Structure and Composition of super-Earths

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Symposium, Feb 3 2009

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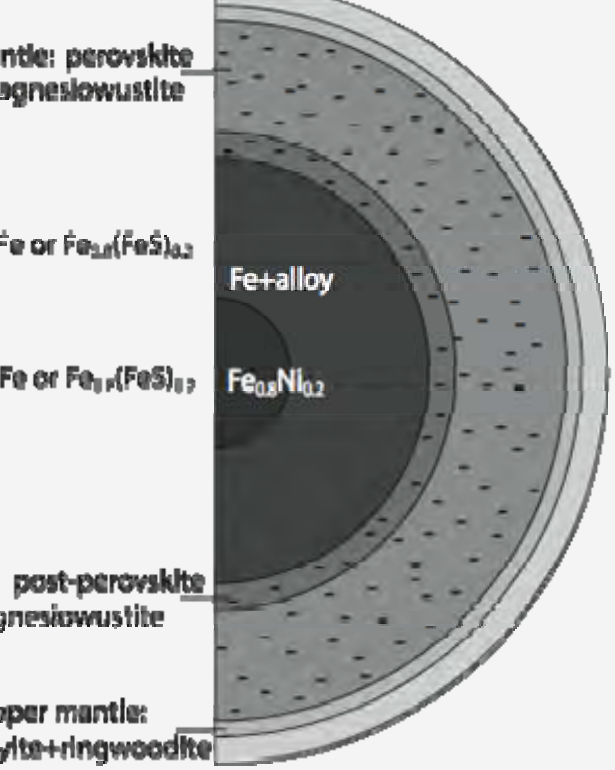
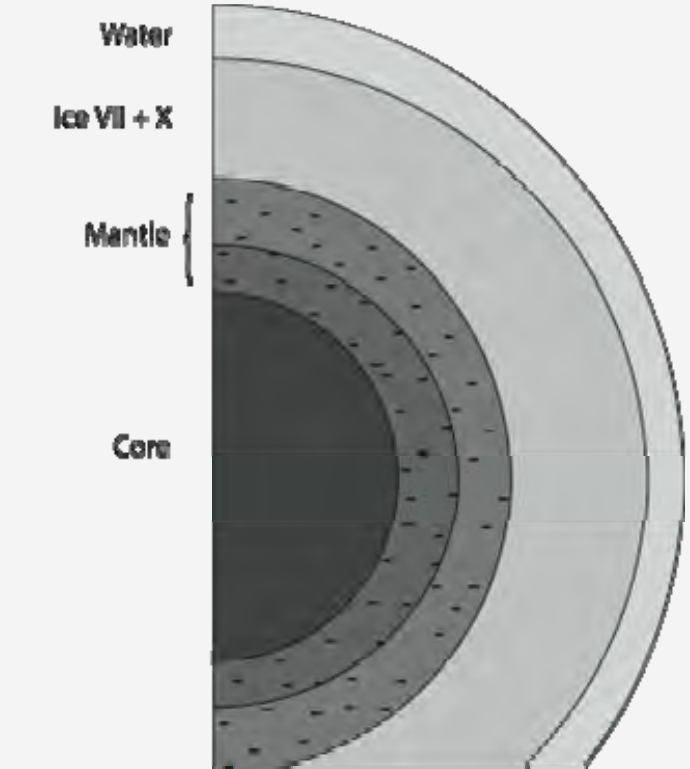
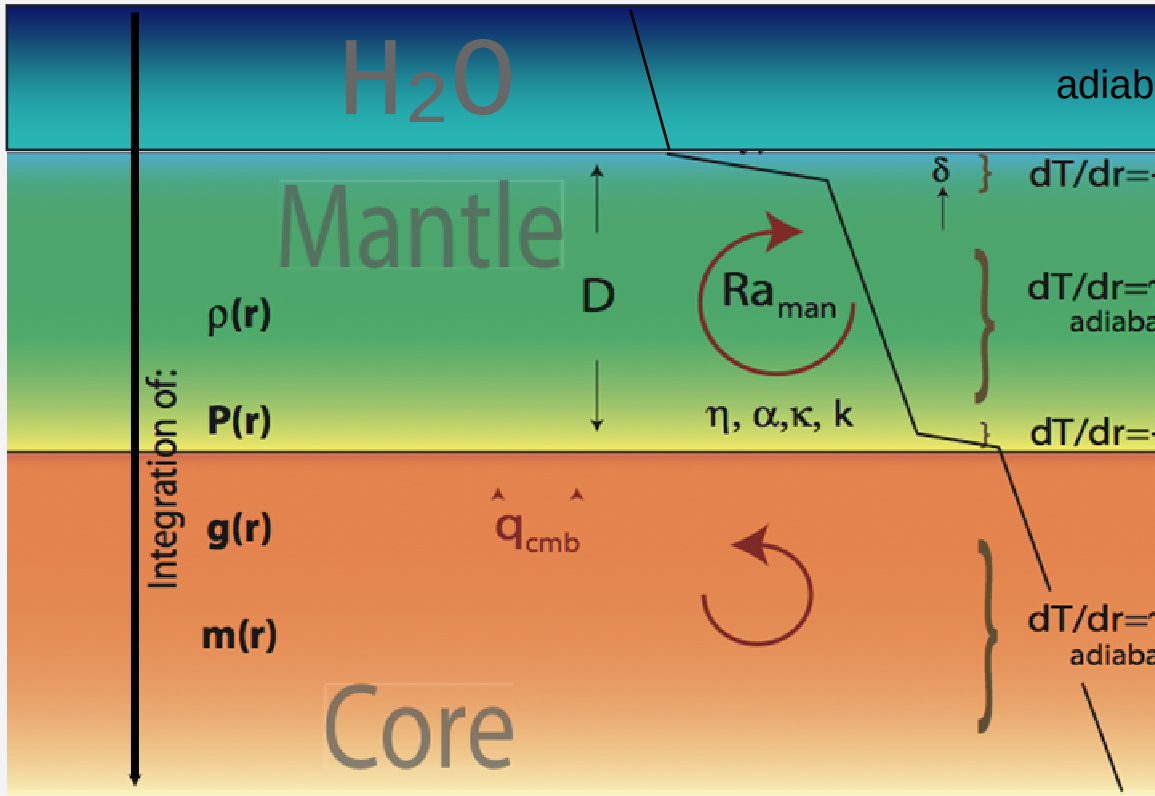


