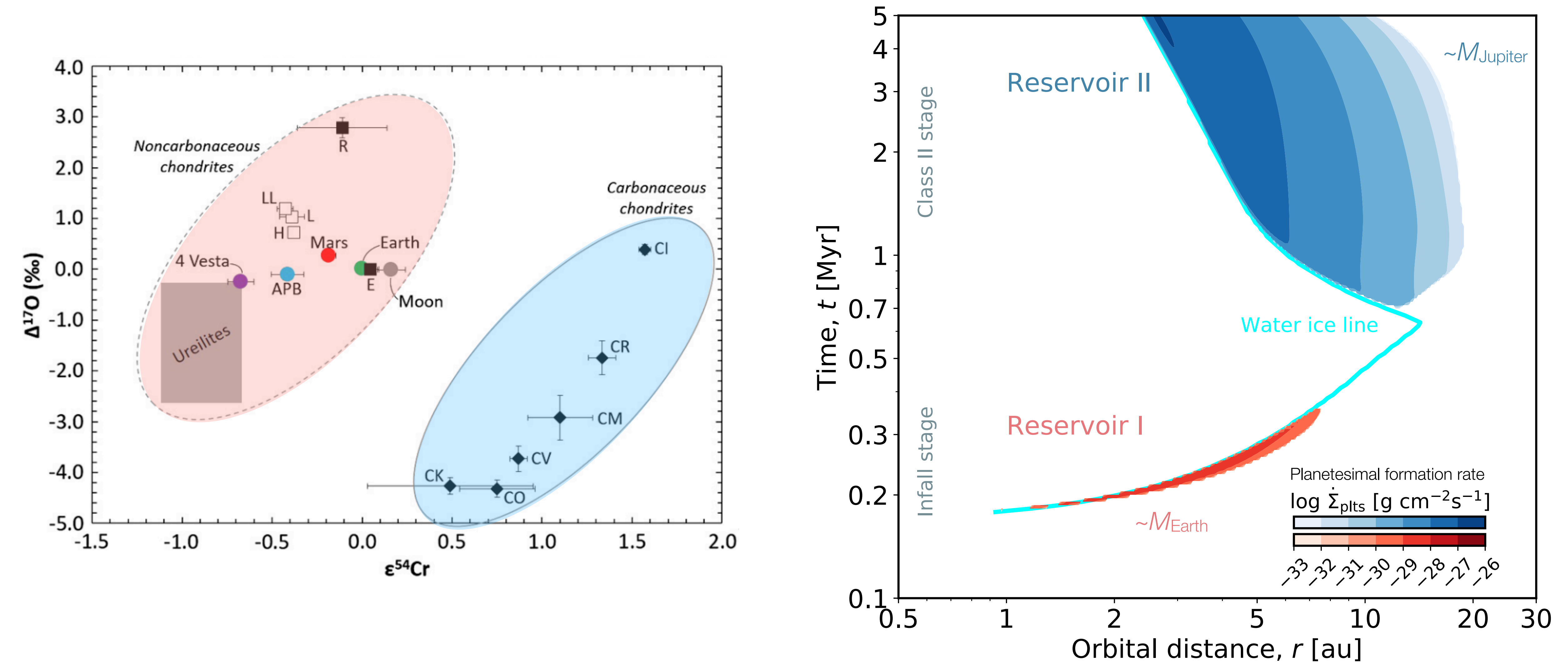


# Earliest compositional bifurcation of planetary building blocks

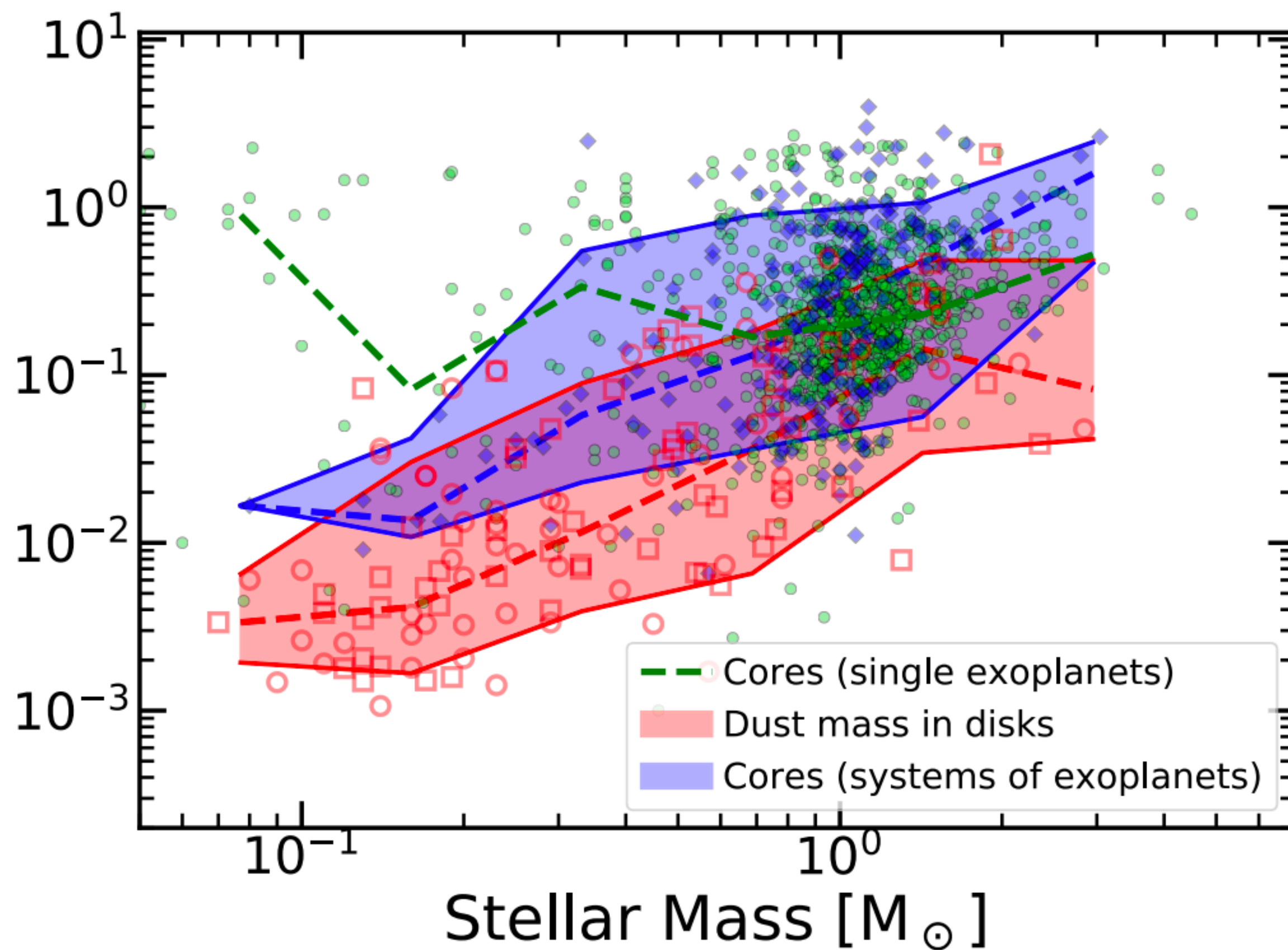
Lichtenberg, Drażkowska, Schönbächler, Golabek, Hands, in prep.



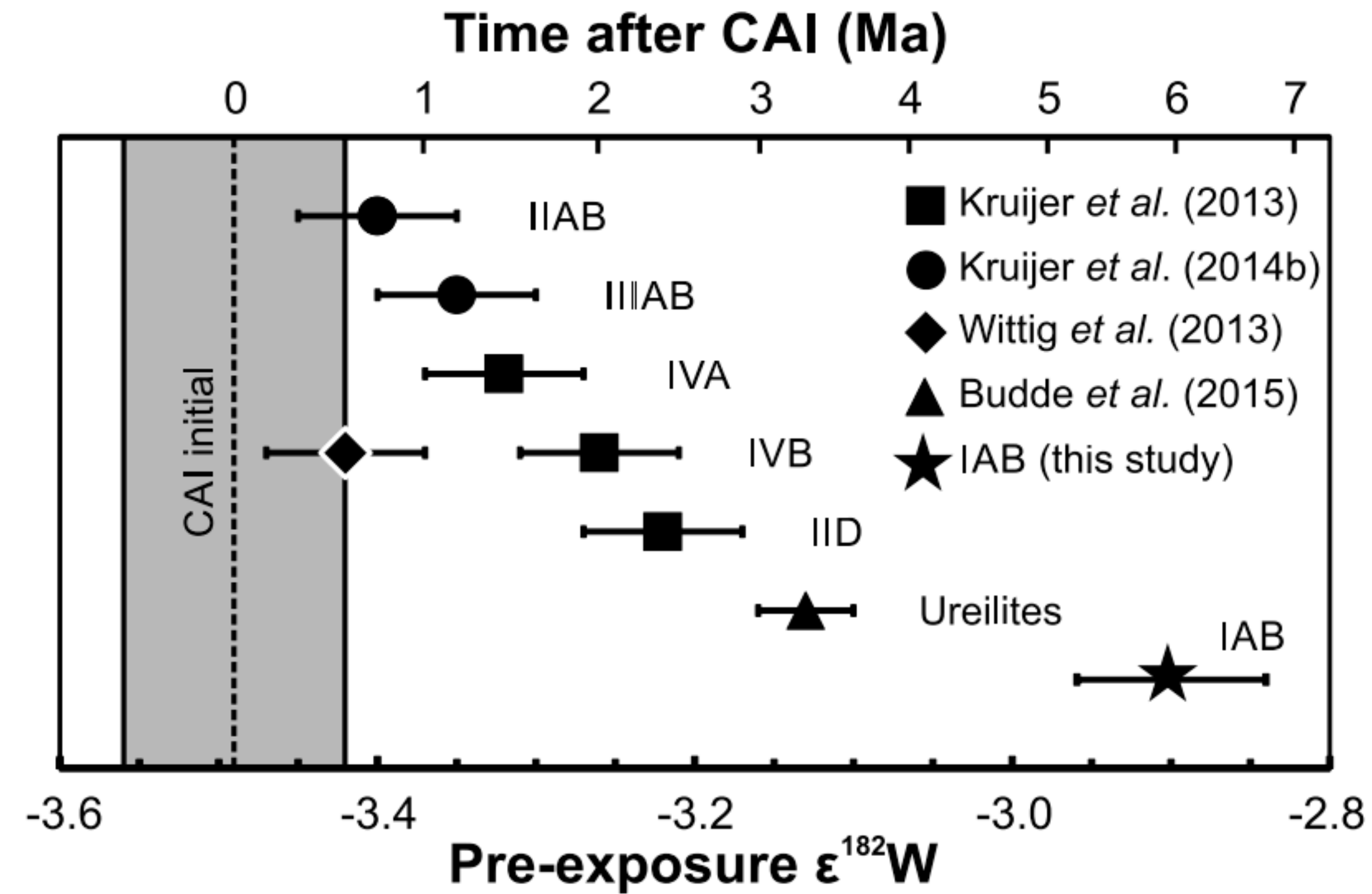
# Rocky planet diversity shaped during accretion

Mass in dust or planetary cores [ $M_J$ ]

