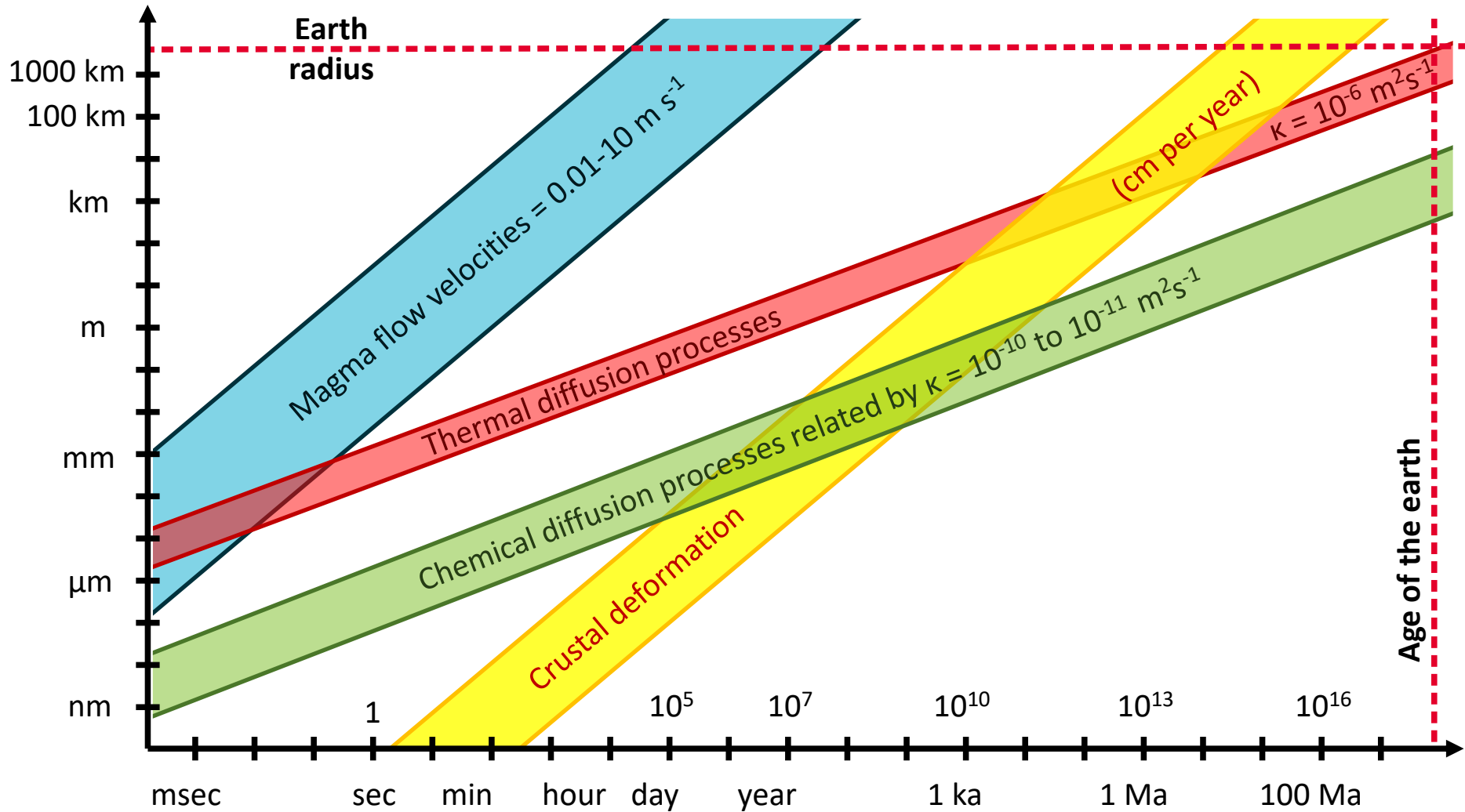


Timescales and lengthscales exercise



Make your own length-time scale plot

Consider:

- Magma flow rates – 0.1-1 m sec typical for mafic magmas in flows and dykes
- Droplet settling rates – 1 mm sulfide droplet sinks at ~1 mm per sec in basalt, 100 mm per sec in komatiite
- Droplet reaction and dissolution rates – 1 mm droplet to R factor 100, ~ 1,000,000 seconds in basalt, 10,000 s in komatiite; similar time to dissolve in S-undersaturated magma
- Time to dissolve a 10cm felsic xenolith, in basalt ~hours, in komatiite ~ minutes.
- Time to lose enough heat to country rock to solidify a 10m thick sill or dyke, ~ days, 100m thick years to 10s of years.
- Lifetime of very large Bushveld-scale replenished layered intrusions ~100k to 1m years.
- Time to generate a 100 m wide thermal aureole around a basaltic sill, 1k-10k years.

Make your own length-time scale plot

Exercise:

- Thermal erosion in lava tubes takes place at a rate of about 10cm per day. How far has the lava in the tube flowed in the time it takes to excavate a 1m deep trench? 10m deep?
- How long does it take to generate a 10m wide thermal aureole around a mafic intrusion? If the magma is continuously flowing through the intrusion, how far would it go in that time?
- Assuming a xenolith melts purely by conduction of heat into its interior, how long would it take a 10cm diameter pelite xenolith to melt in a basaltic magma? How far could it be carried in that time?
- How far could a 1mm sulfide droplet be transported upward by an ascending basaltic magma? Komatiitic?