Rocky



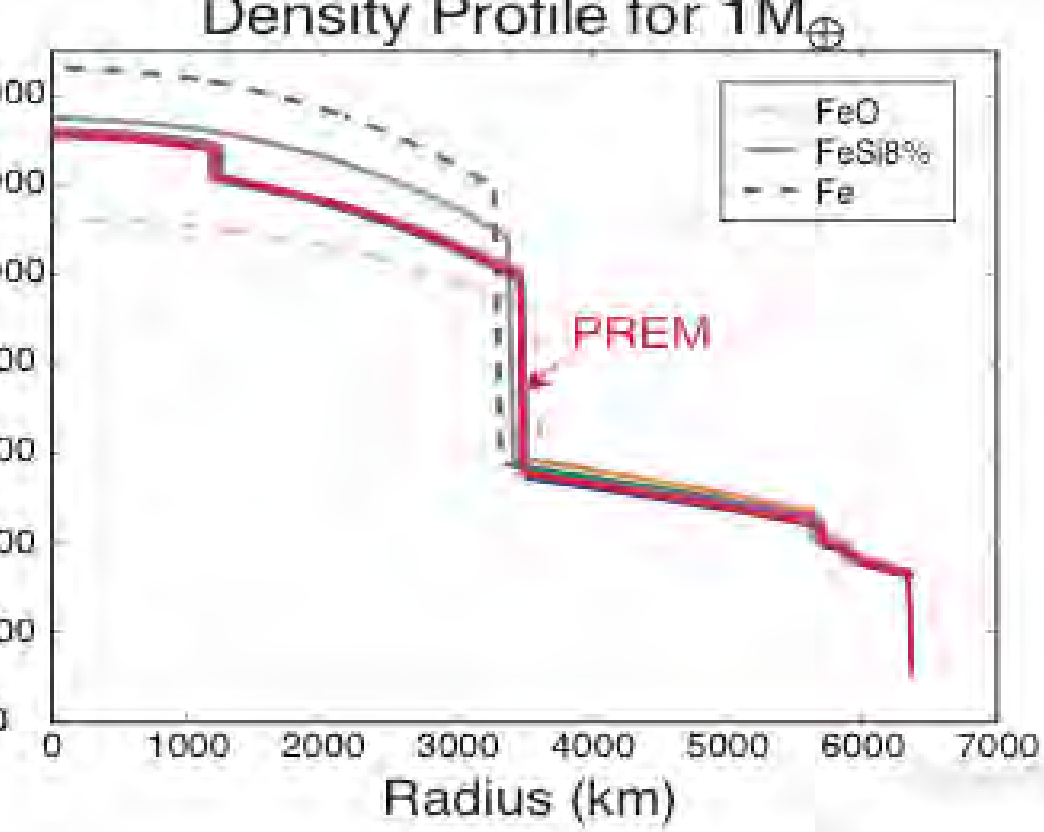
Icy/Ocean

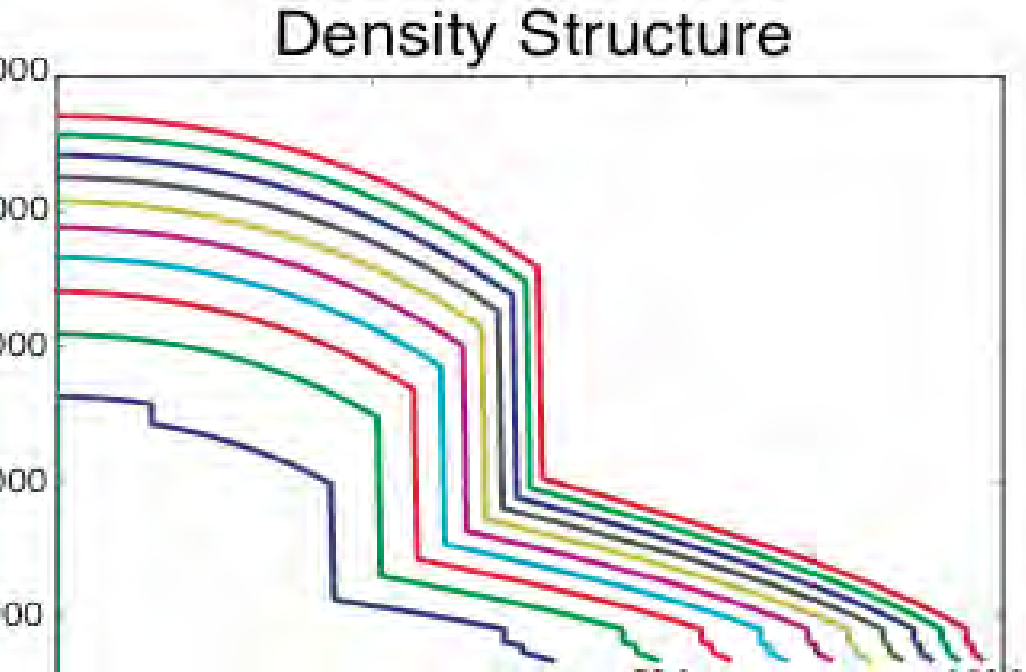
Input: M, P_{surf}, T_{surf},
guess R, g_{surf},
composition + Vinet E