Extrasolar systems



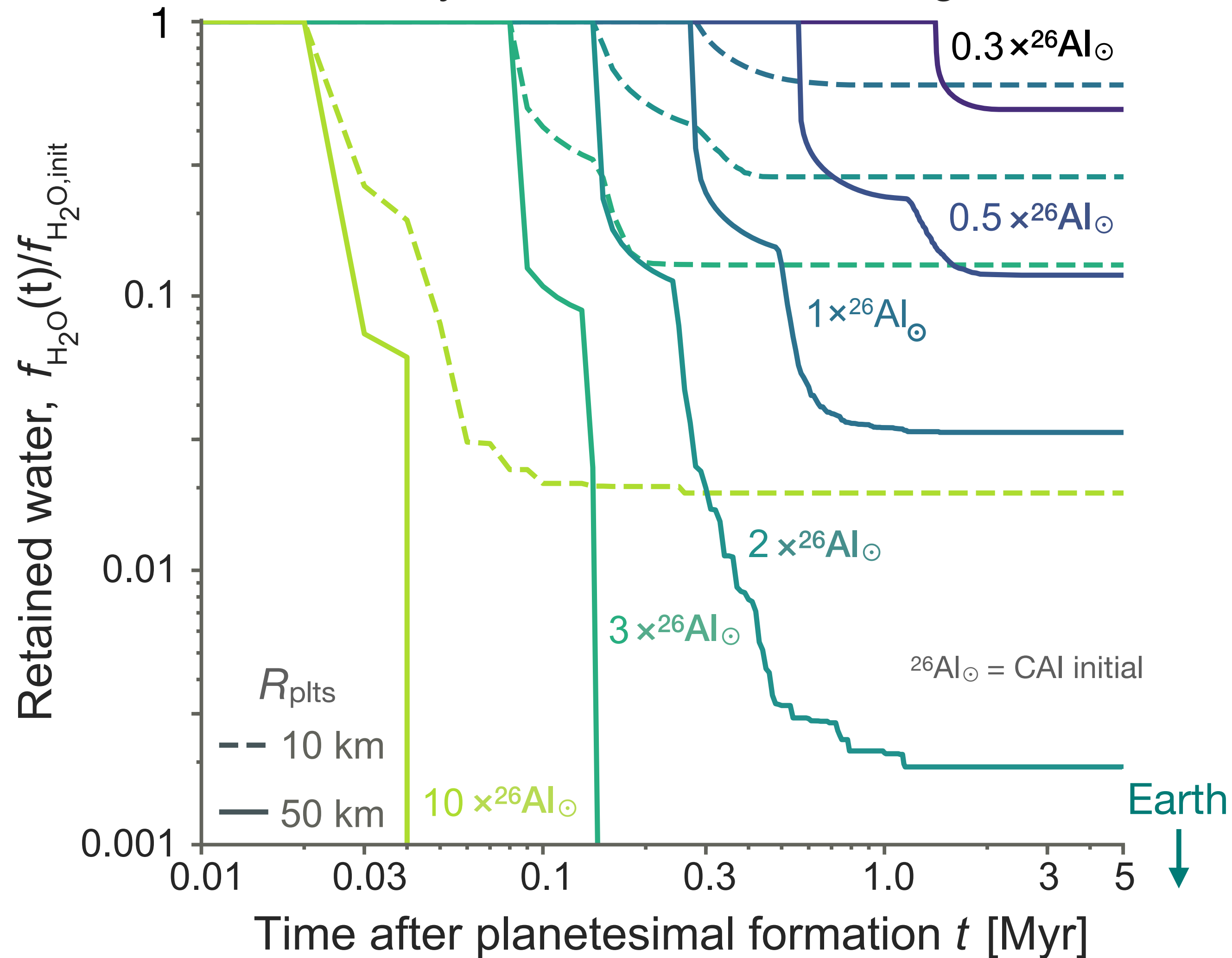
Solar System



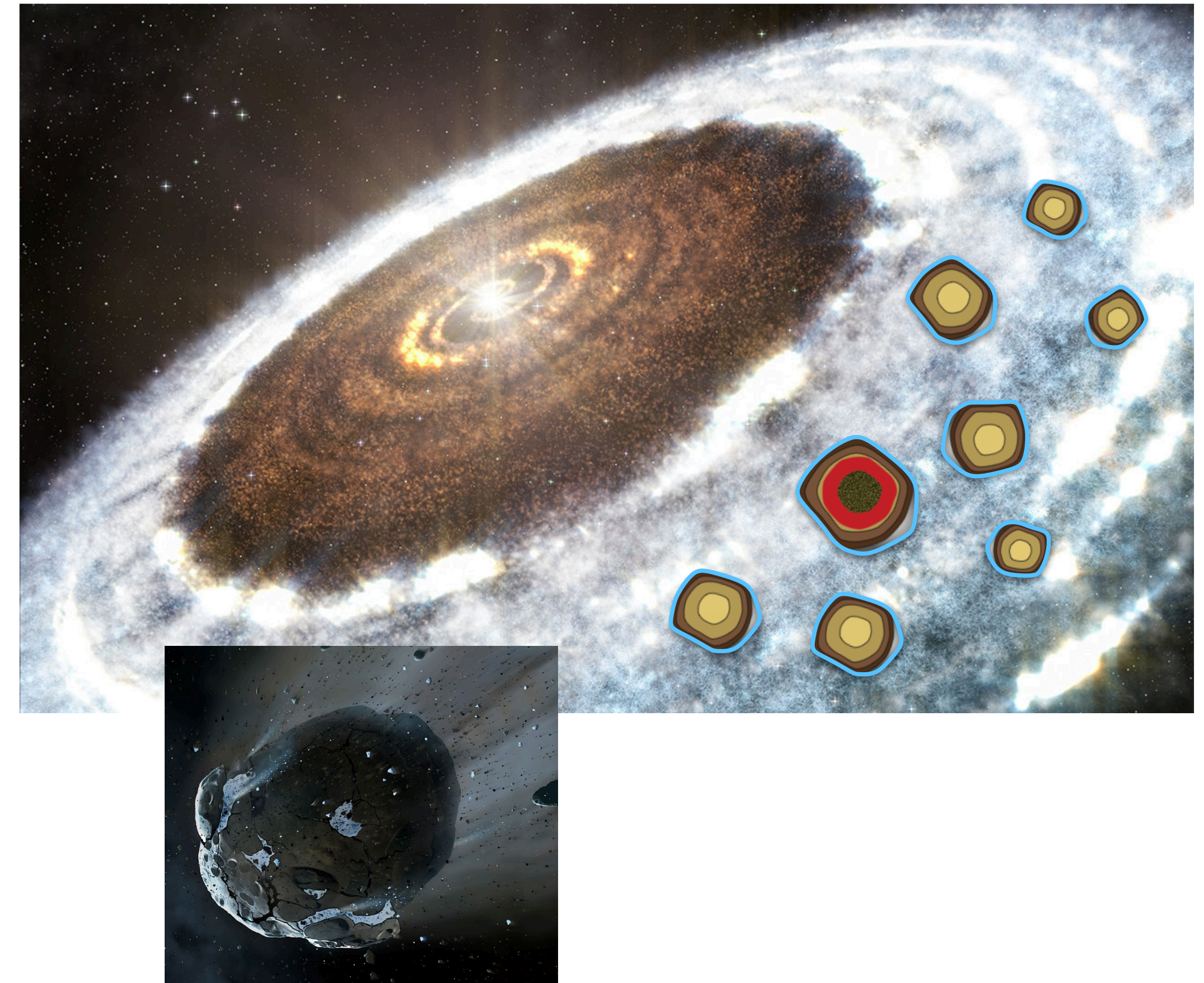


# Volatile inventory altered during accretion

Dehydration from  $^{26}\text{Al}$  heating

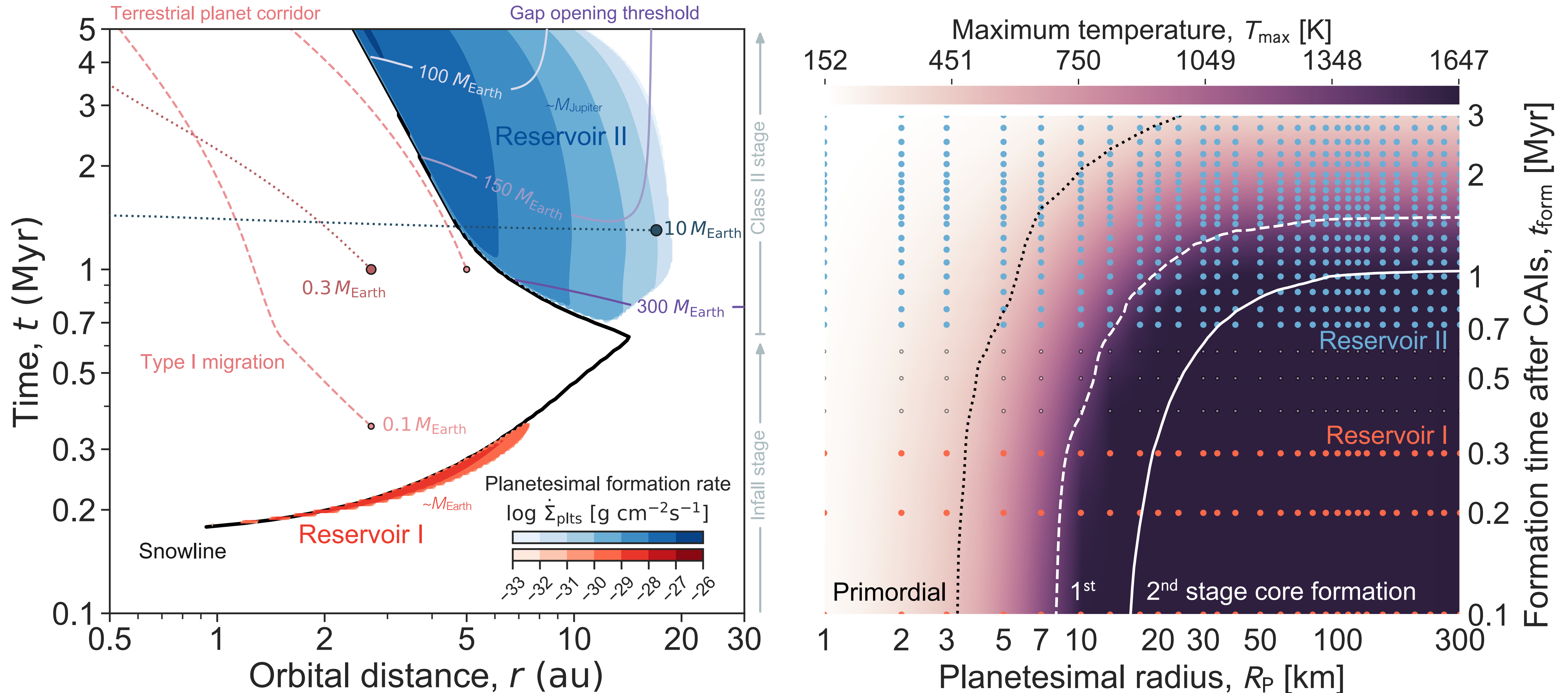


$^{26}\text{Al}$ -heated icy planetesimals forming planets



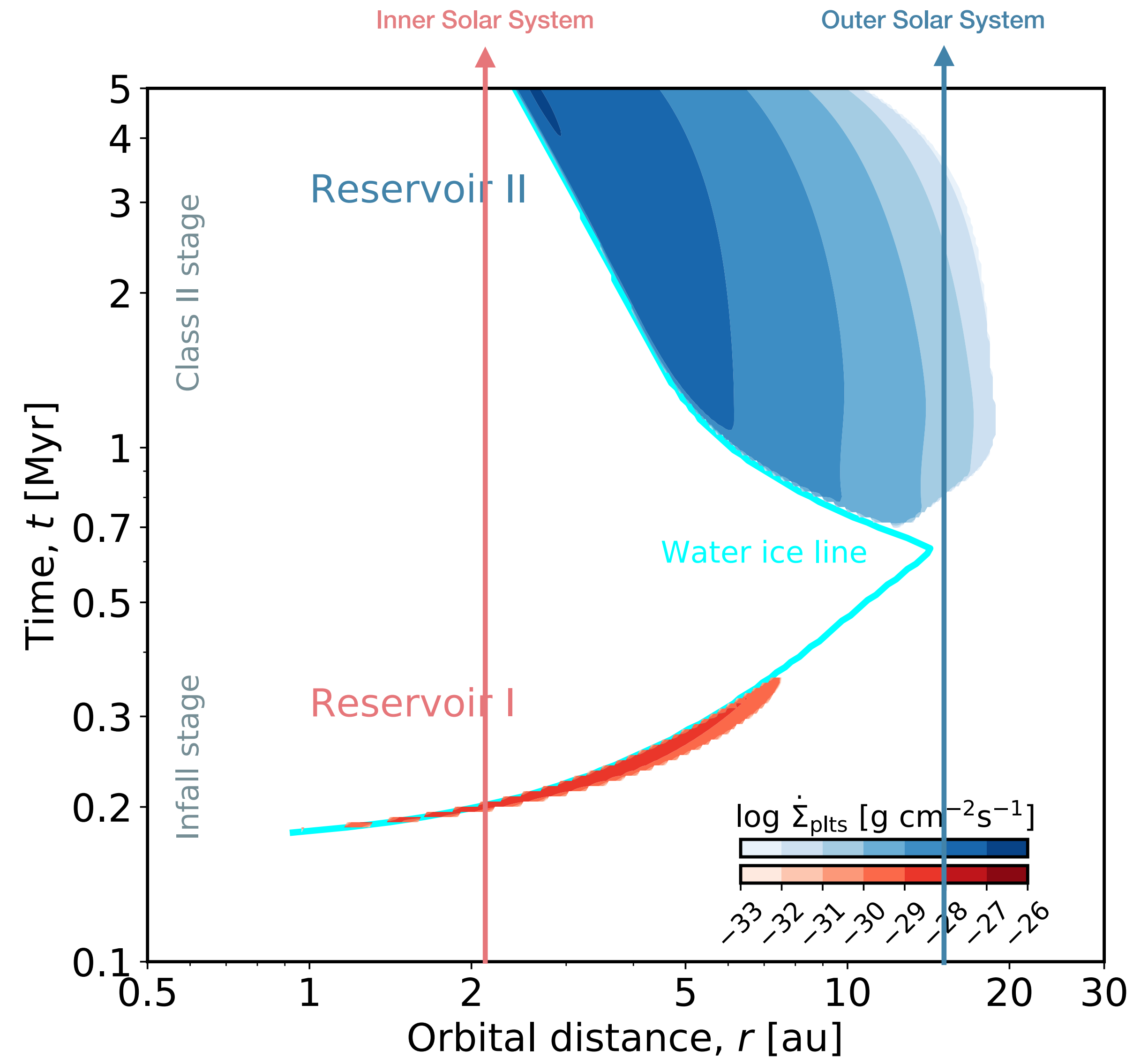
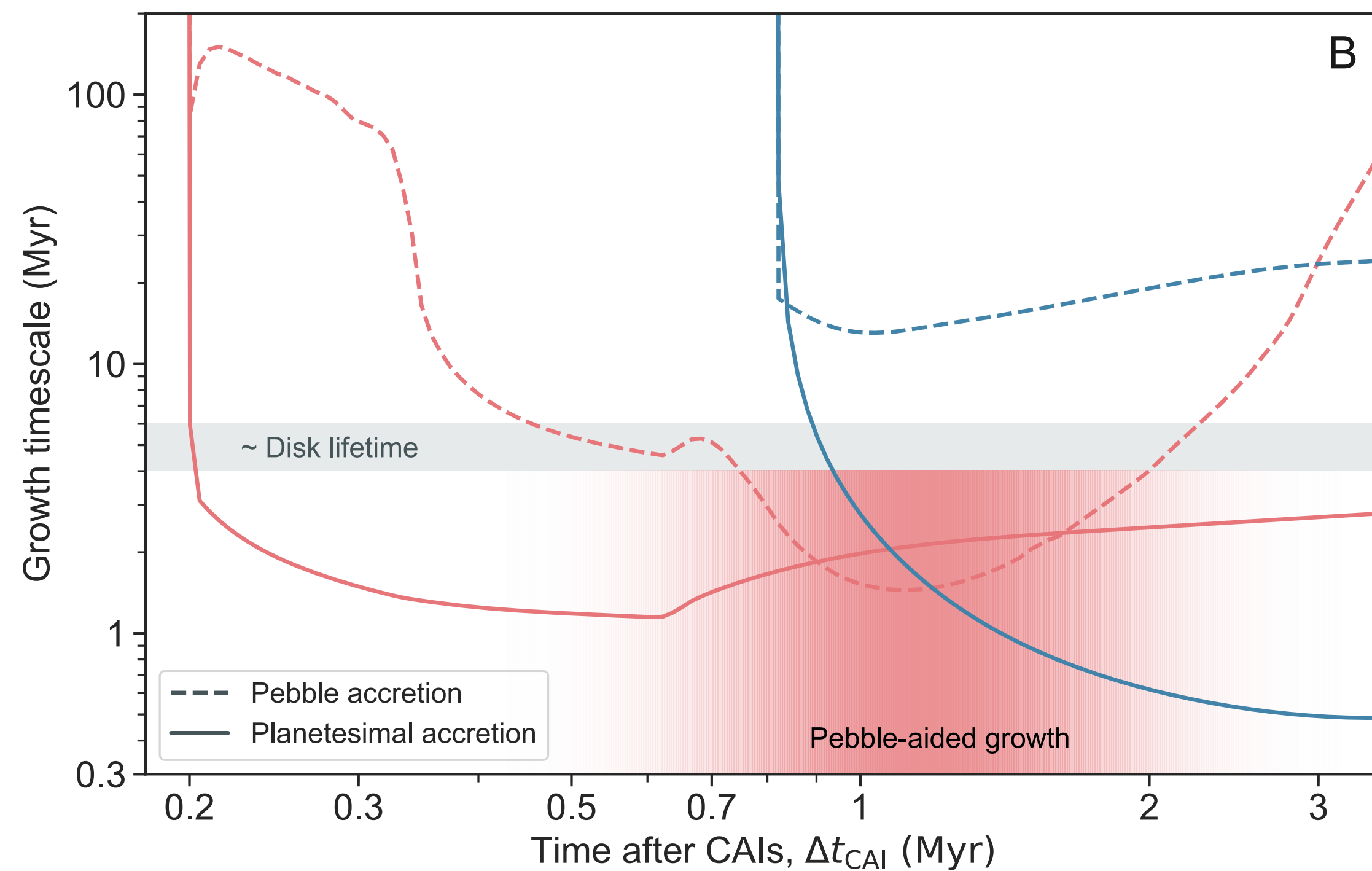
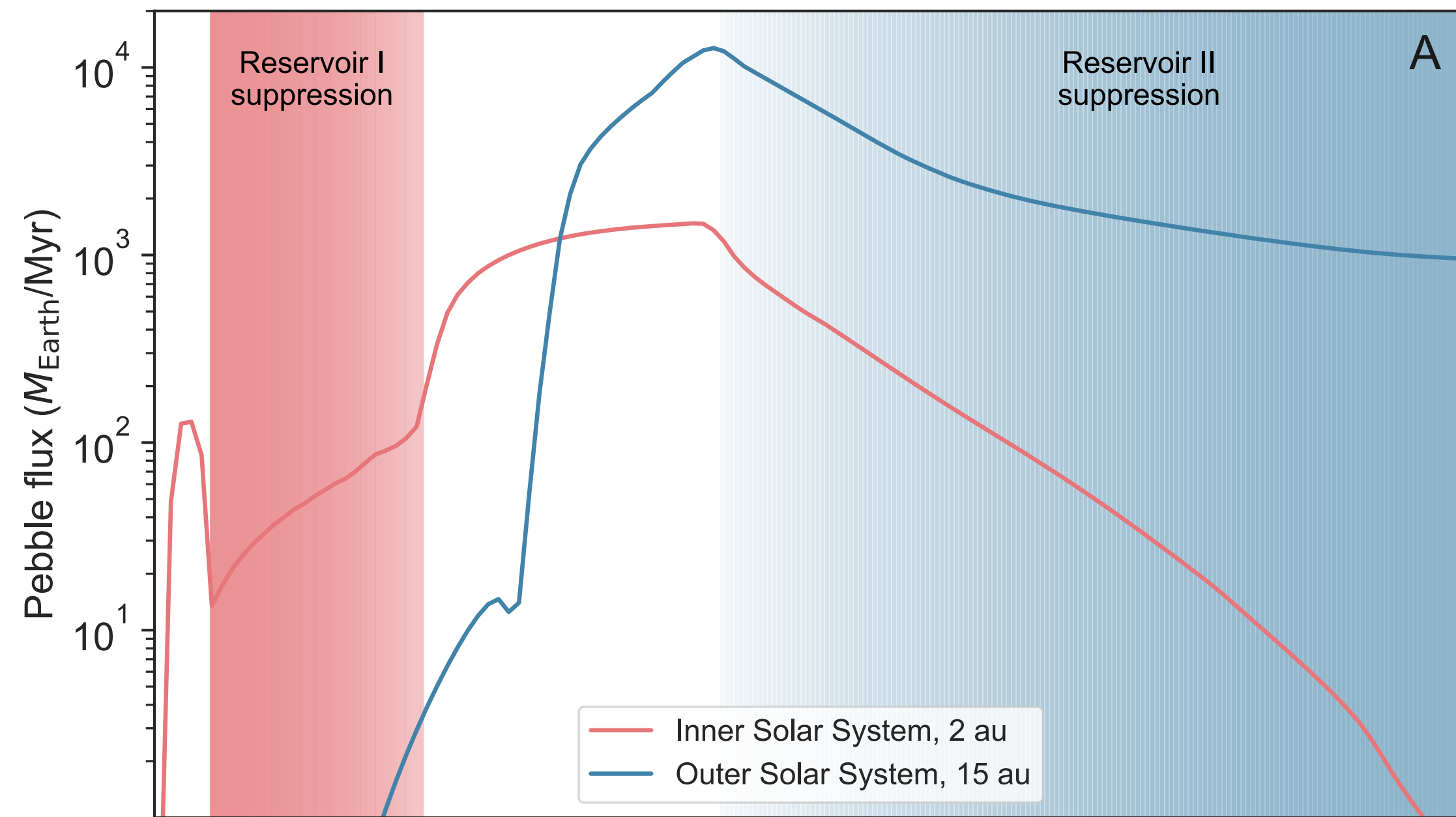


