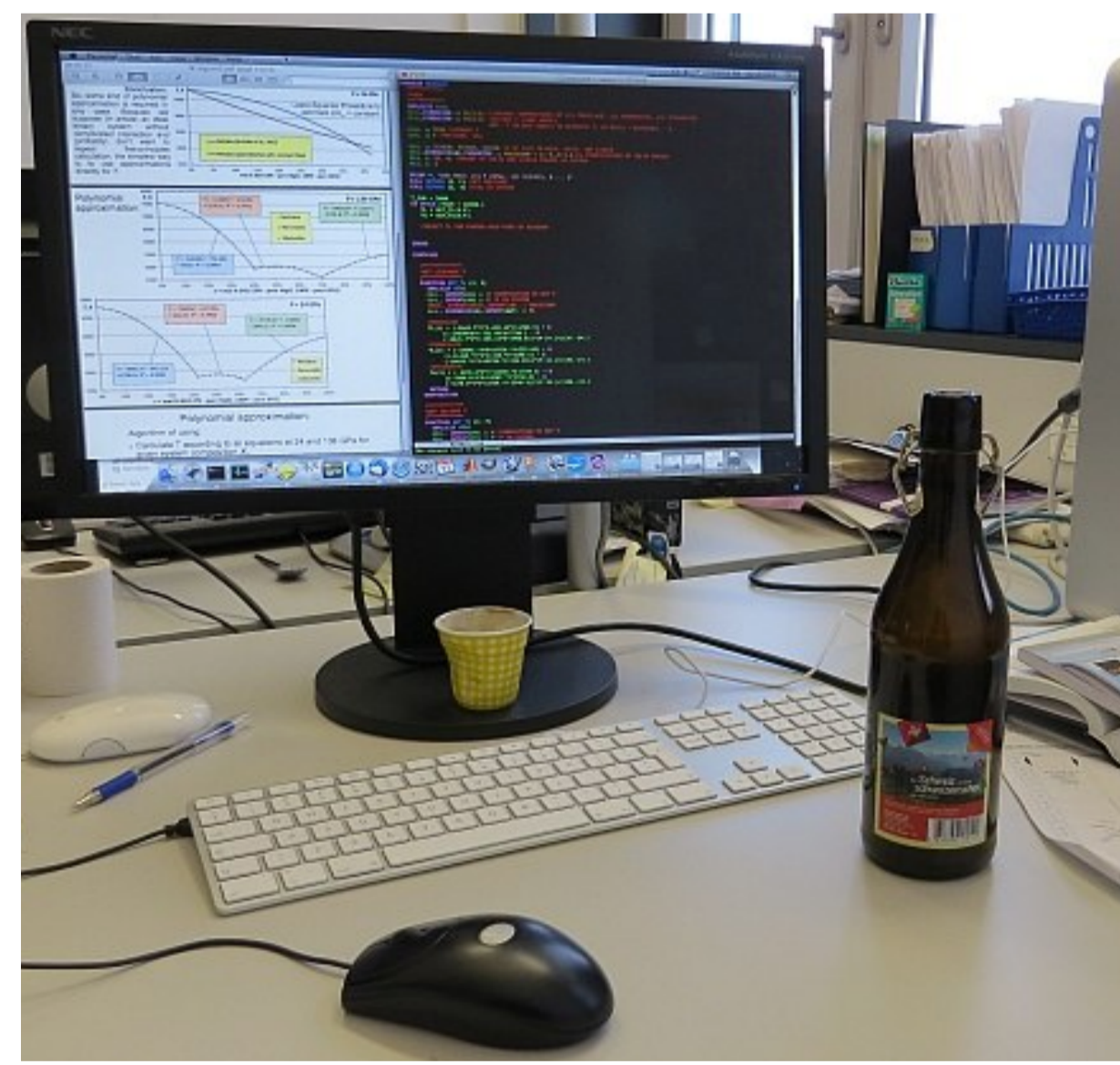
What is K_D between melt and solid?

Melting temperatures: only first steps in deep thickets of component interaction...