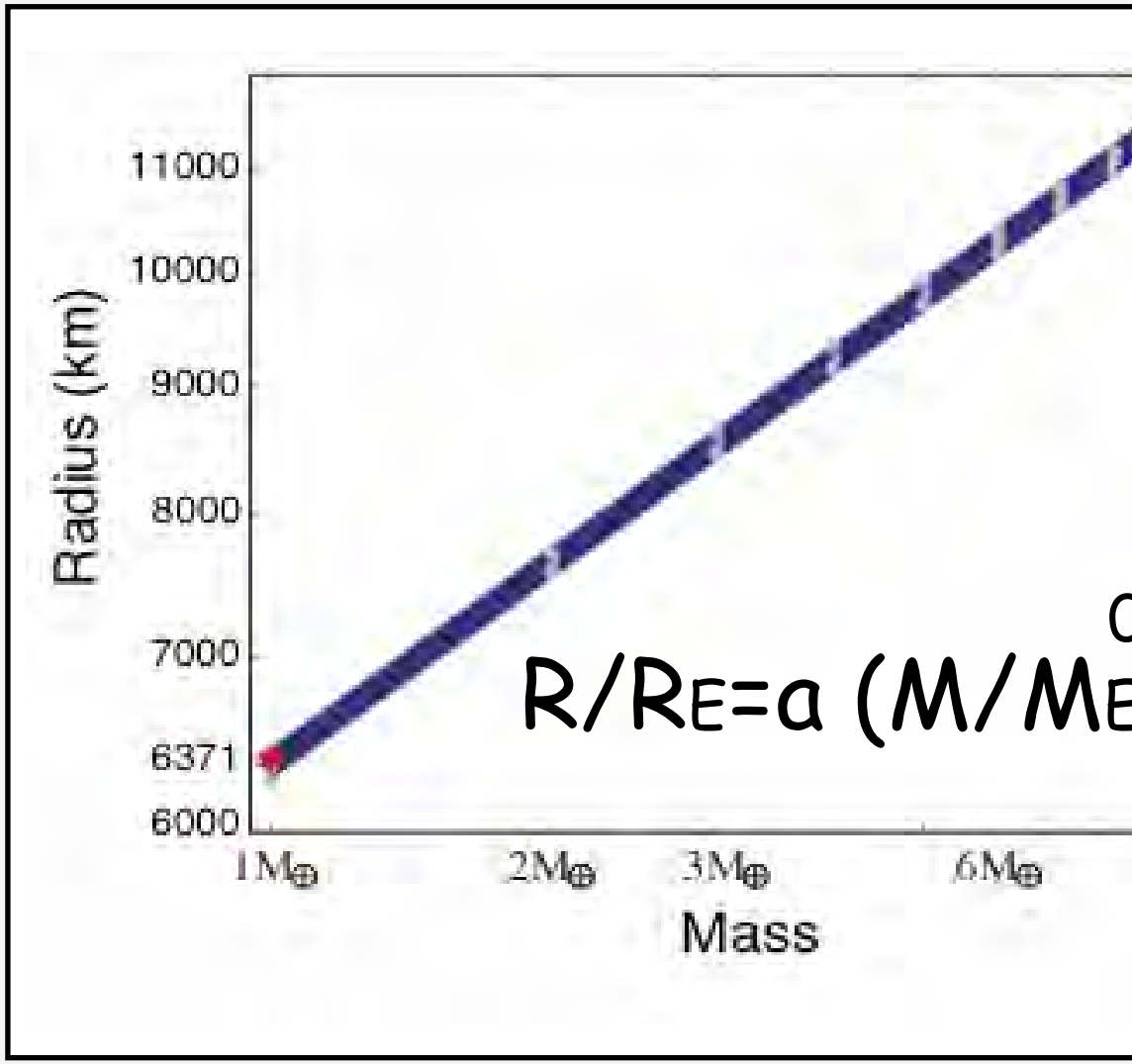


Output: R, $\rho(r)$,
P(r), g(r), m(r),

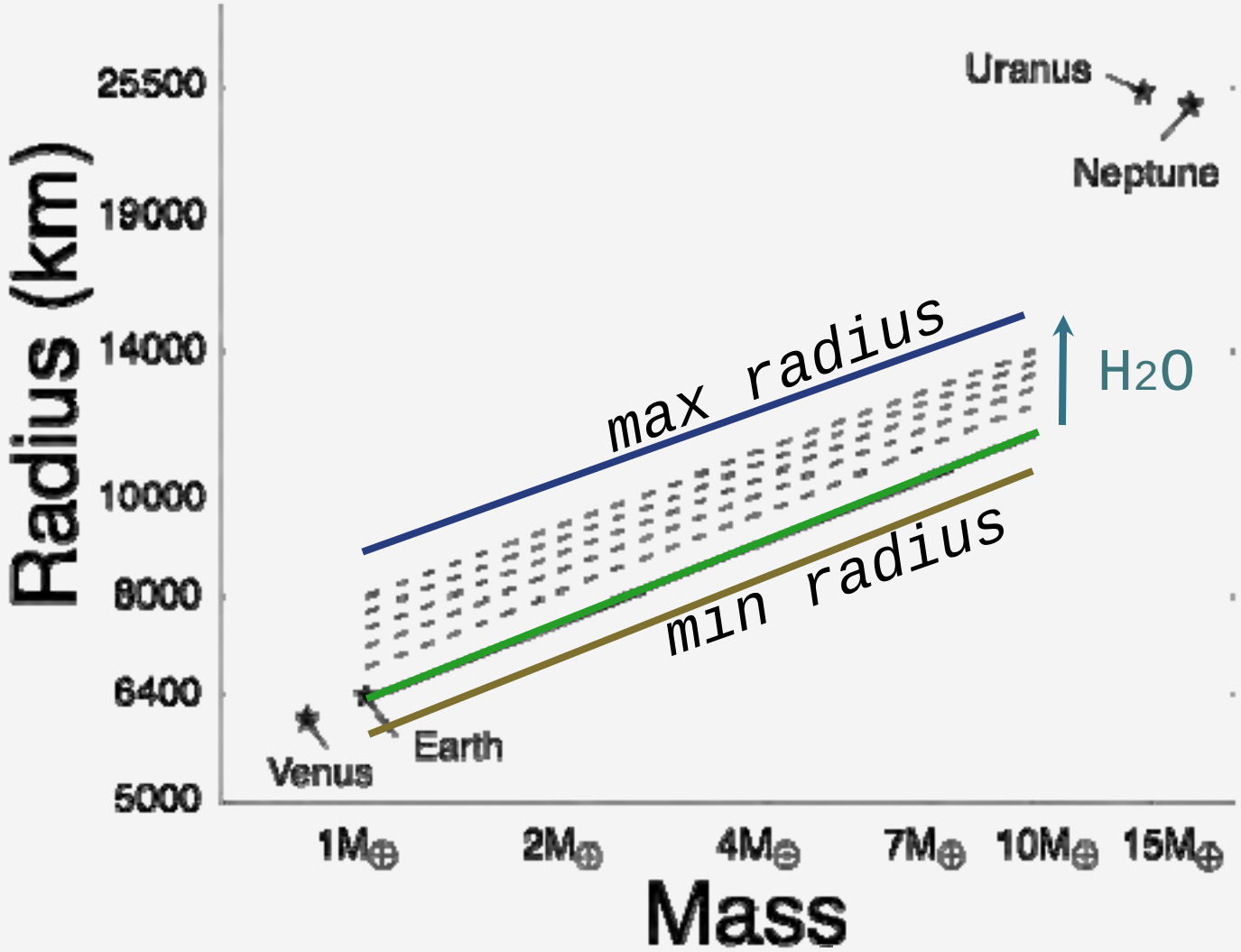
rocky super-Eart







Generalized M-R relationship



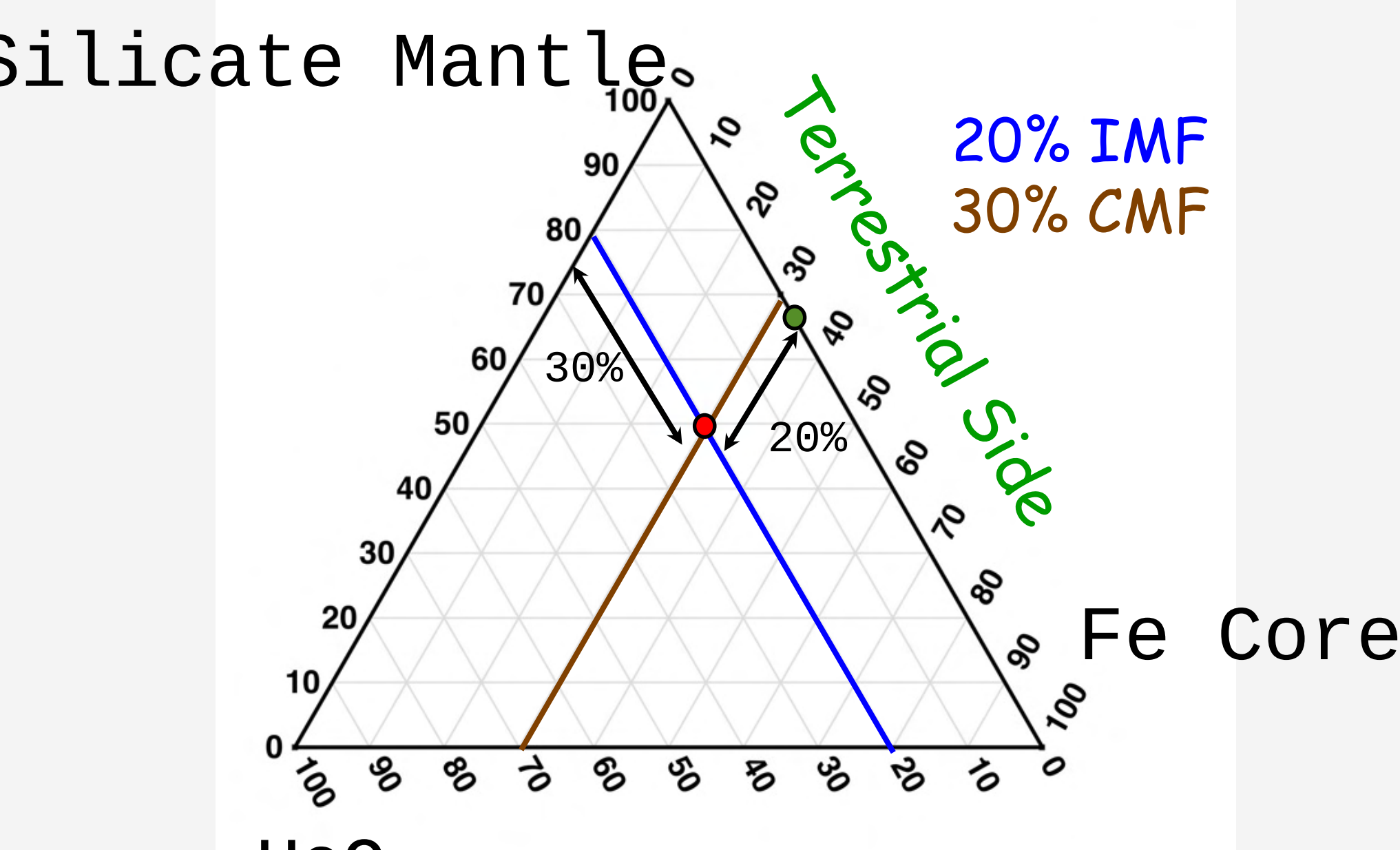
Salpeter & Zapolsky 19
Stevenson 1982

Sotin et al. 2007;
Fortney et al. 2007;
Seager et al. 2007

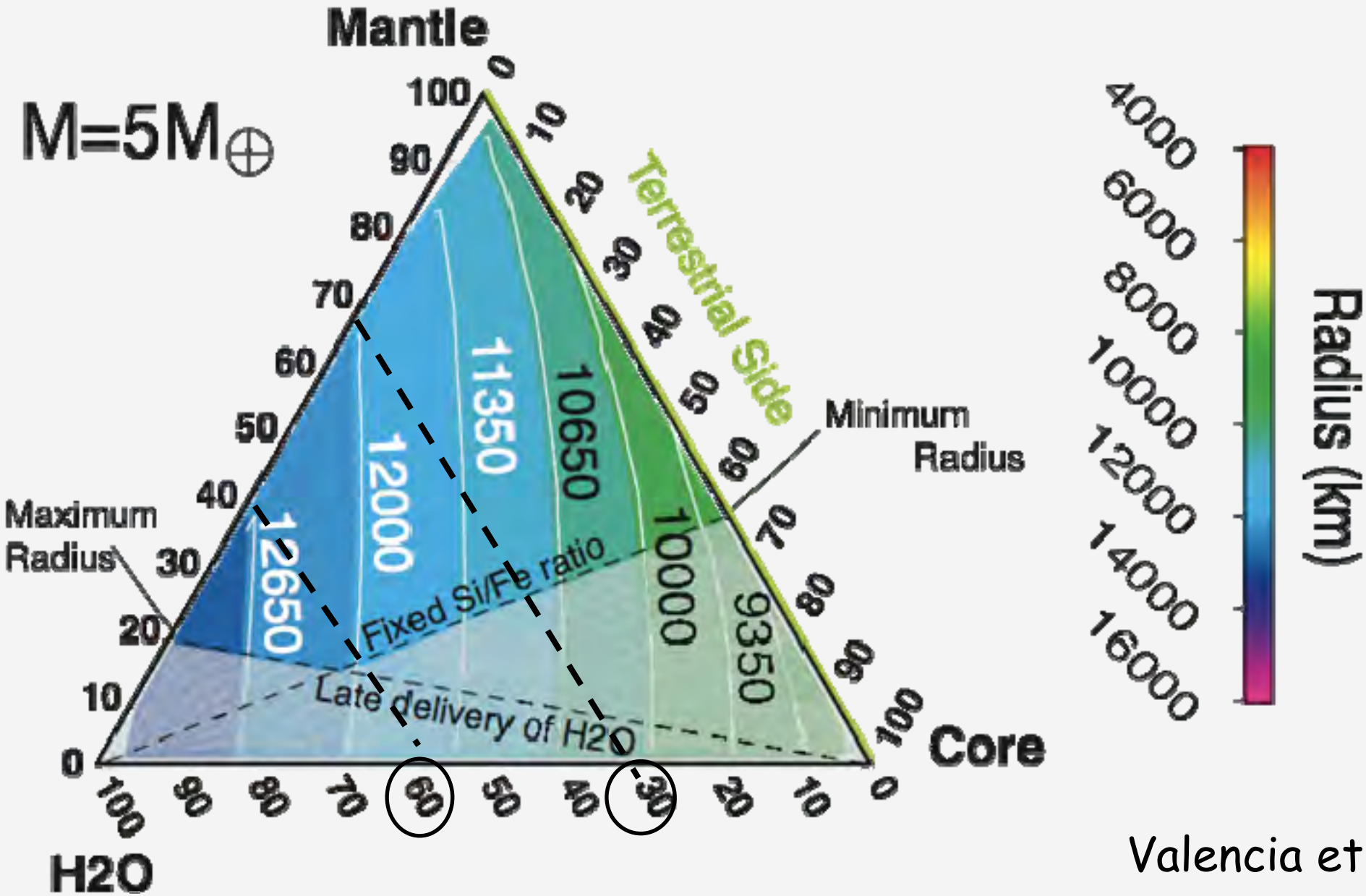
th-like: Fe/Si)