# Two primordial reservoirs, thermally processed



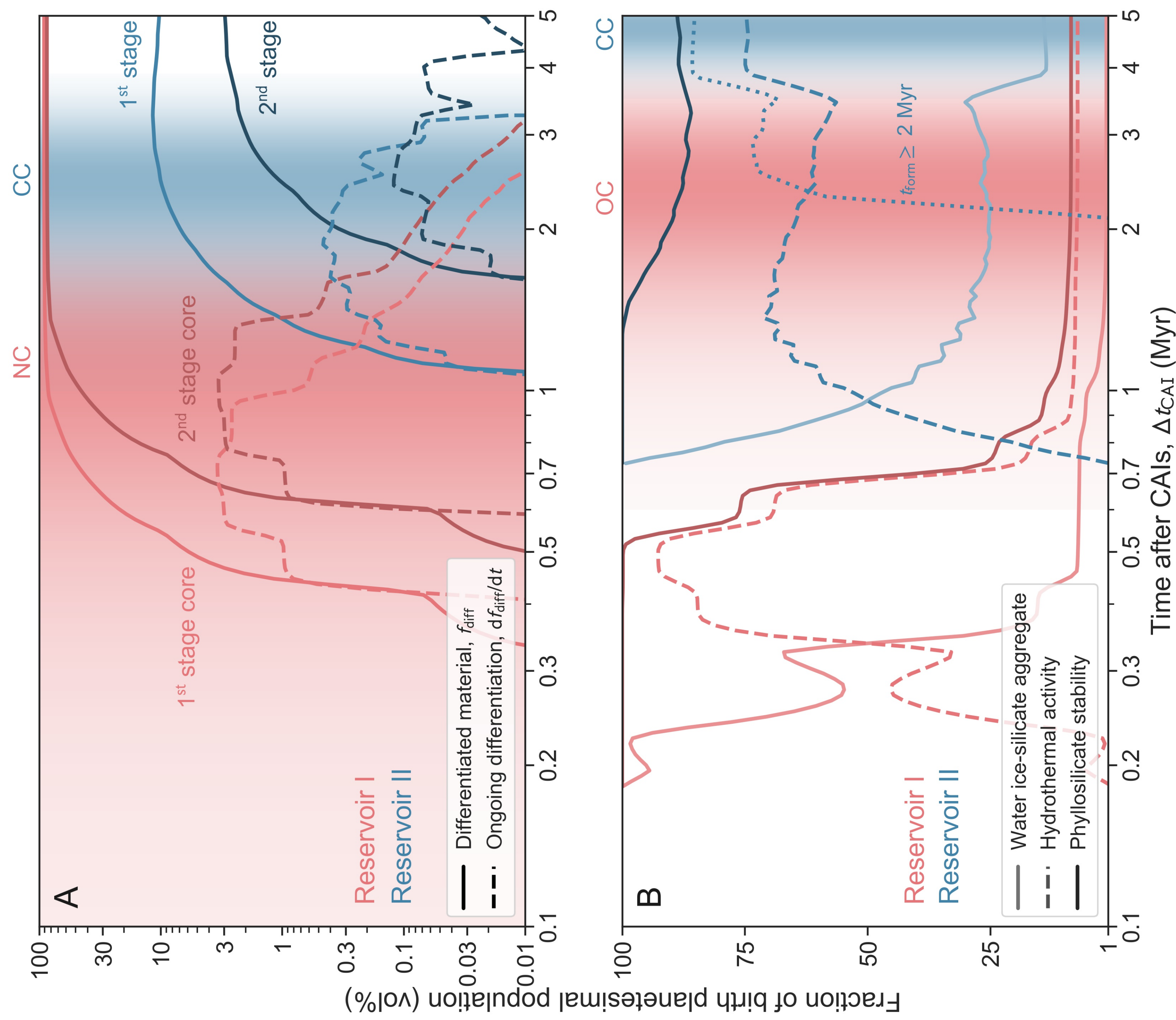


# Dominant growth mode



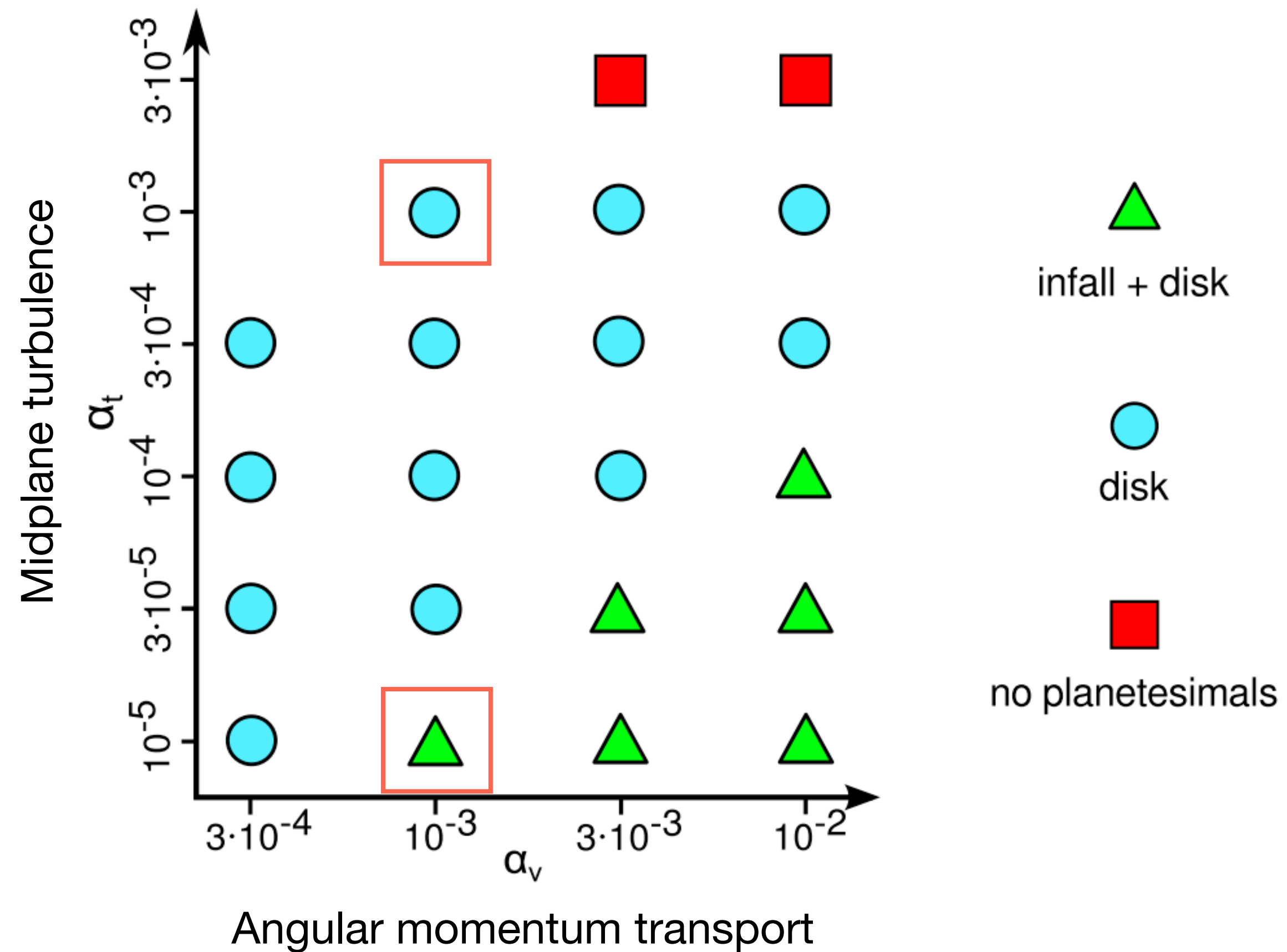


# Planetesimal swarm compositional evolution and match with meteorite