METHODS & NOTES

0. Work hard



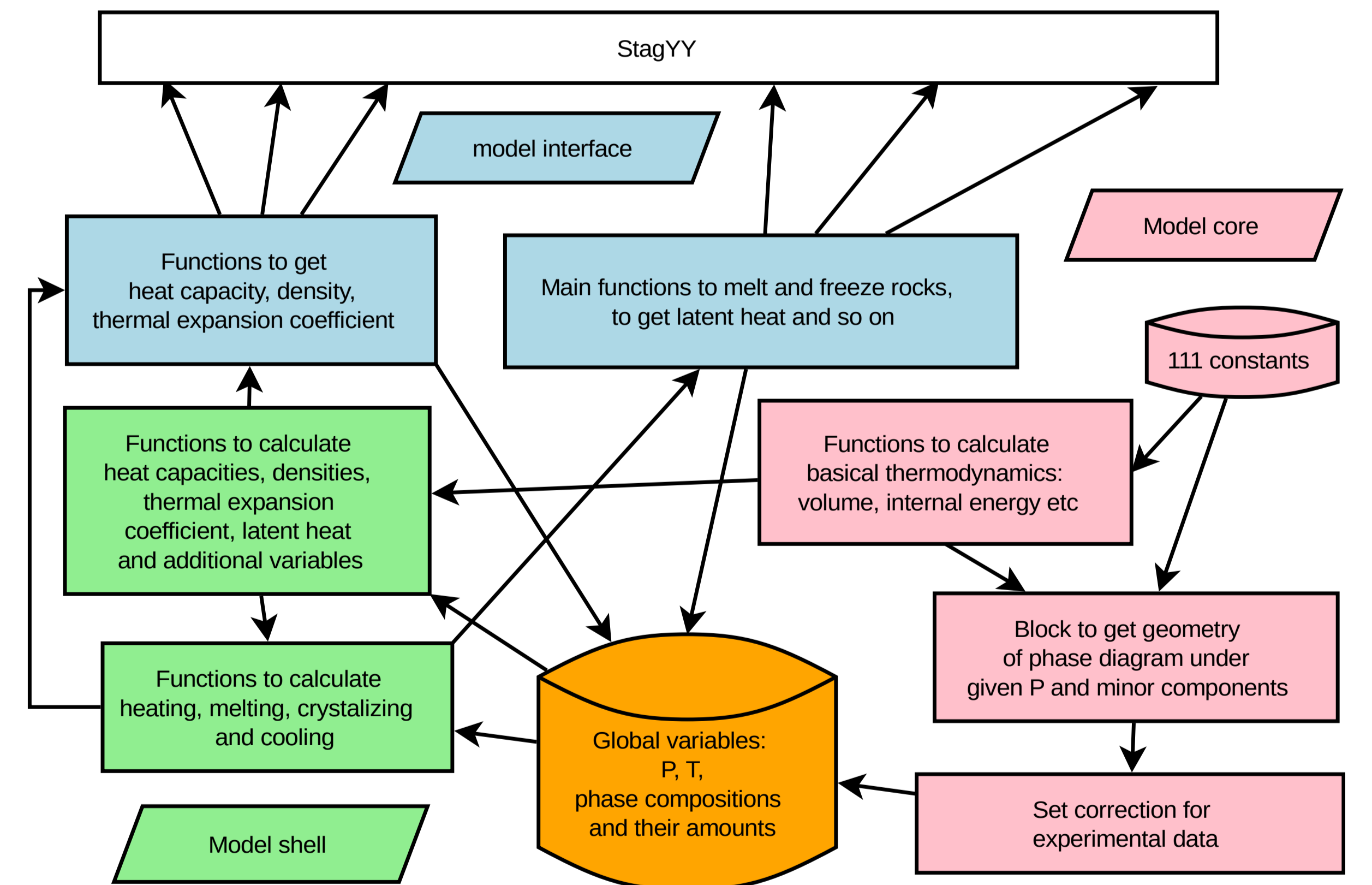
1. Composition & phases

Mantle composition is expected to be between pyrolyte and MORB.