0.262(1-0.138 I

Ternary Diagram: Tool to show composition



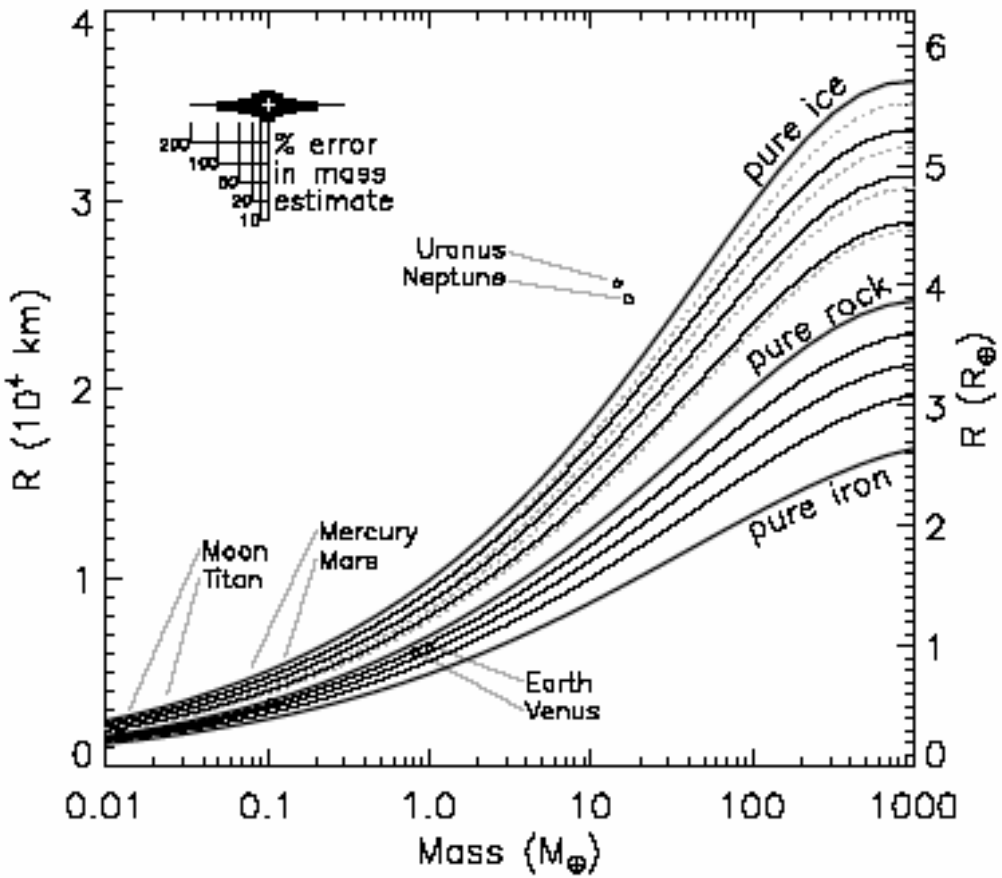
Super-Earth Composition

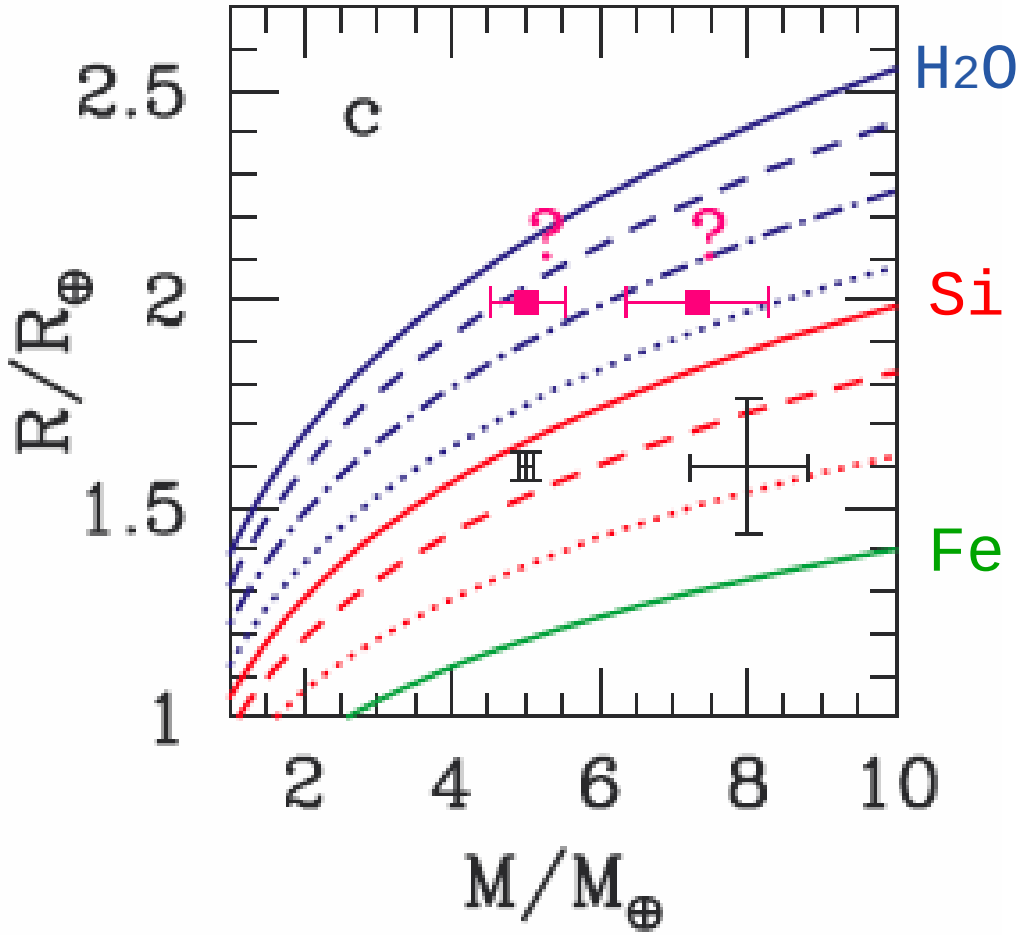


Valencia et al. 200

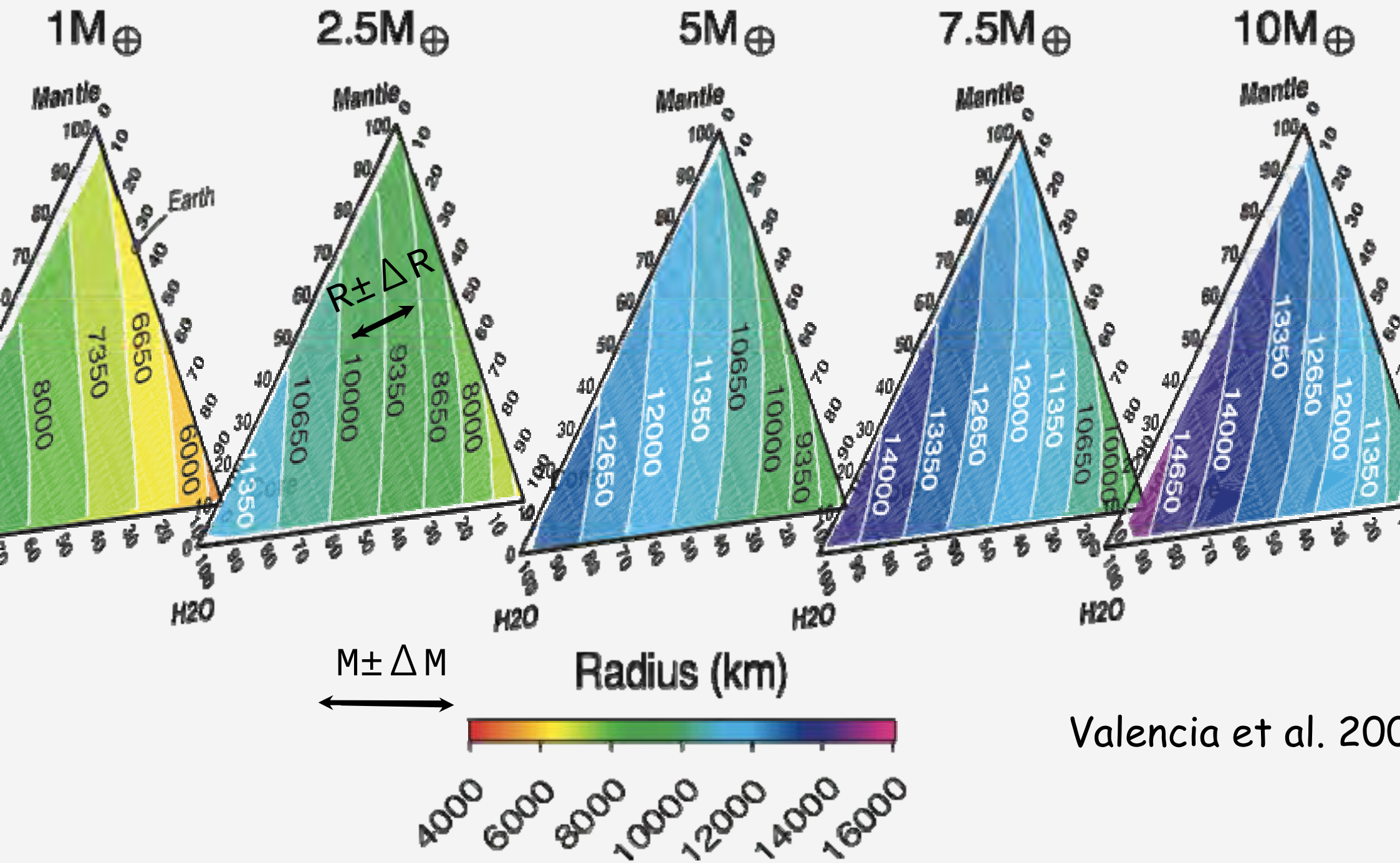
There is degeneracy in composition.