record

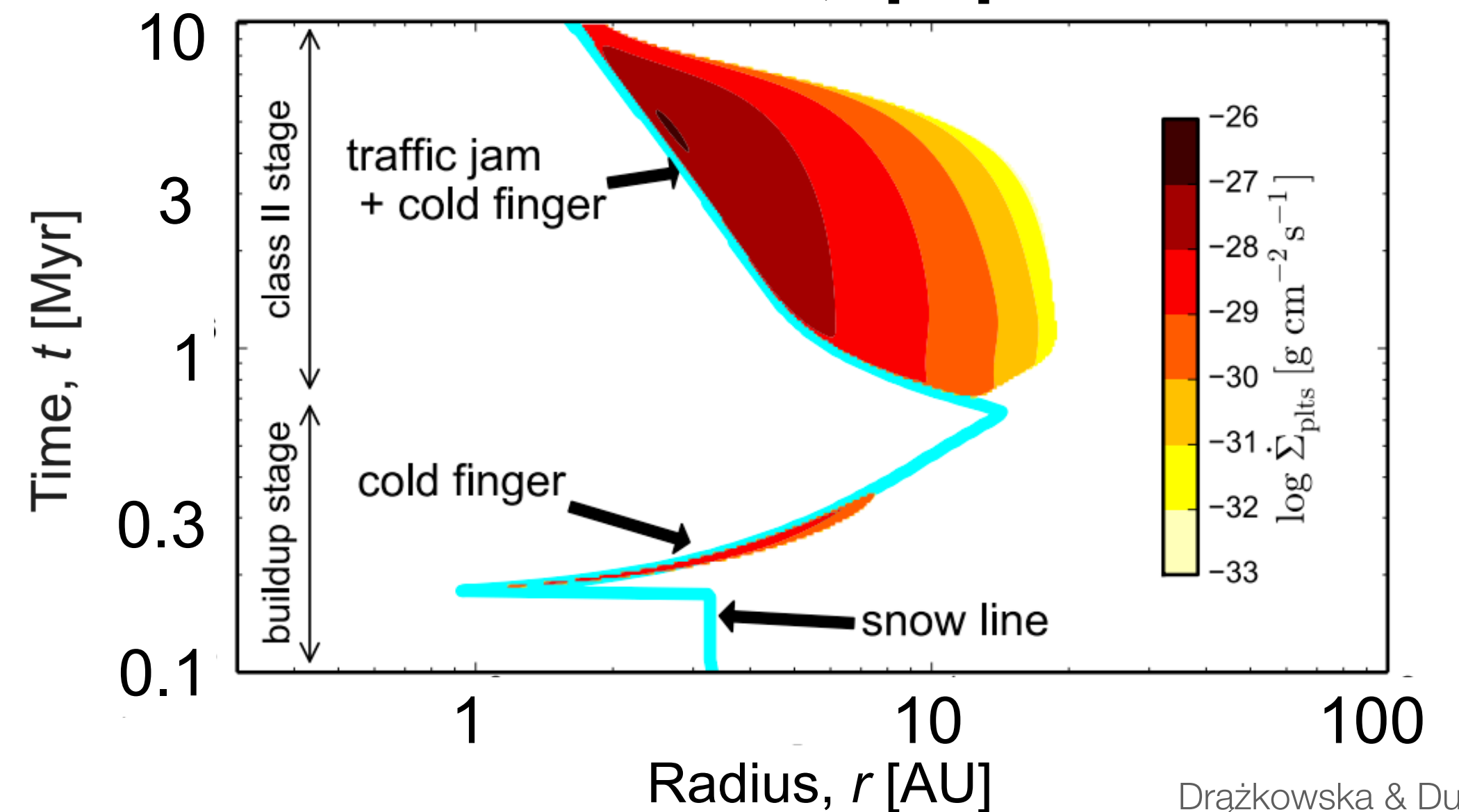
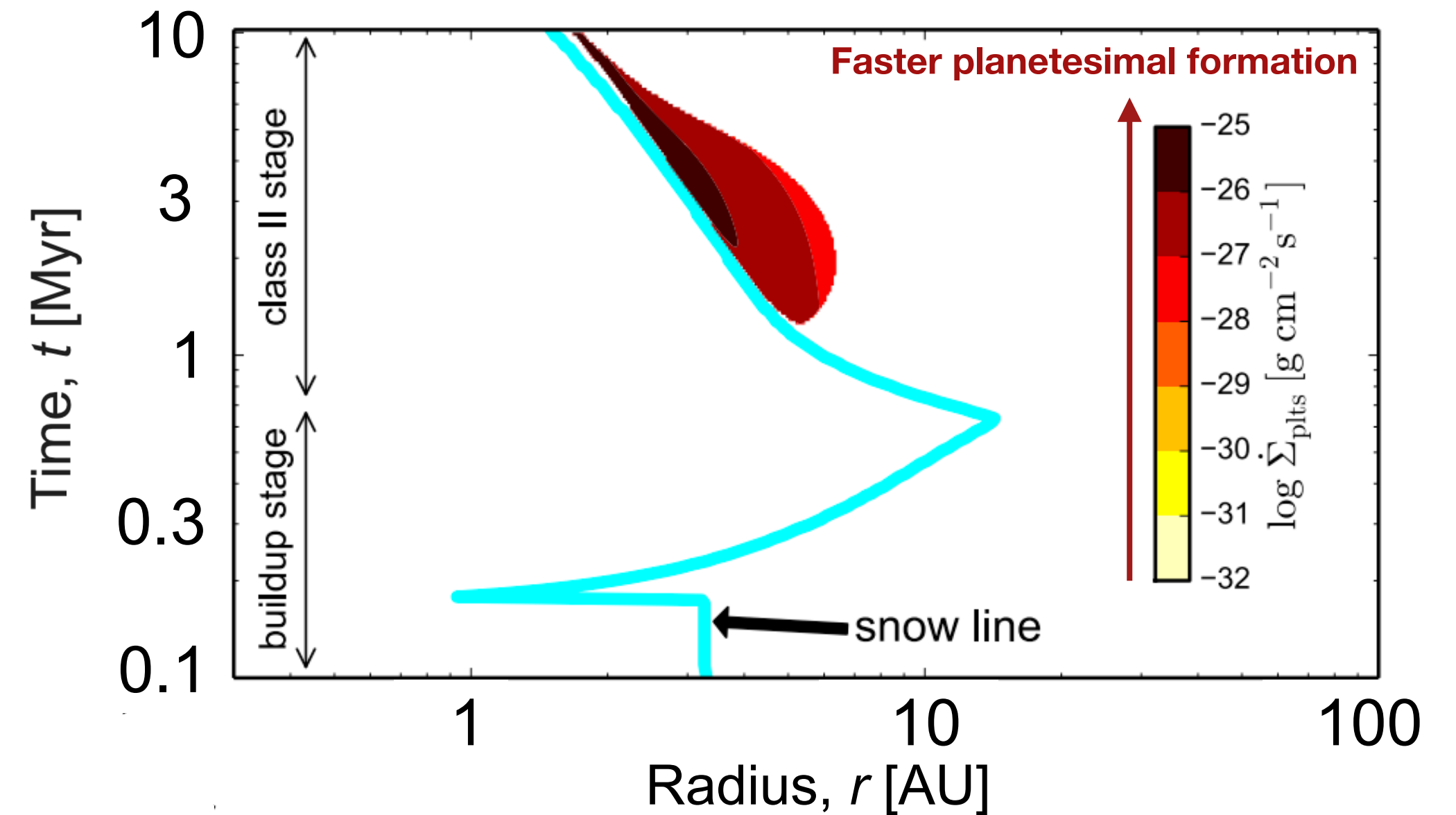




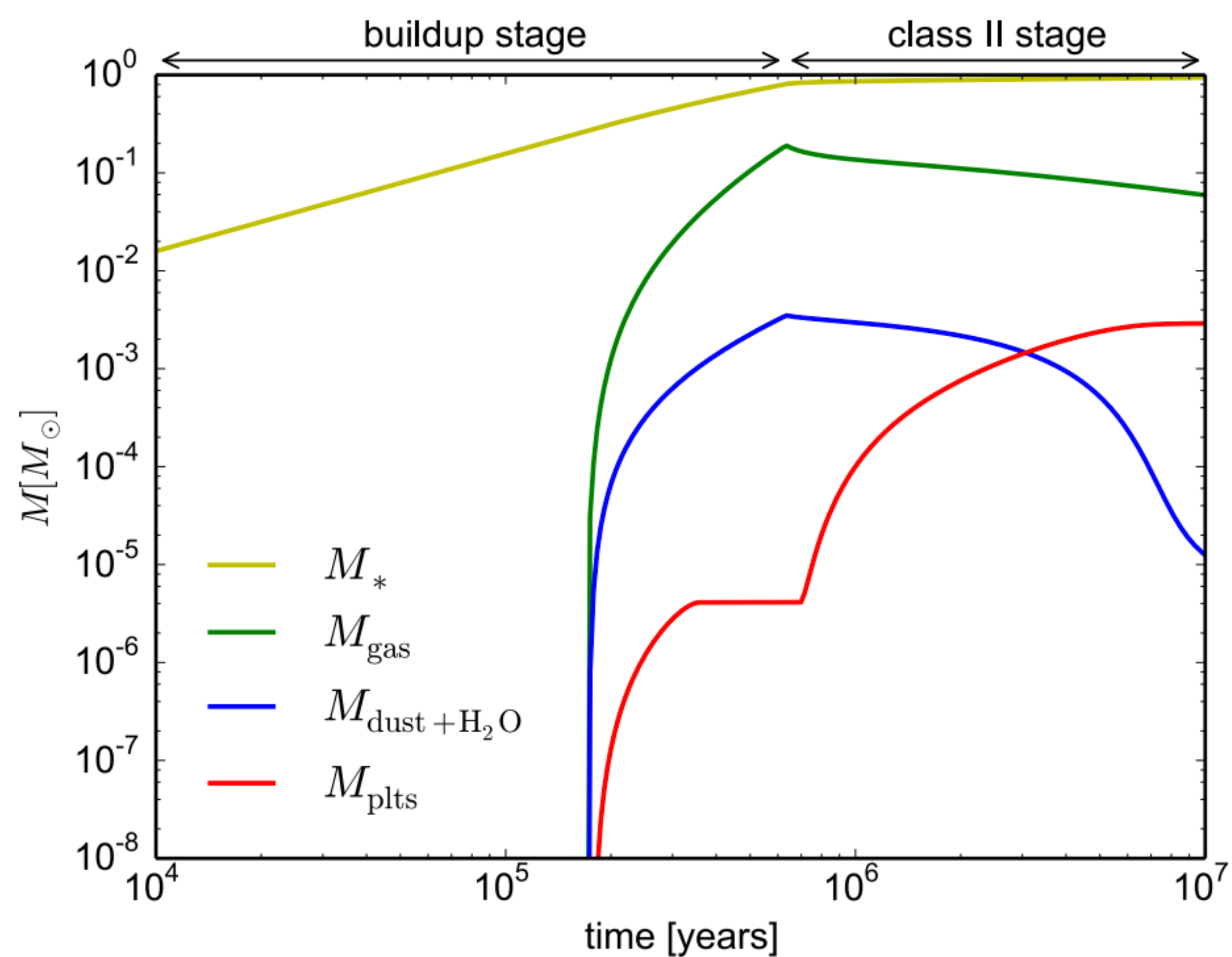
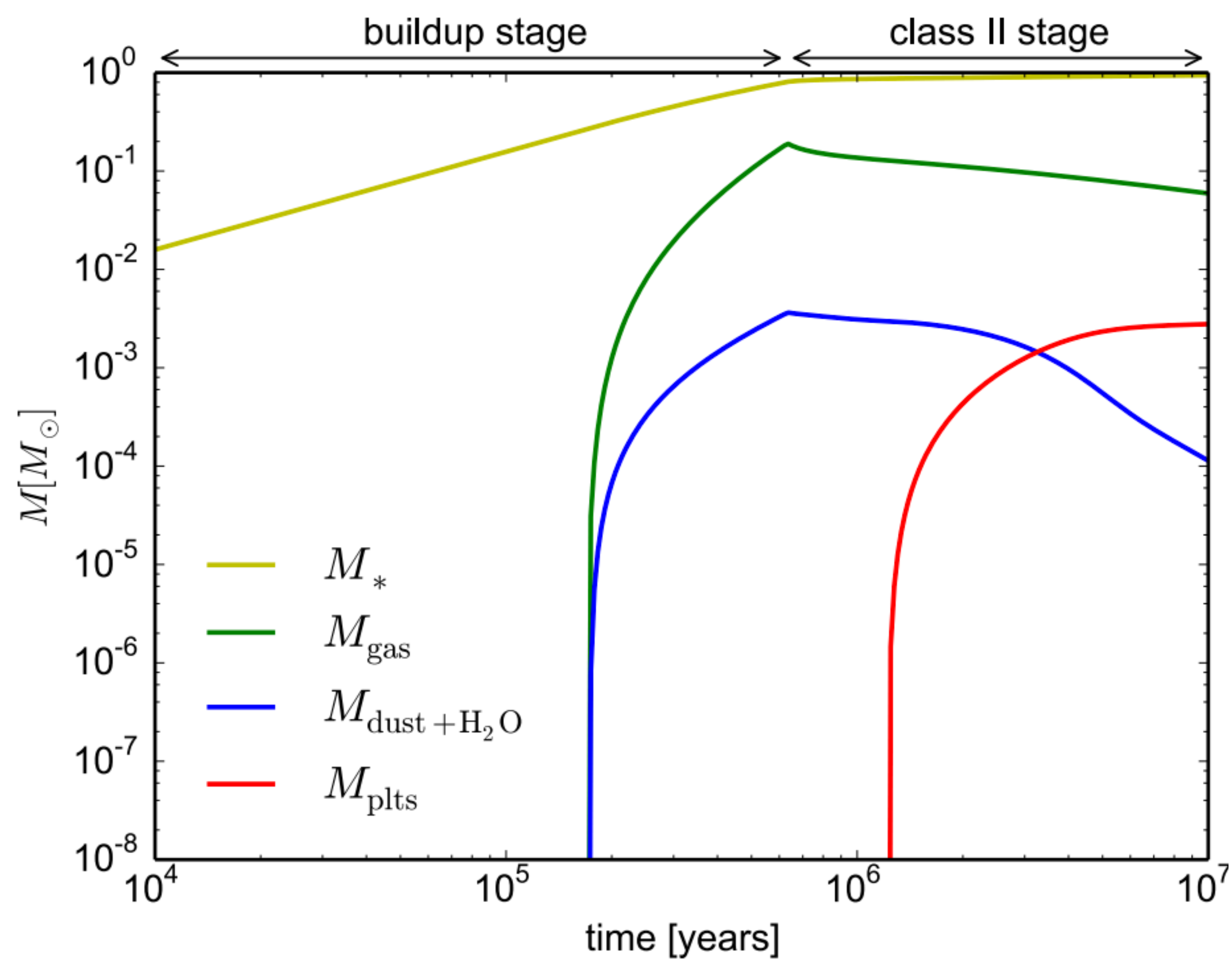
# Rapid accretion in midplane-quiescent disks