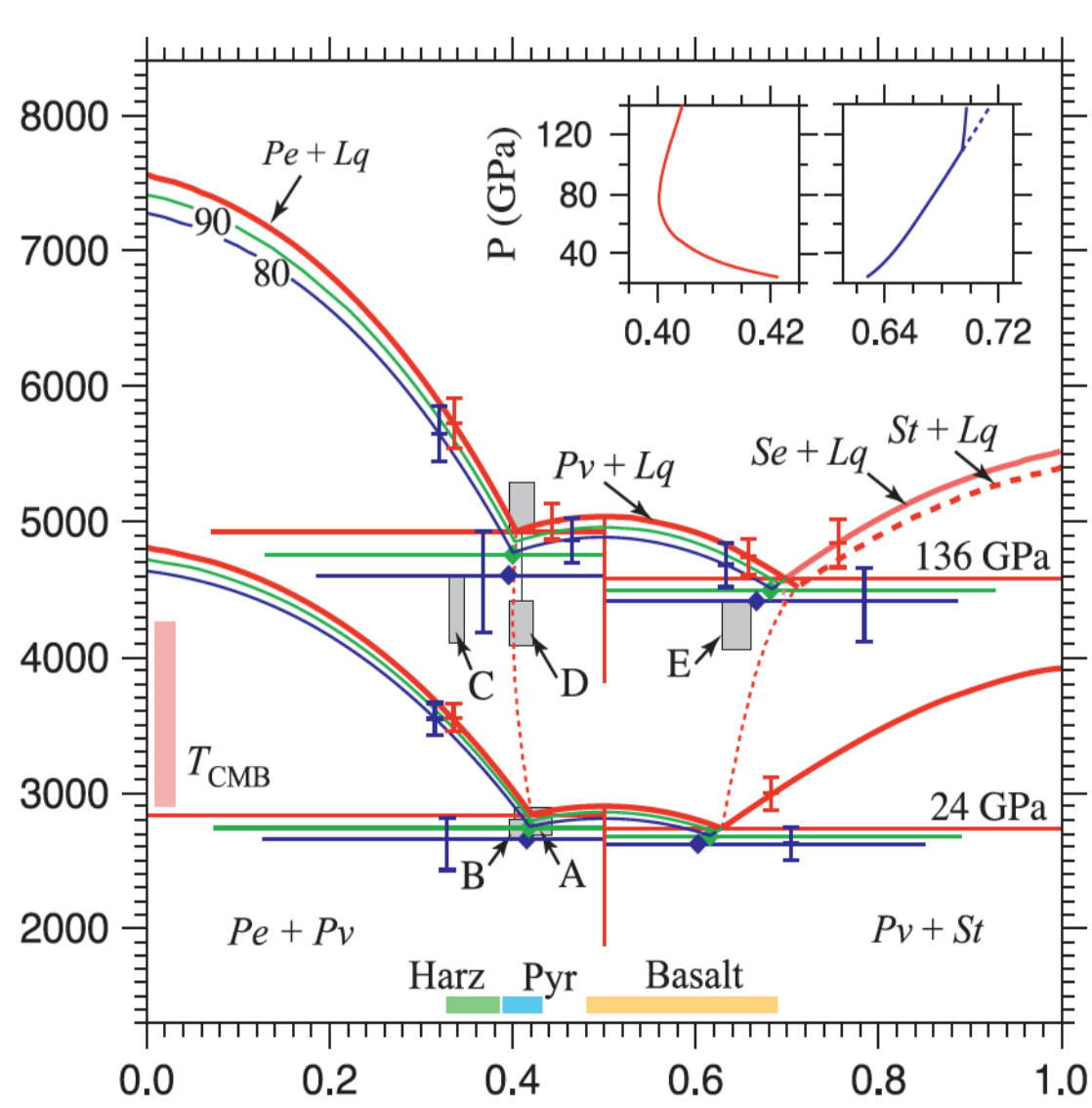
MgO and SiO₂ are the most important components of the Lower Mantle to determine topology of phase diagram

Molecular Dynamics overestimates melting temperatures because of oversimplicity of described systems and some numerical issues.