M-R relationship can not tell us about SE composition



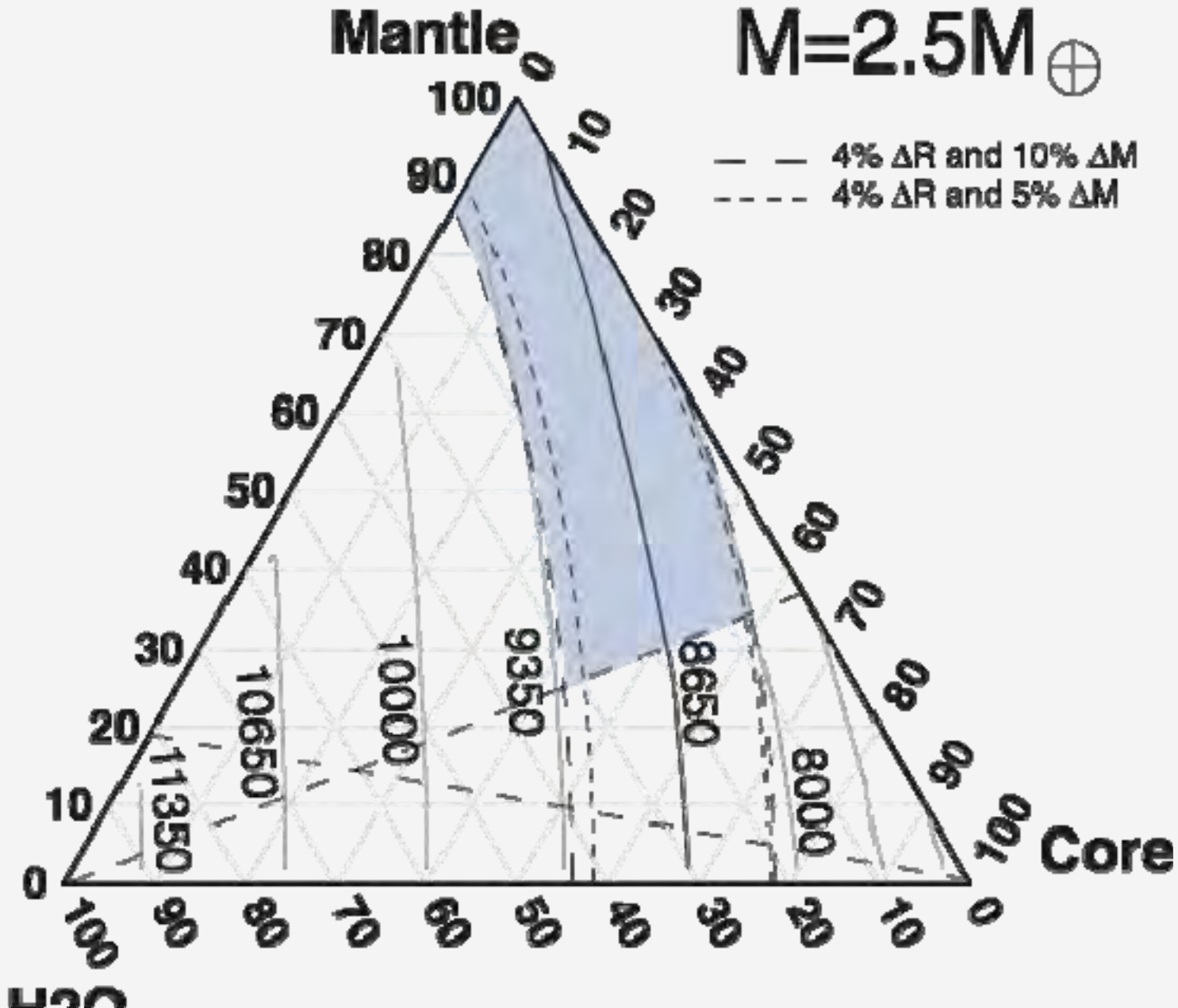


Toblerone Diagram



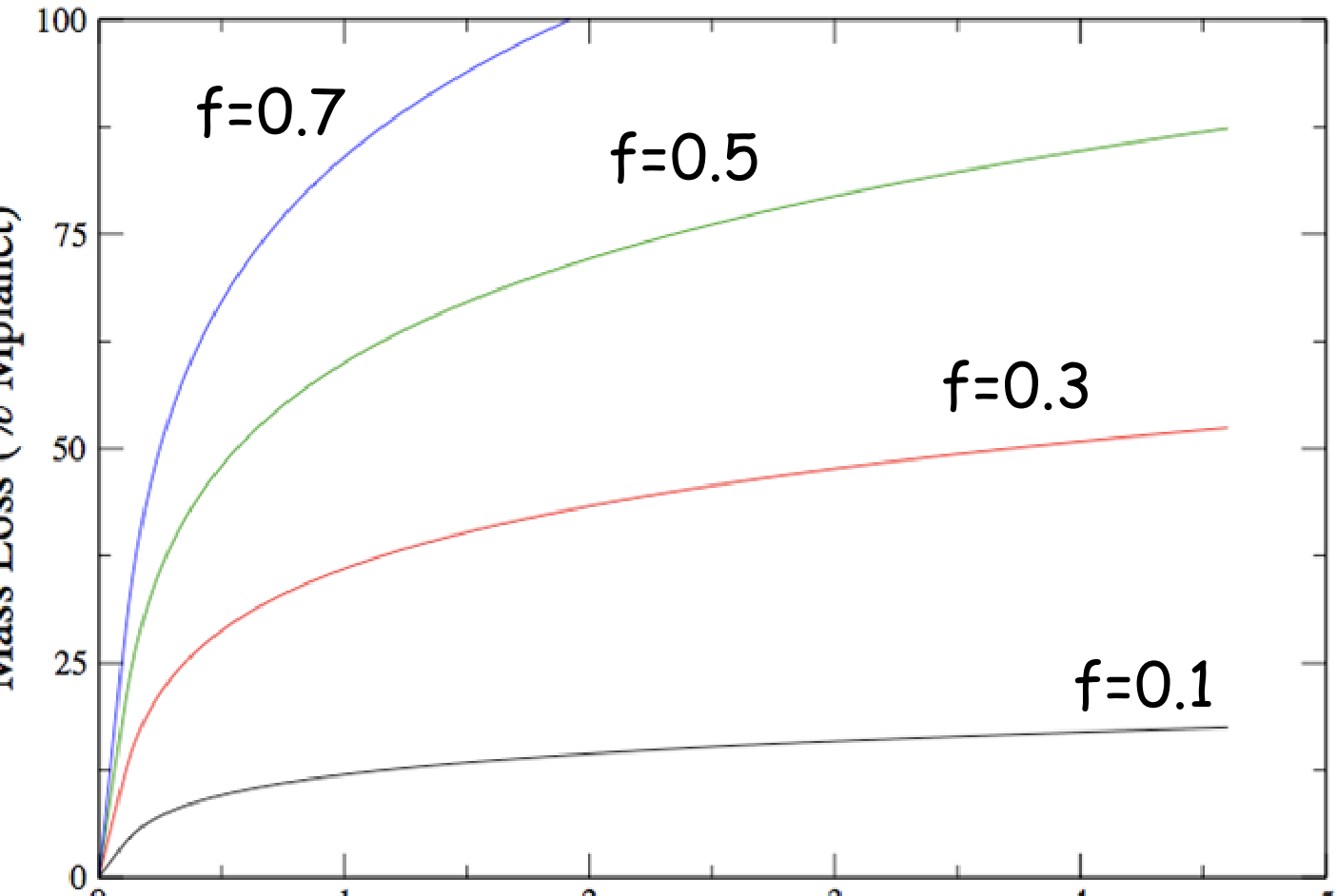
Valencia et al. 200

Precision in Measurements



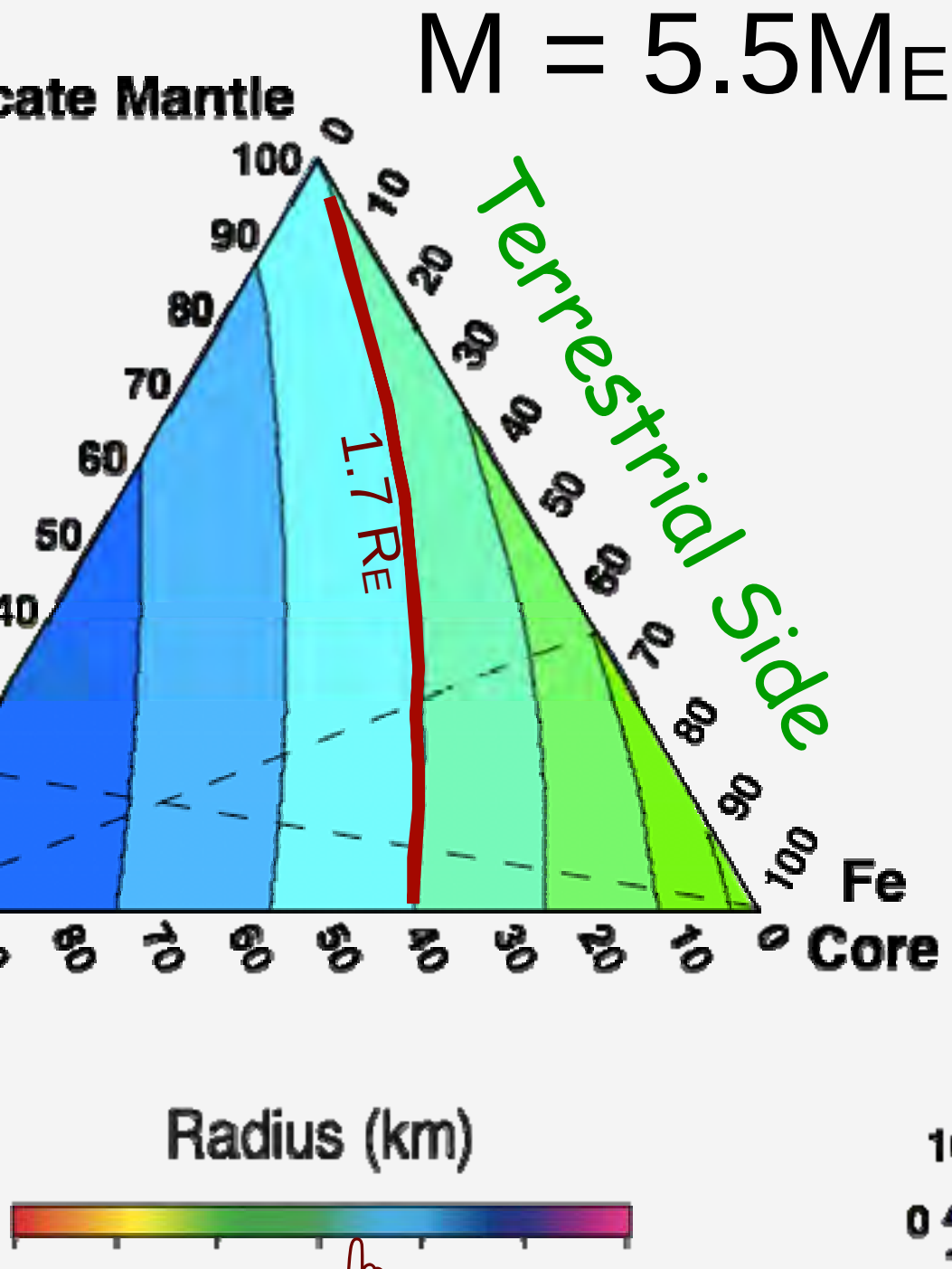
= 1.7 ± 0.17 R_E, P = 0.85 AU, T_{eff} = 2000K, ...Mass