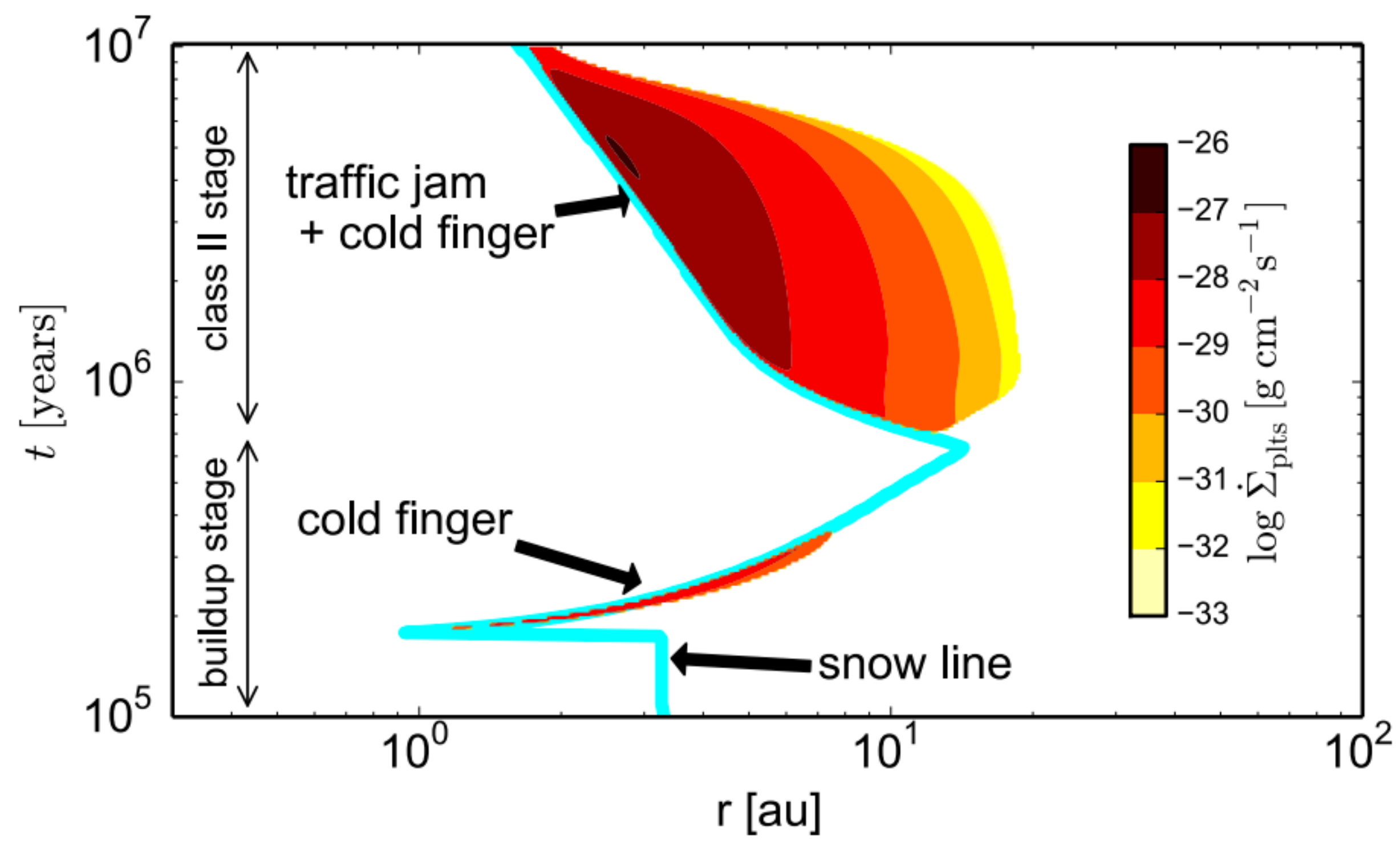
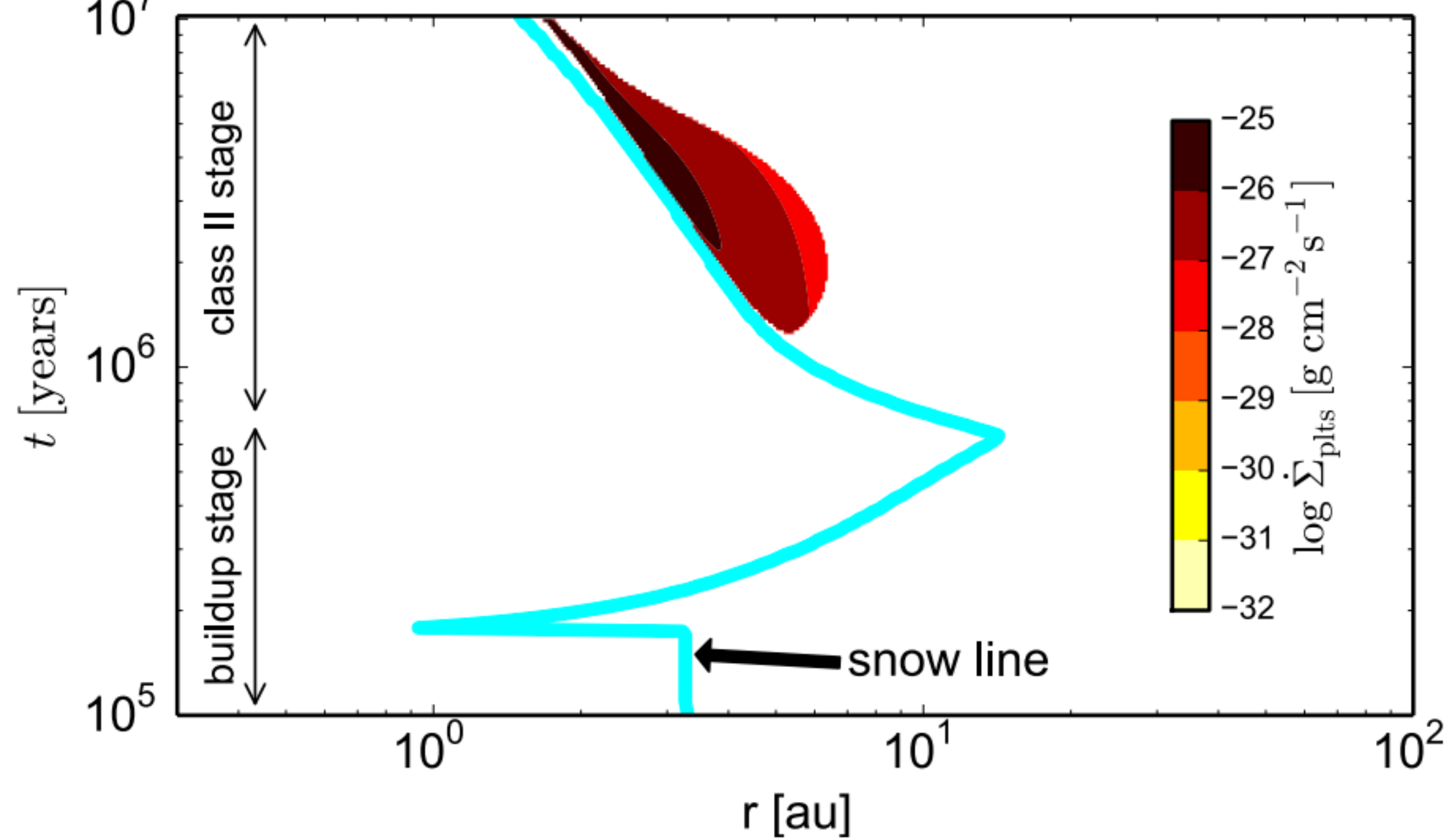
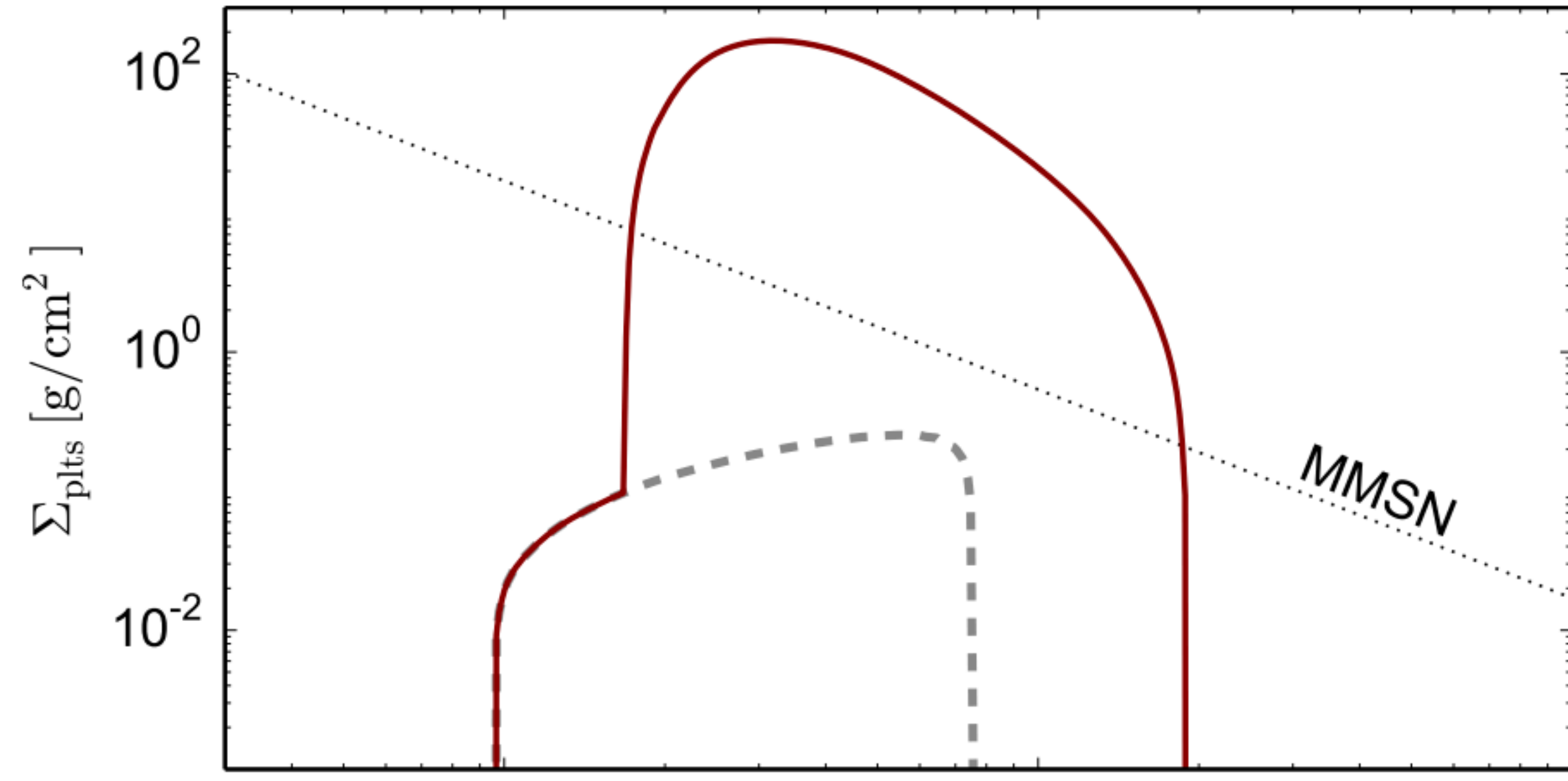
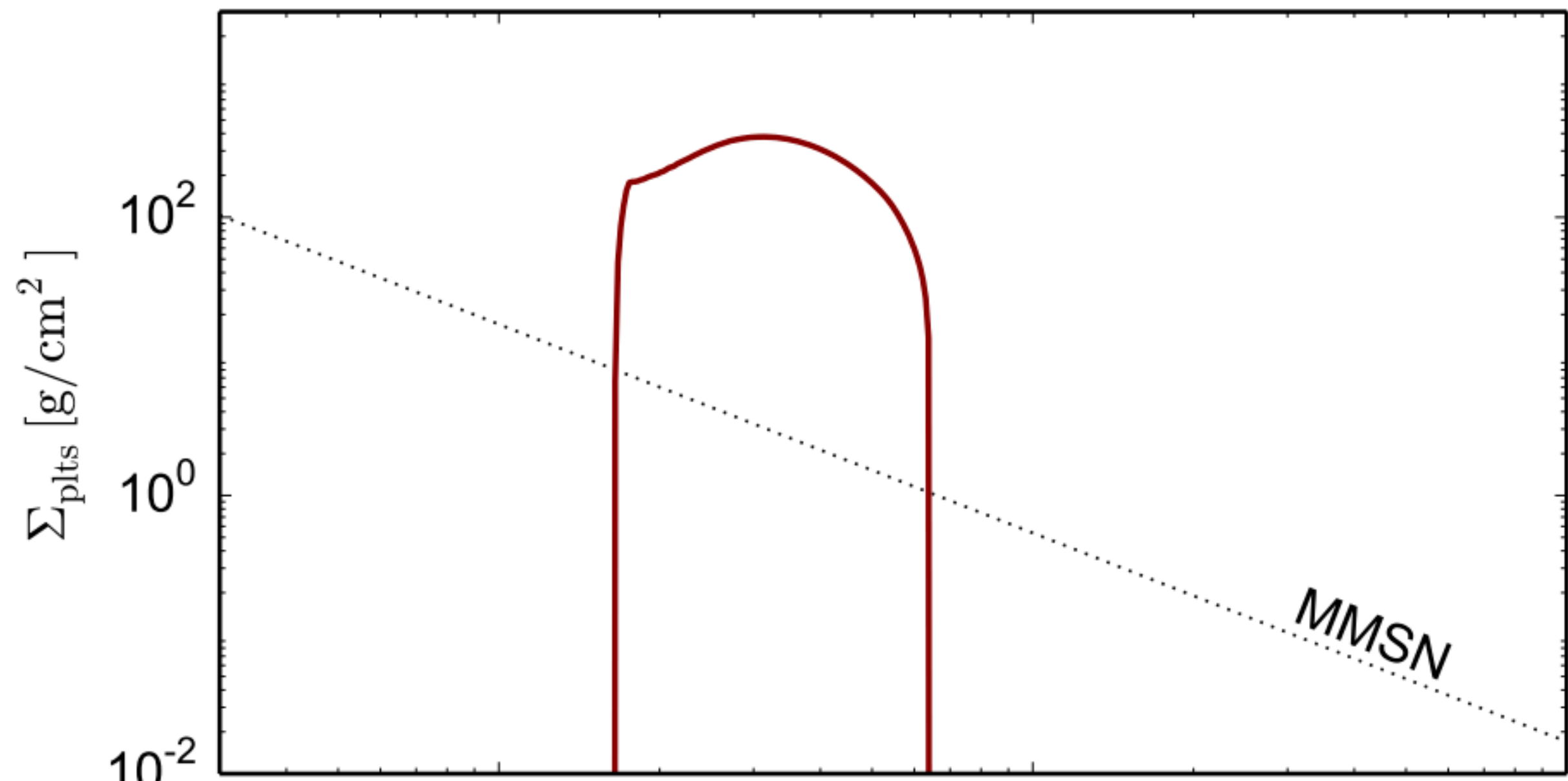
$$\nu = \alpha_v c_s H_g$$