So we use experimentally derived soliduses.



2. Melting diagram topology



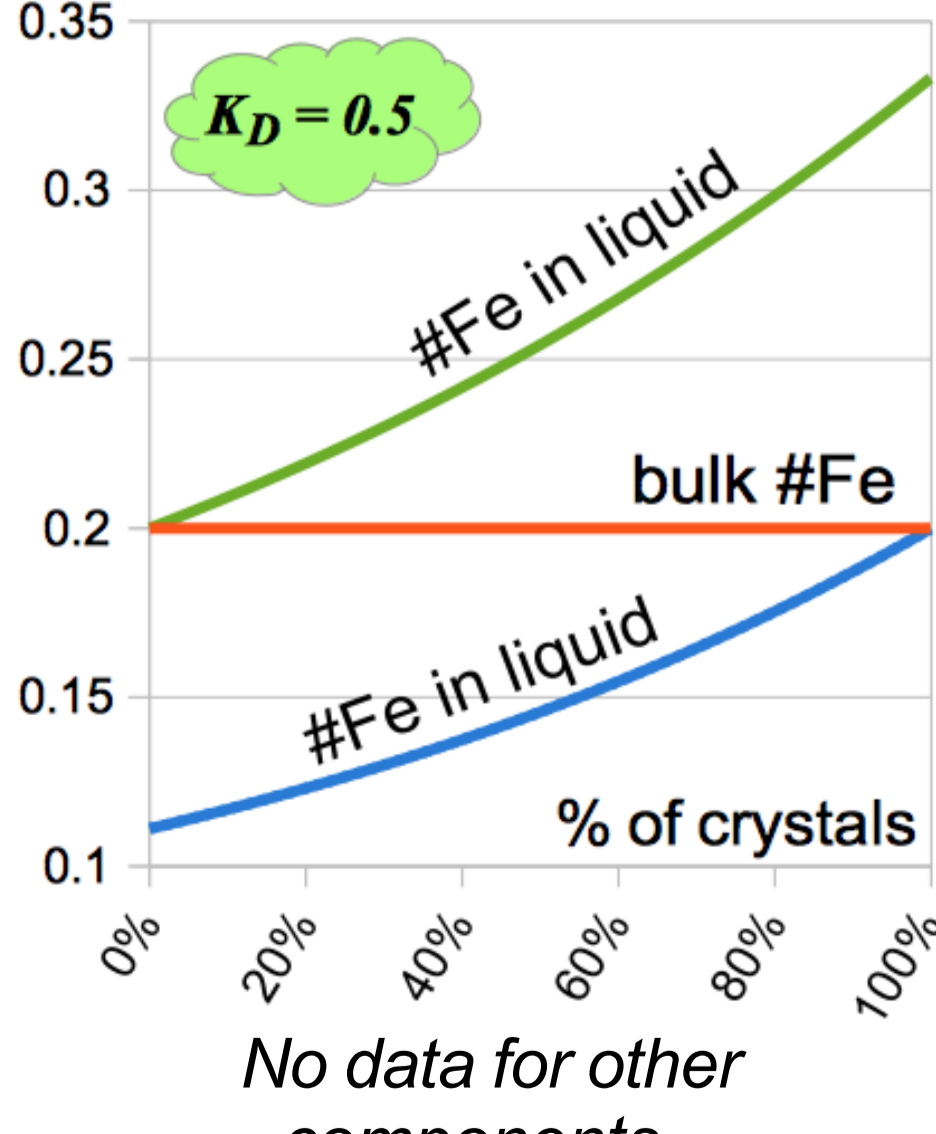
Thermodynamic parameters from [de Koker et al., 2013].

Numerical integration of Clausius-Clapeyron law for range of pressures:

$$T = T_0 + \Delta P / \frac{dp}{dT}$$

$$\frac{dp}{dT} = \frac{\Delta H_m}{T \Delta V}$$

3. Iron partitioning:



CONTACT



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Or just photo this QR...



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