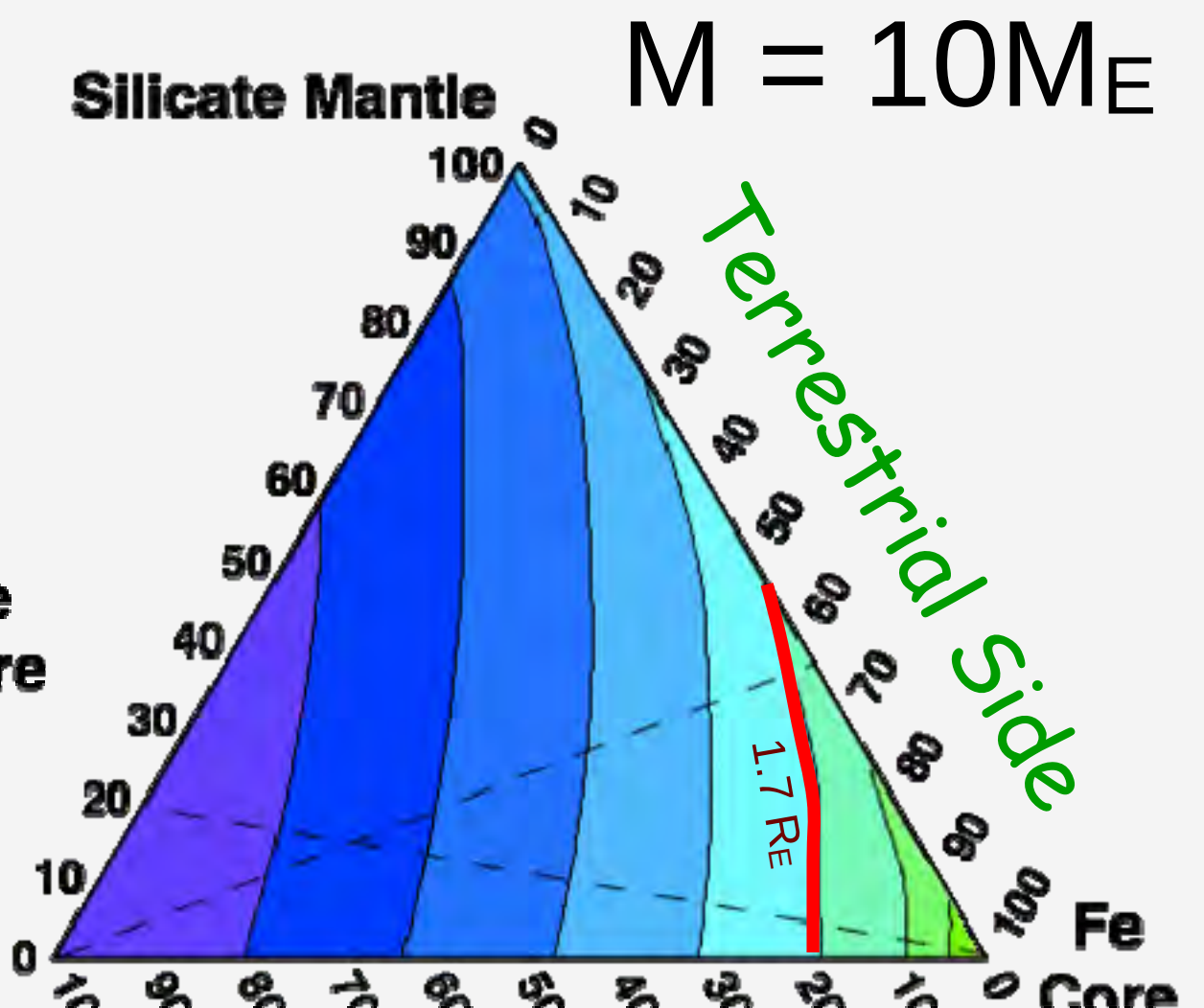
Can it retain an atmosphere?



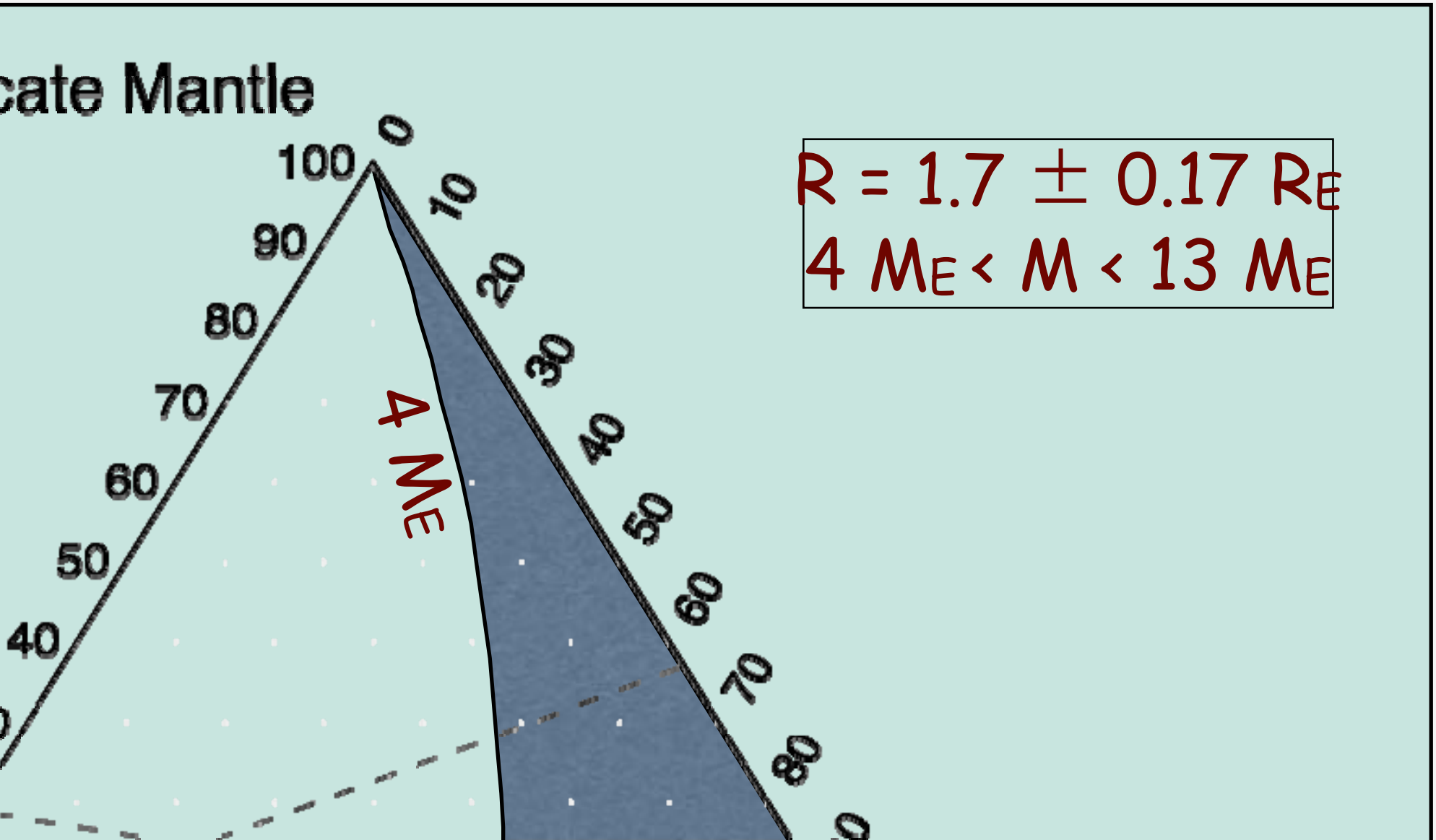
Unlikely

Energy limited calculation based


M = 5.5M_E
cate Mantle
Terrestrial Side
1.7 R_E
Fe
Core
Radius (km)


M = 10M_E
Silicate Mantle
Terrestrial Side
1.7 R_E
Fe
Core

errestrial CoRoT-Exo-7b



$R = 1.7 \pm 0.17\ R_E$

$4\ M_E < M < 13\ M_E$

Conclusions

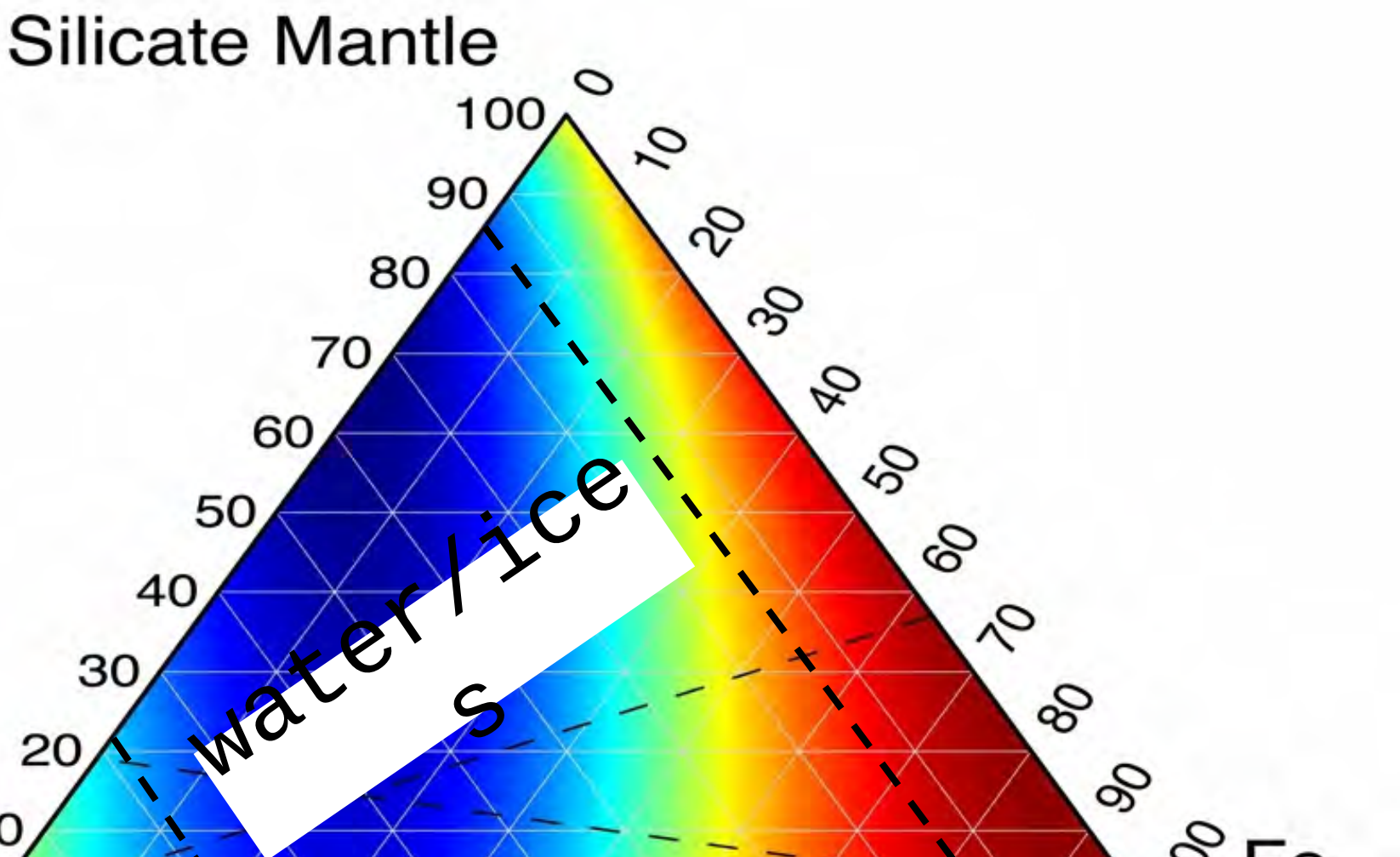
degeneracy in composition that can fit the
rage density.

etailed model ('toblerone' diagram) to infer
type from M and R data.