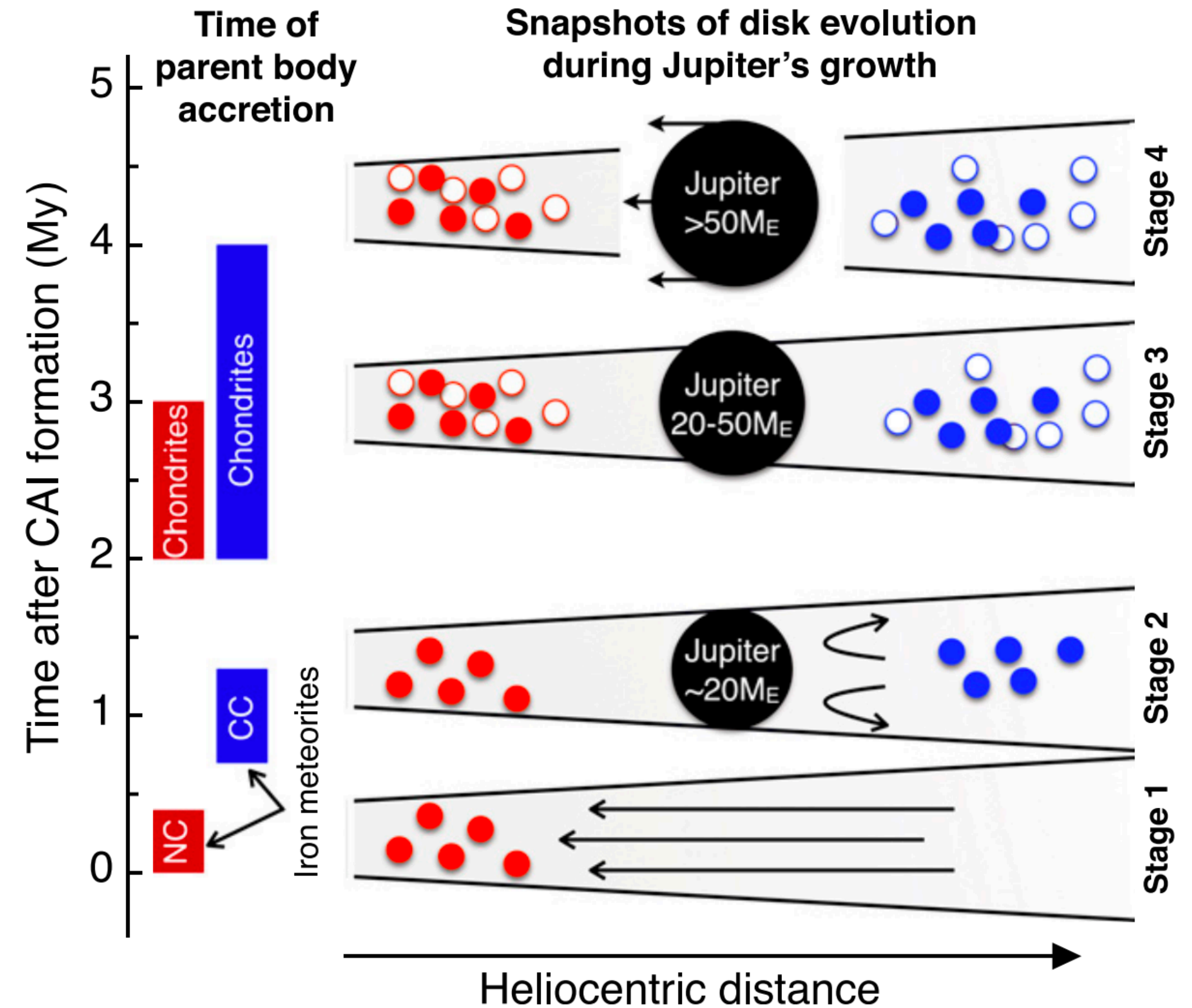
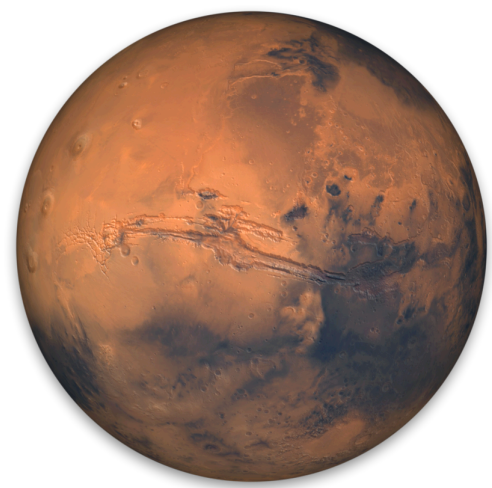
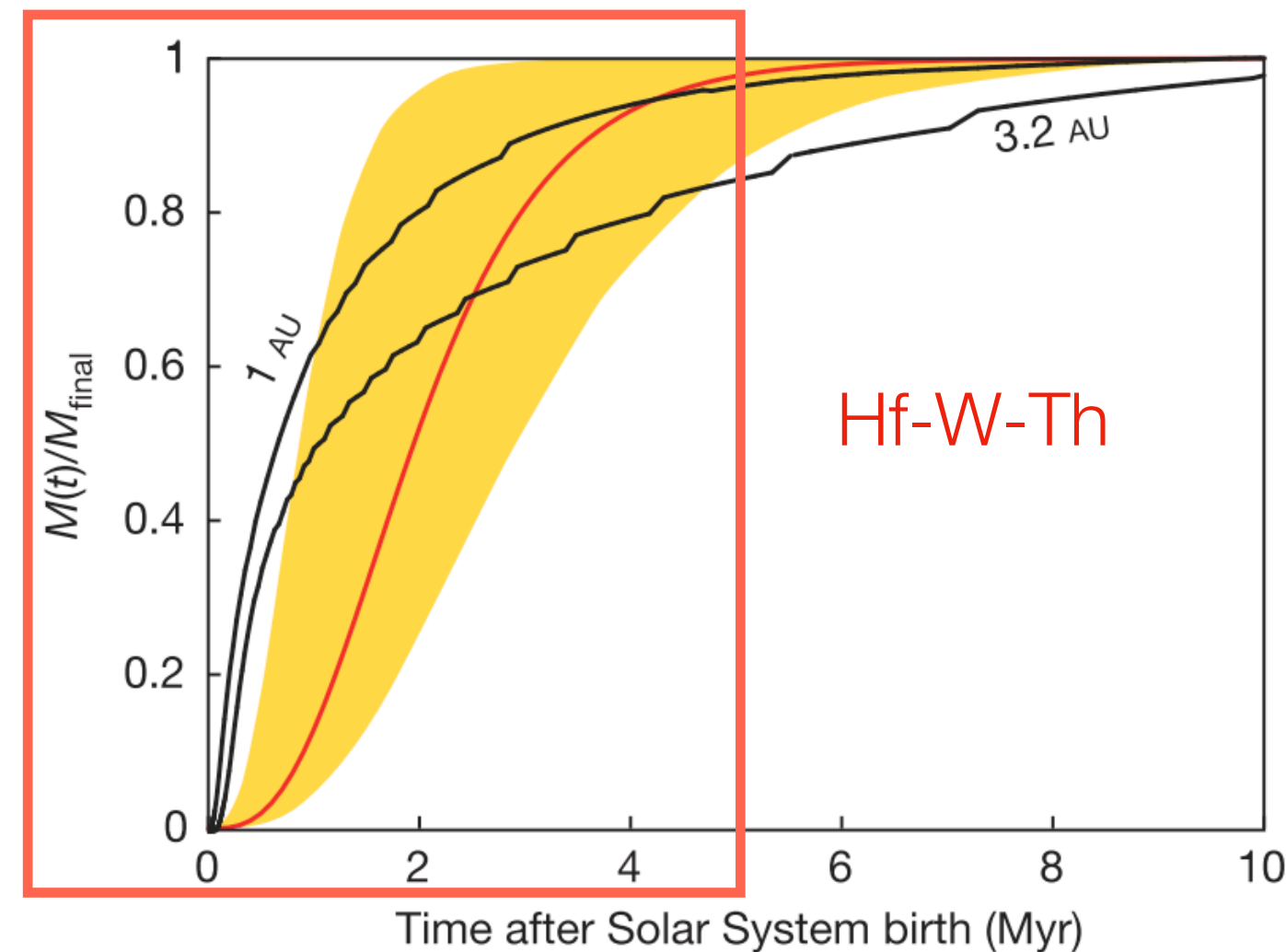
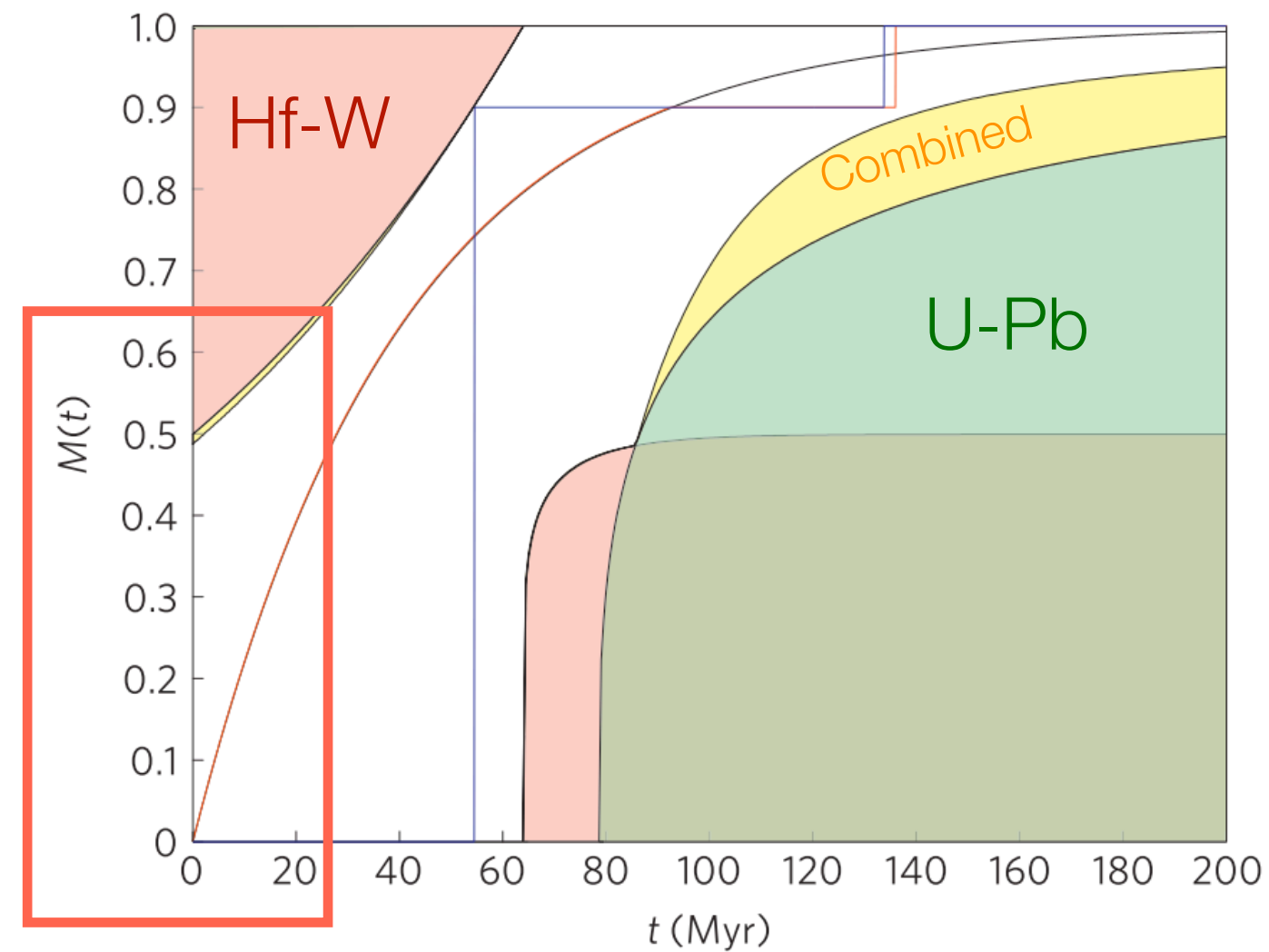