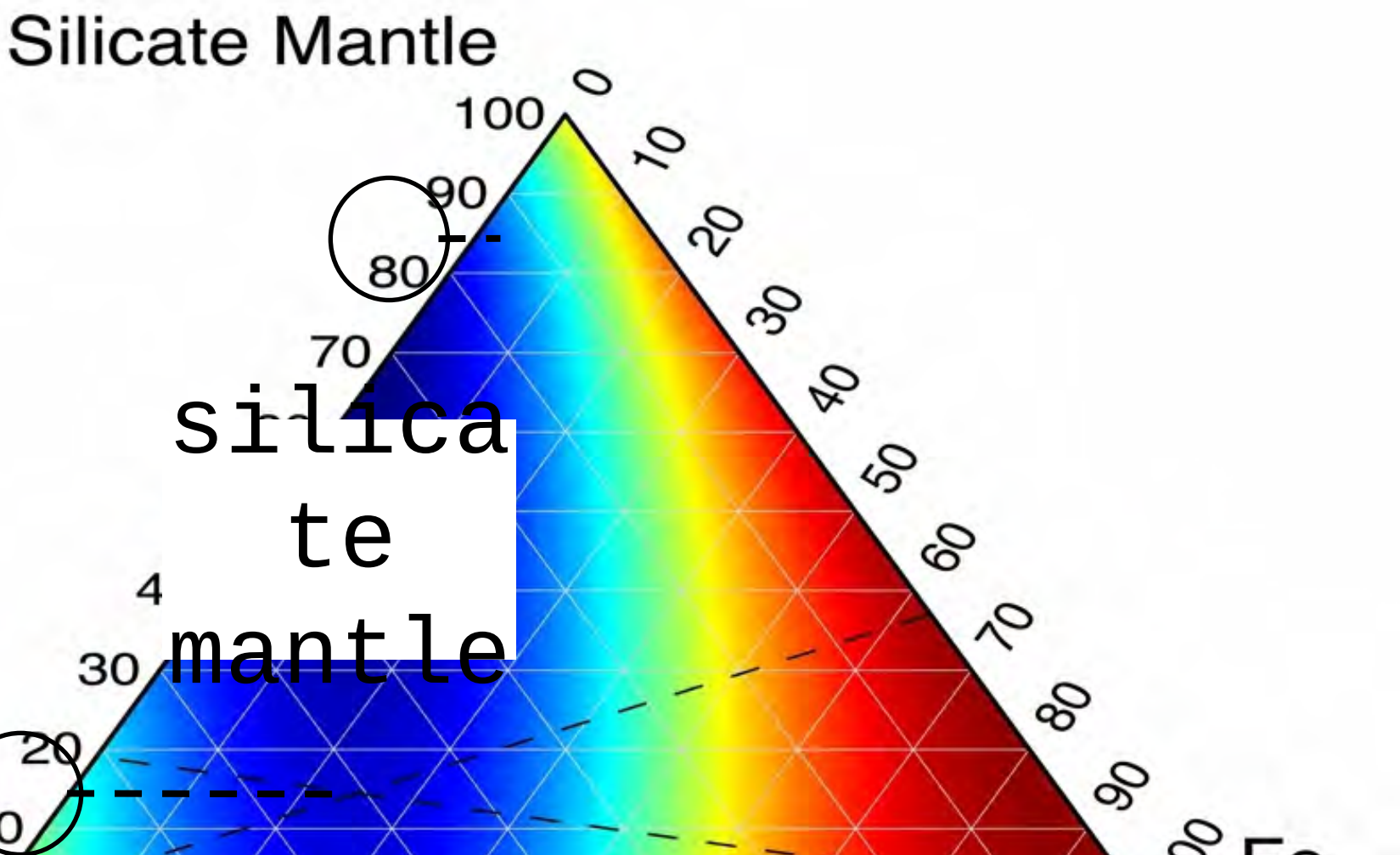
a maximum radius above which the planet is
ly volatile rich (H2O). Below this value the
y or may not be rocky.