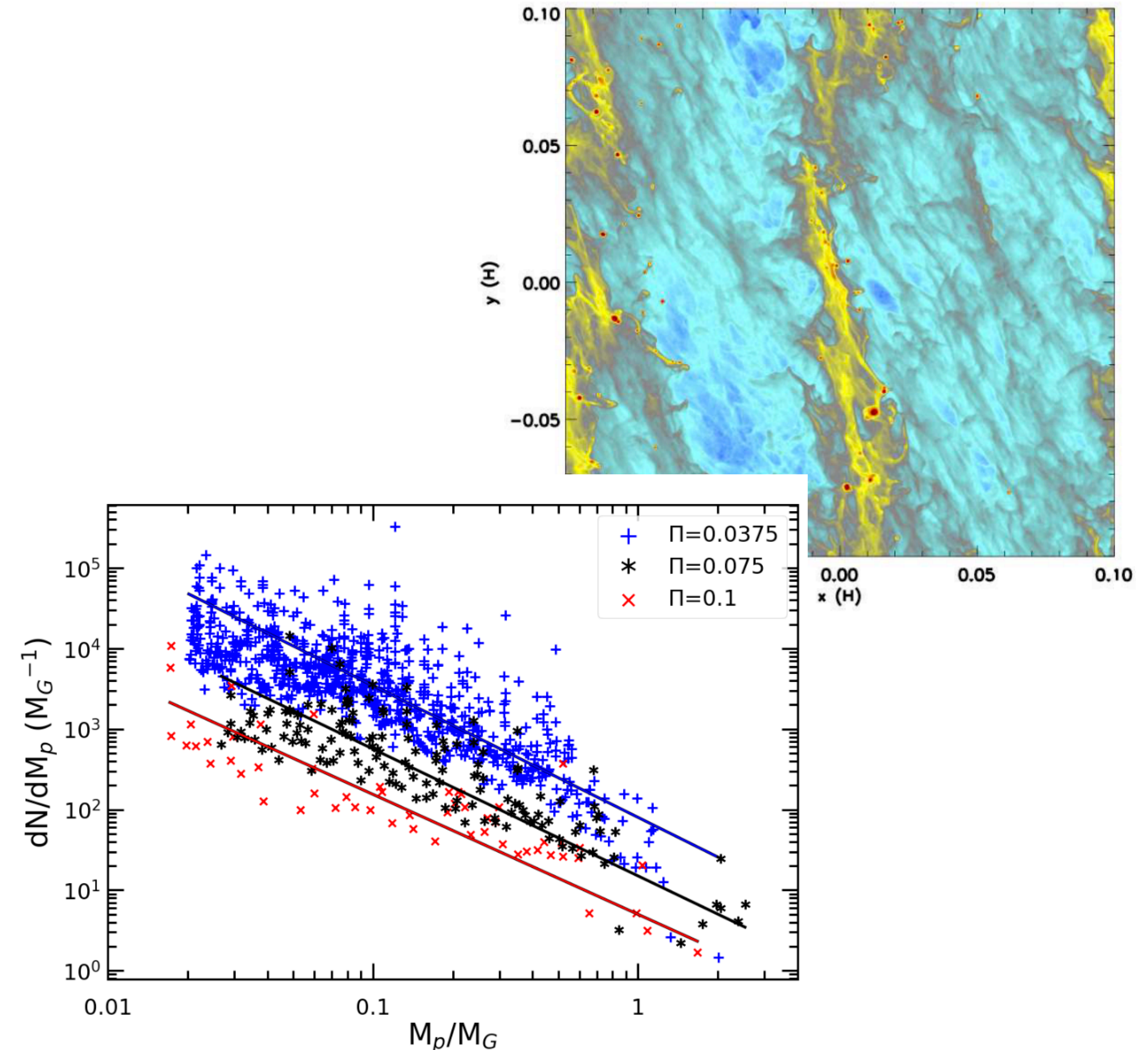
# But protracted growth for the inner planets?





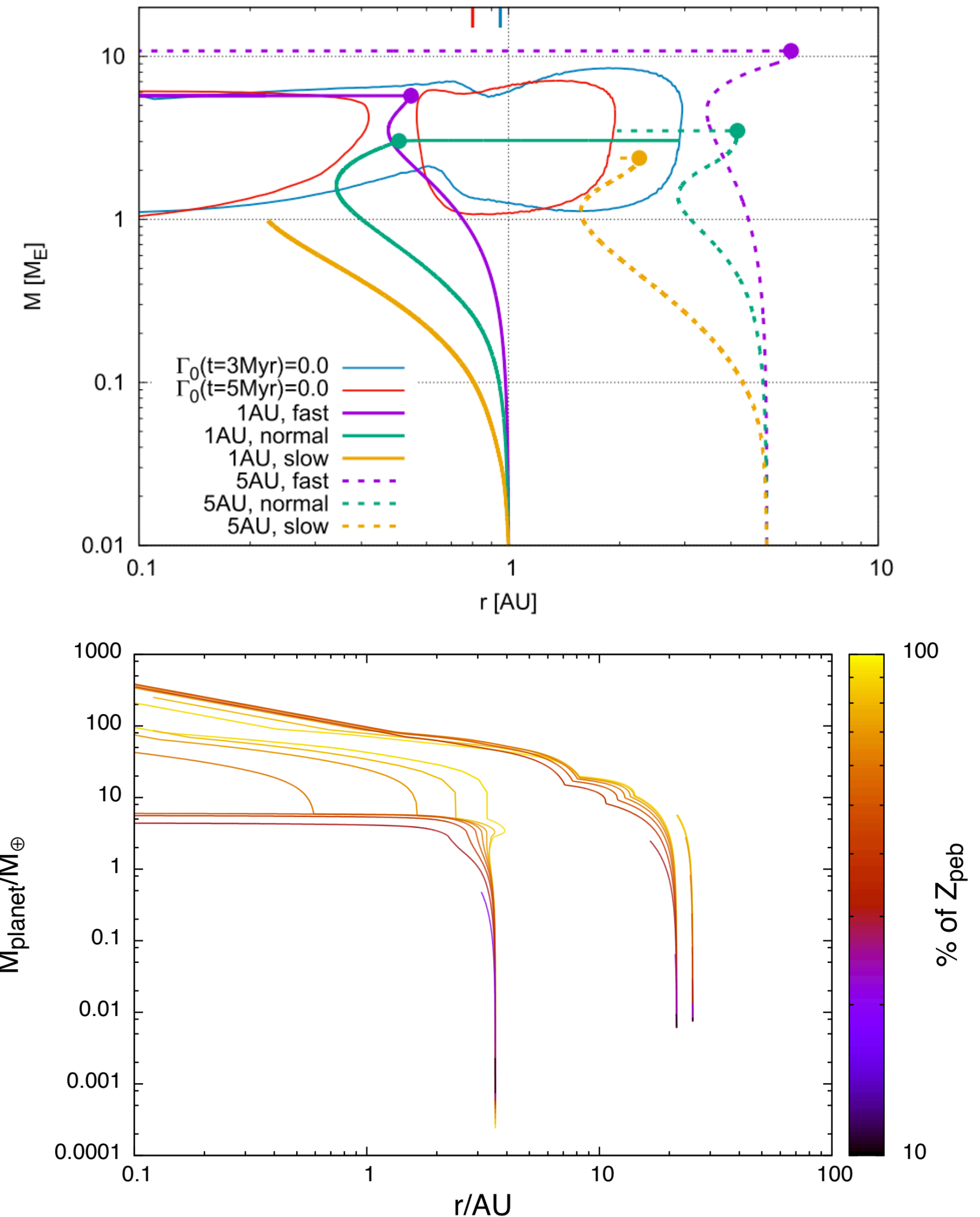
# Both combined is a challenge

- Hard to form a  $20 M_{\text{Earth}}$  planet in  $\approx 1$  Myr
  - ▶ Streaming instability (SI) requires favourable local conditions  $\approx 10^5$ - $10^6$  yrs
  - ▶ SI-generated size-frequency distribution ( $R_{\text{max}} \approx 250$  km) limits efficacy of pebble accretion
- Optimistic models of pebble accretion rapid ( $\approx 10^4$  yr); migration-constrained
- Jupiter is a porous ‘filter’
- ➔ Early-formed Jupiter scatters  $\gg M_{\text{ast.-belt}}$  into inner Solar System (need Grand Tack)



# Both combined is a challenge

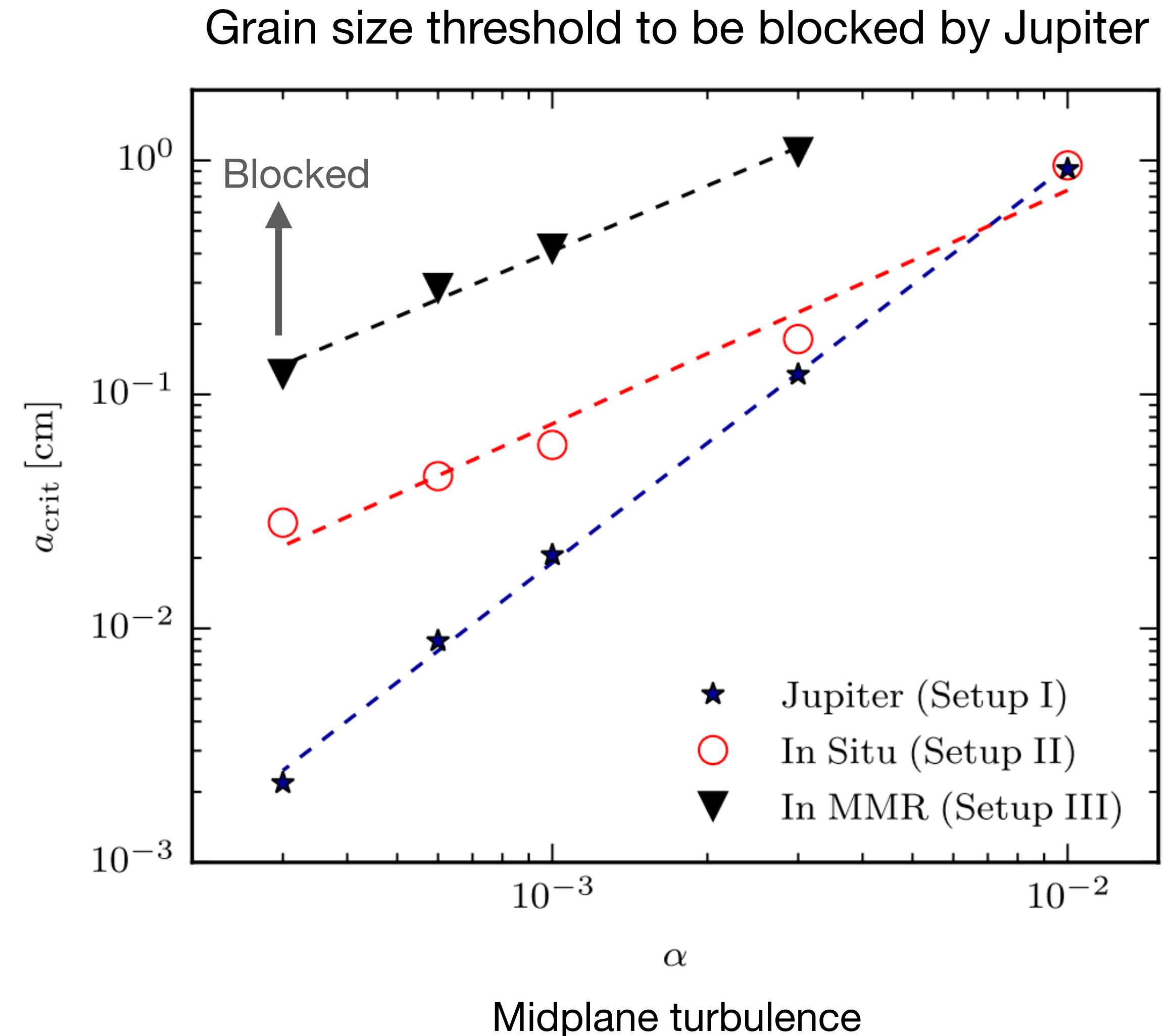
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  - ▶ Streaming instability (SI) requires favourable local conditions  $\approx 10^5\text{-}10^6 \text{ yrs}$
  - ▶ SI-generated size-frequency distribution ( $R_{\text{max}} \approx 300 \text{ km}$ ) limits efficacy of pebble accretion
- Optimistic models of pebble accretion rapid ( $\approx 10^4 \text{ yr}$ ); migration-constrained
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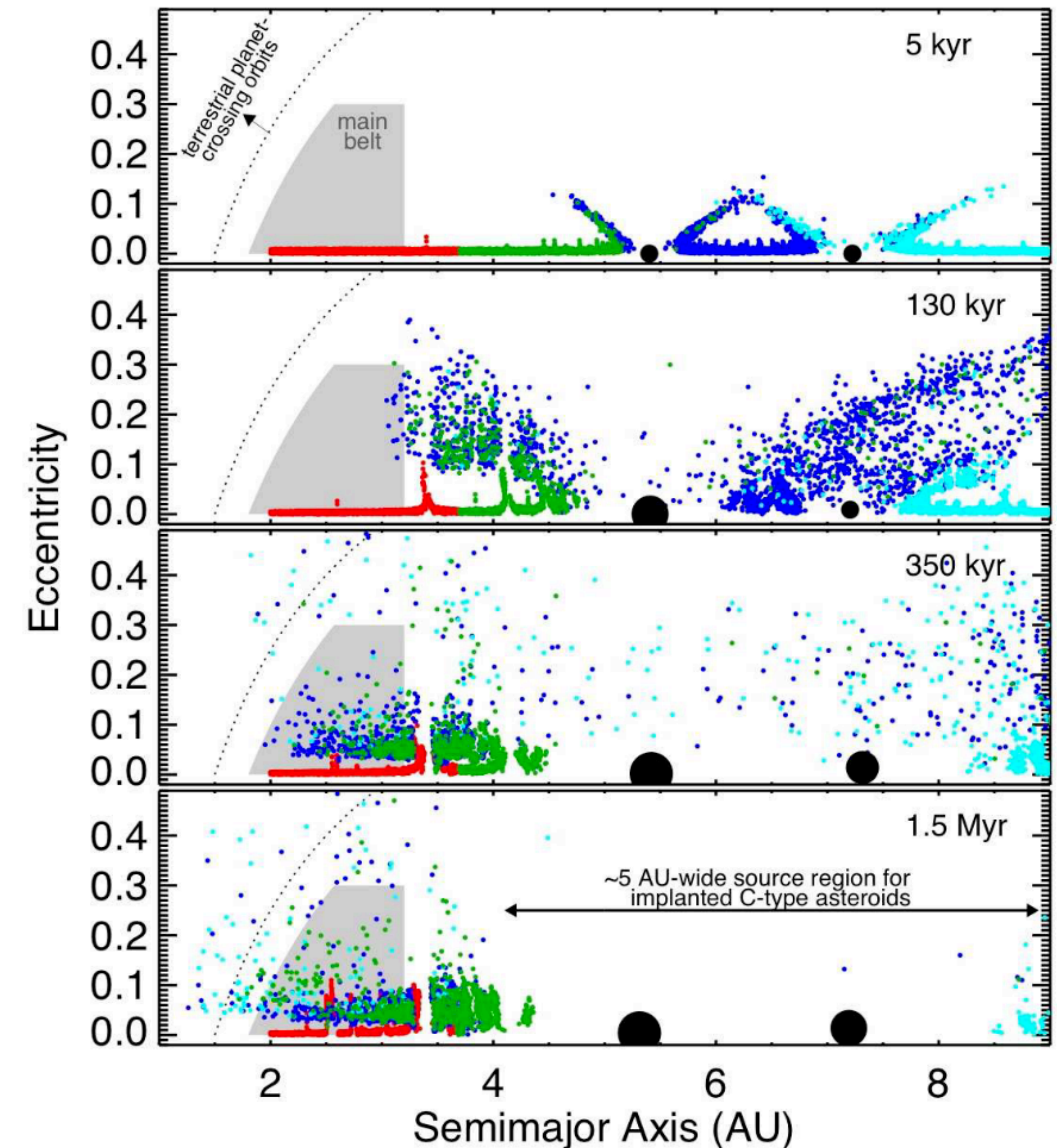
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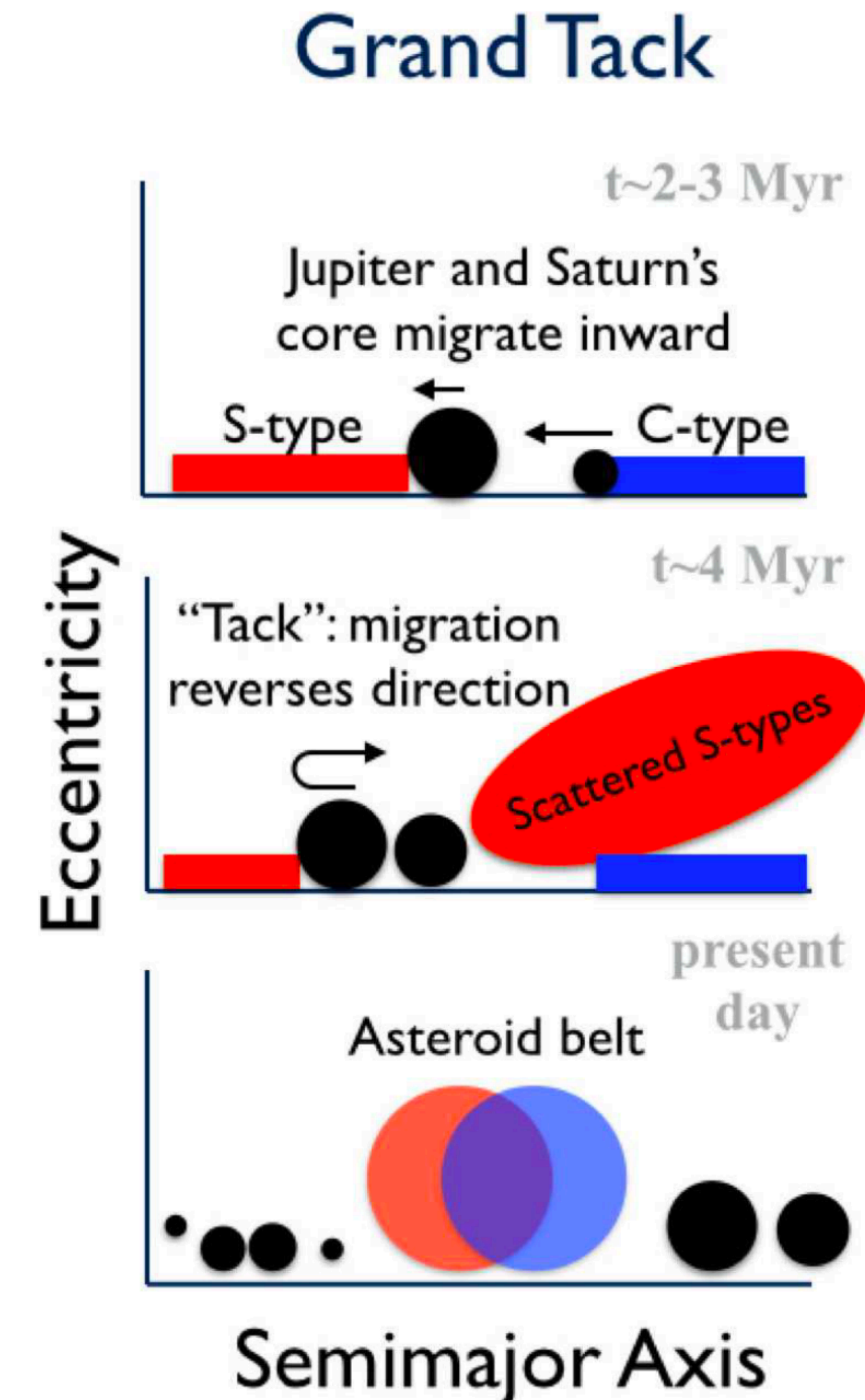
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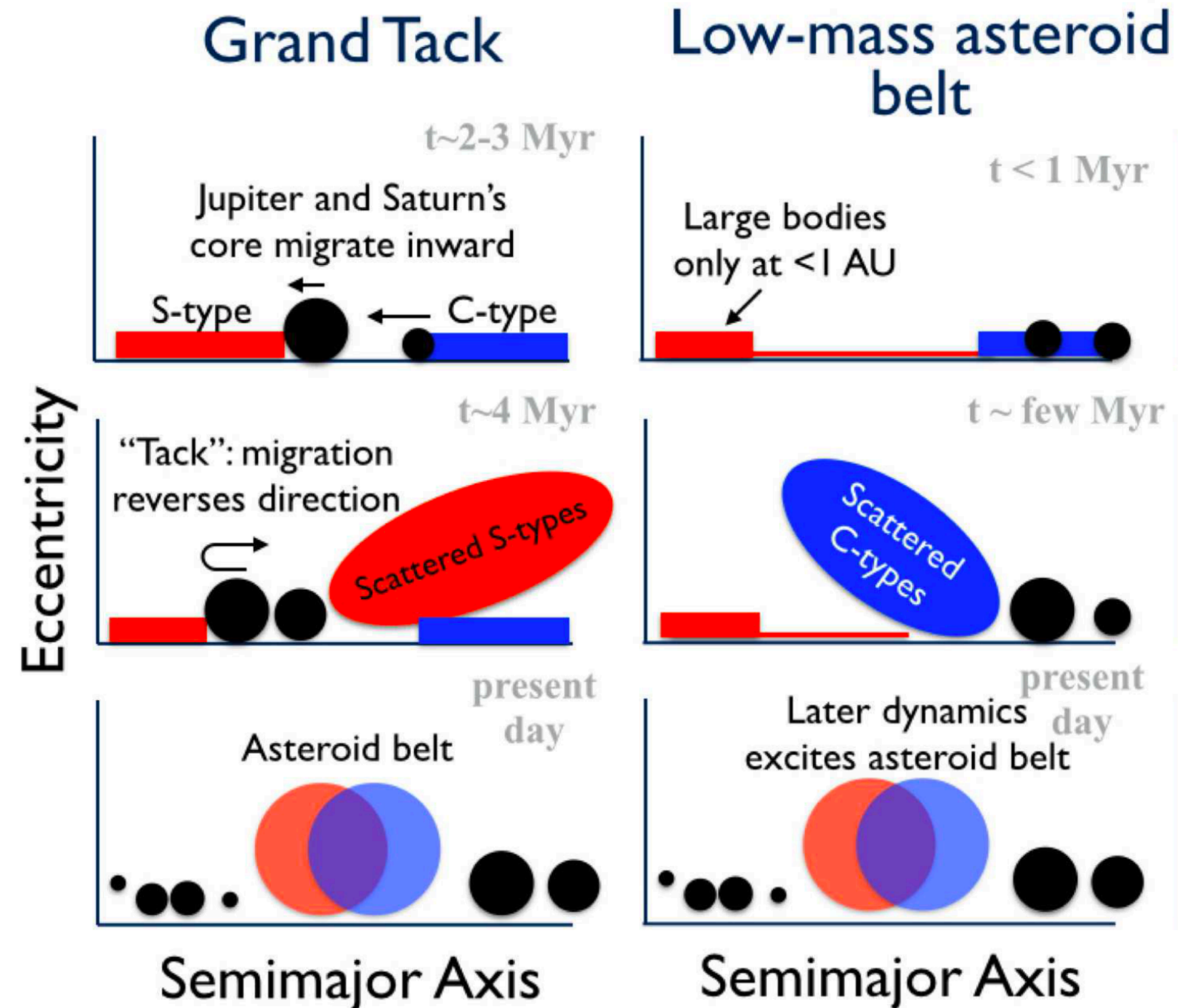
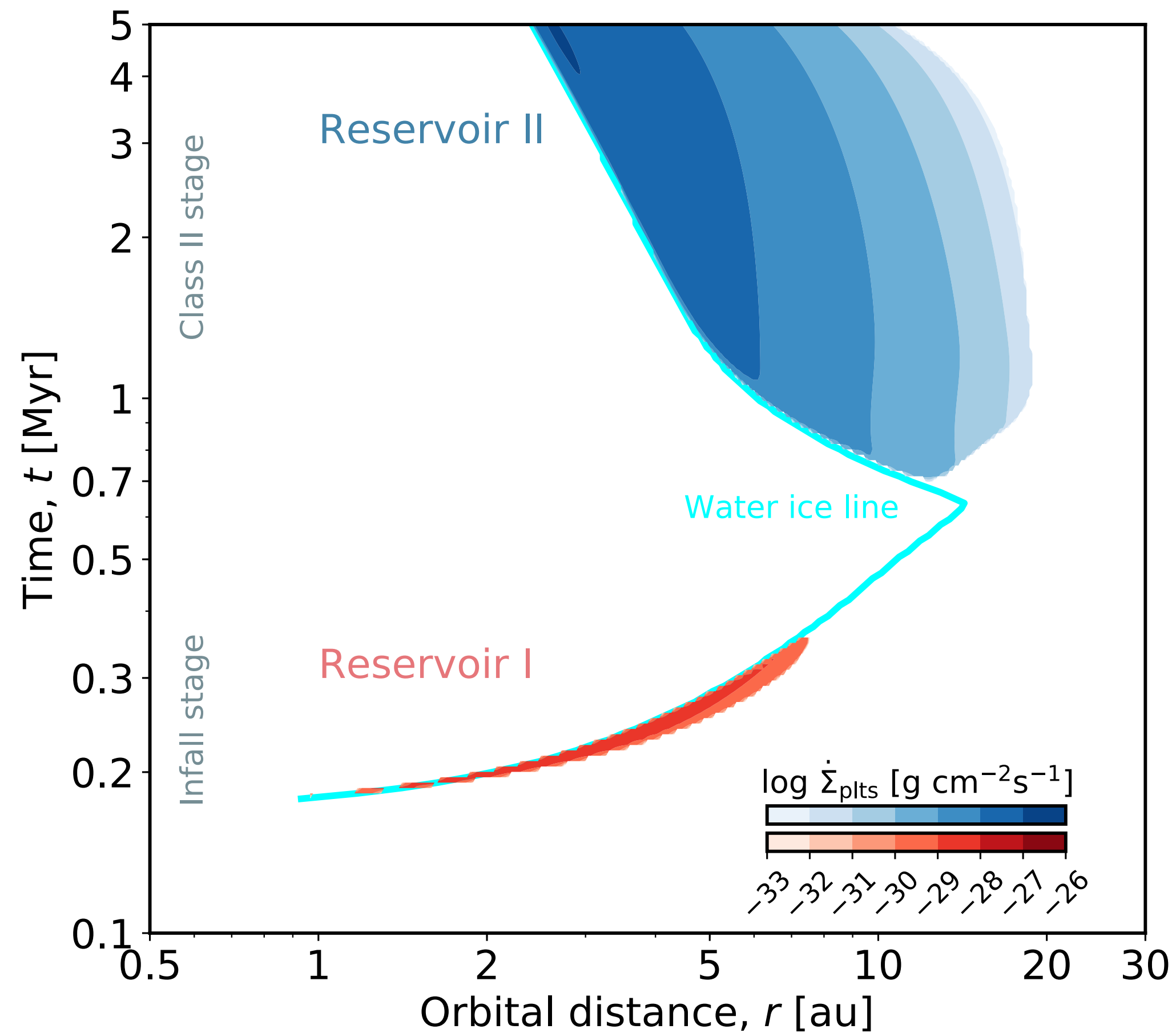


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# No secondary dynamics necessary





# Cause for reservoir separation?