ff to invest in increasing radius precision

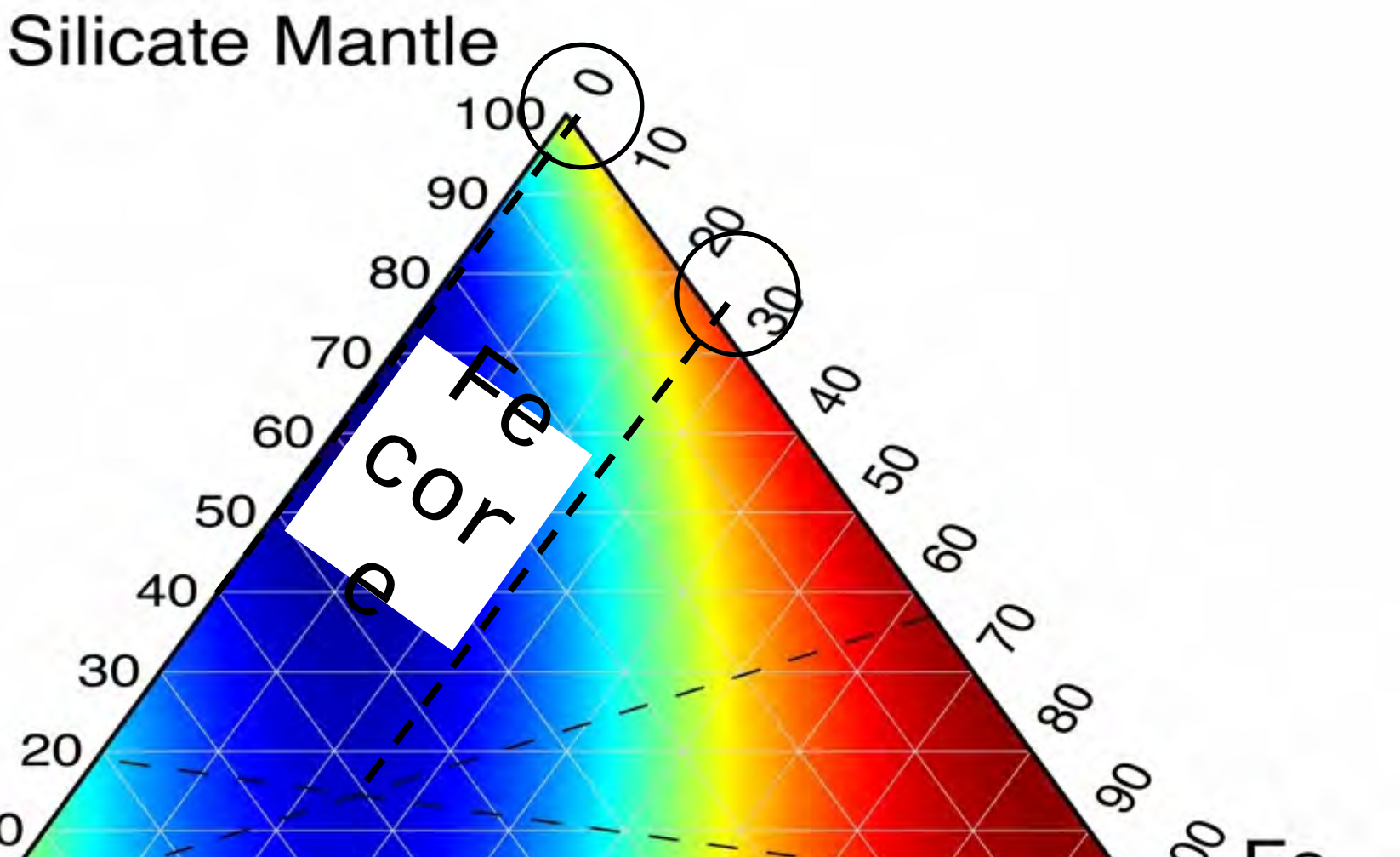
Constraining composition



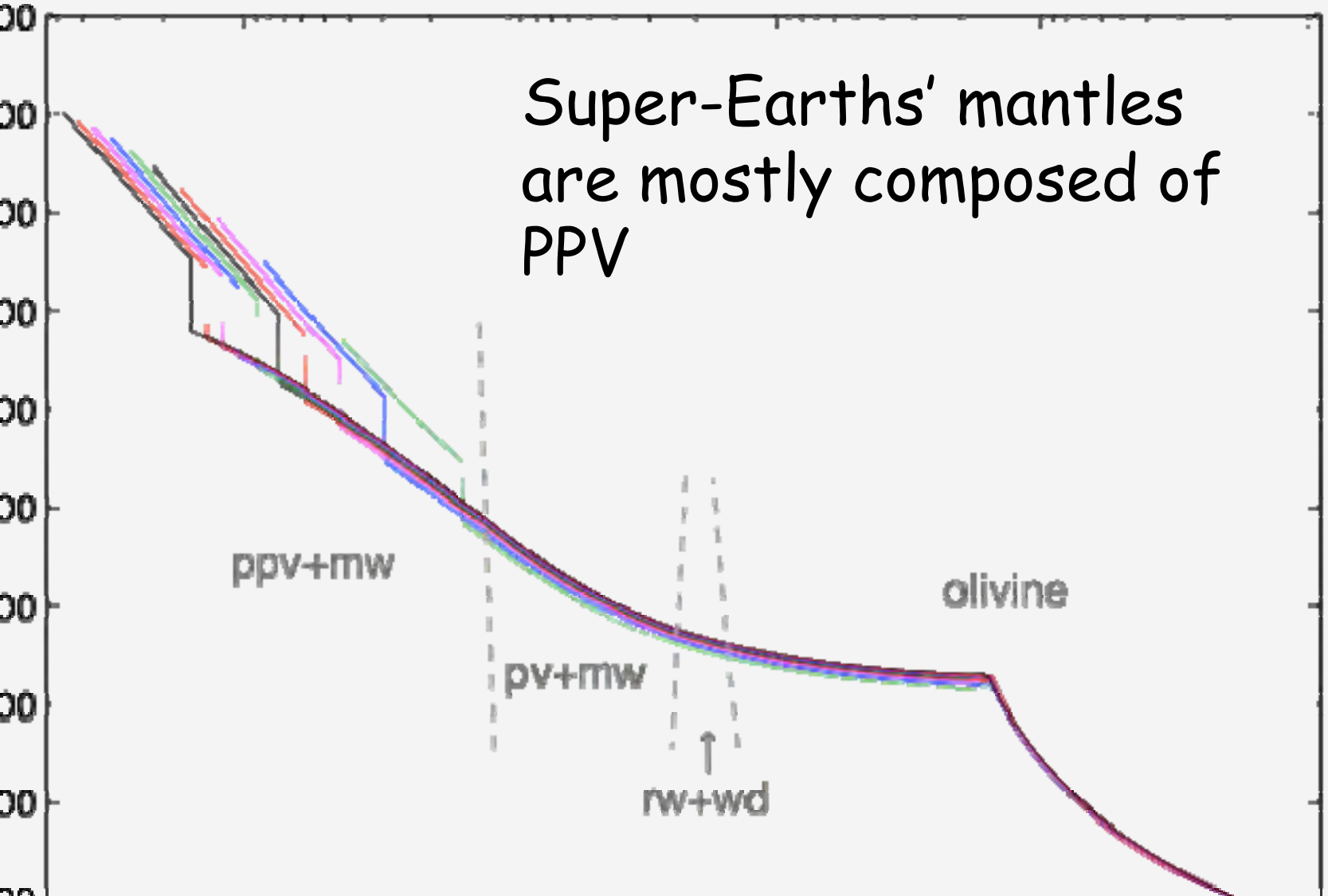
Plausible Composition



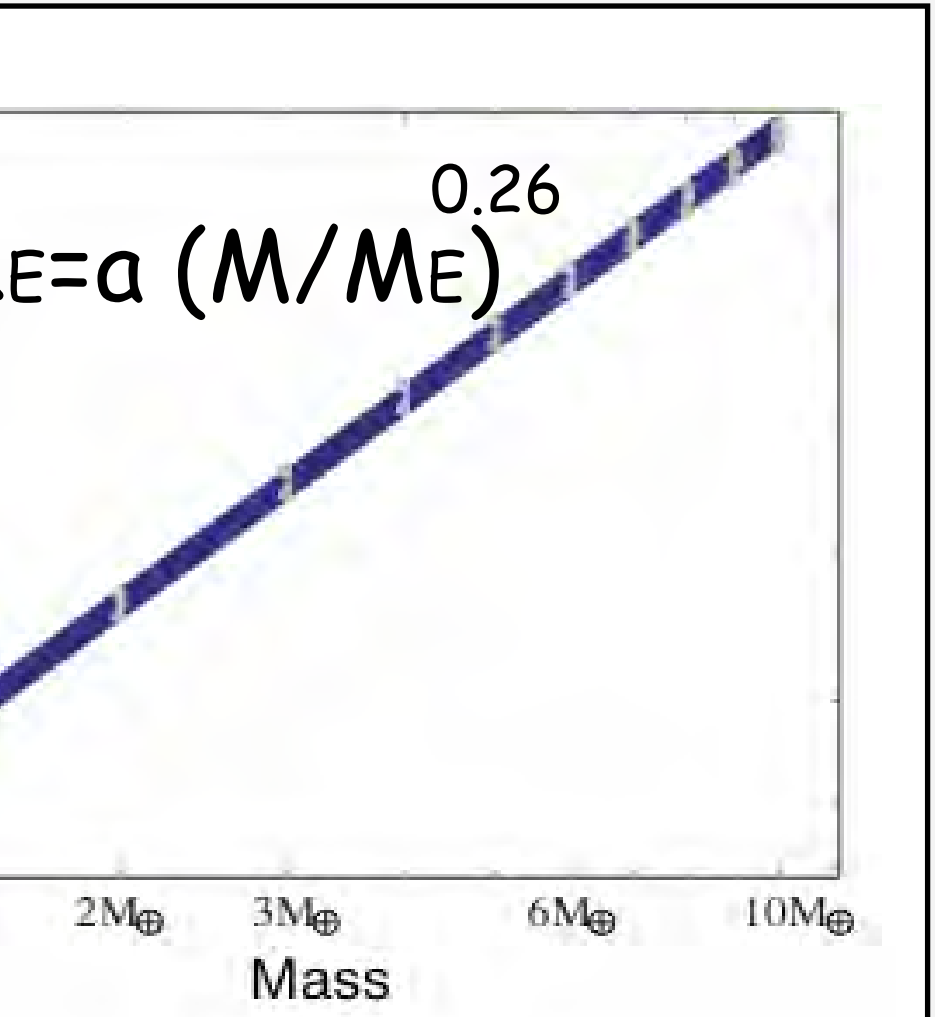
Plausible Composition

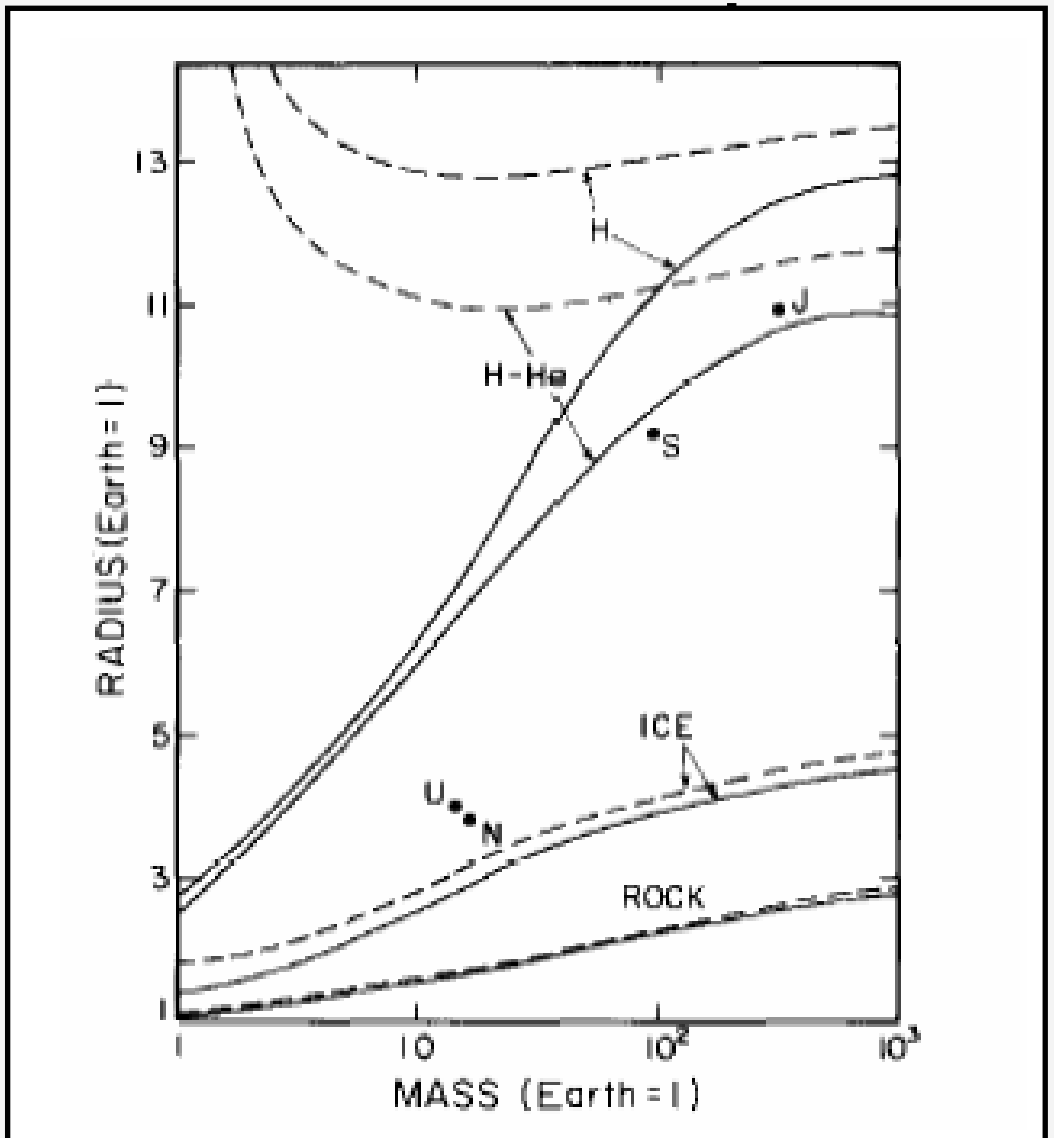


structure of Super-Earths



M-R relationship





lancia et al. 2006