

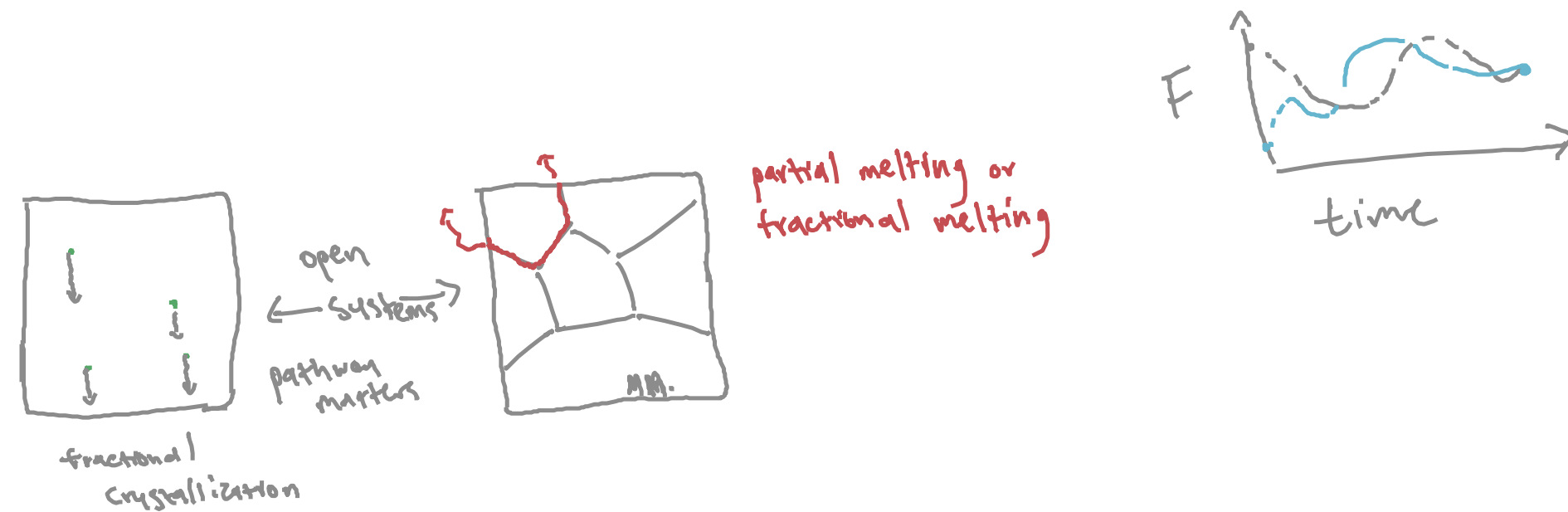
## Lecture 9: Partial melting and explaining the crust

1. Partial melting
2. Explaining the crust

*We acknowledge and respect the  $lək̓ʷəŋən$  peoples on whose traditional territory the university stands and the Songhees, Esquimalt and  $W̓SÁNEĆ$  peoples whose historical relationships with the land continue to this day.*



# Fractional melting: concept and derivation



change in the mass of the system = rate of melting

$$dM_o = -dM_m = dM_s$$

$$-C_m dM_m = d(C_s M_s)$$

$$\frac{C_s}{C_{s0}} = (1-F)^{\frac{1}{D}-1}$$

$$\frac{C_m}{C_{s0}} = \frac{1}{D} (1-F)^{\frac{1}{D}-1}$$

# Fractional melting: concept and derivation

decompression melting

100 % Solid  
 $C_{S0} = C_0$

average or pooled melt

starts 100% L  
goes to 100% S

for some trace element i

$$\frac{C_S}{C_{S0}} = (1-F)^{\left(\frac{1}{D}-1\right)}$$

$$\frac{C_m}{C_{S0}} = \frac{1}{D} (1-F)^{\left(\frac{1}{D}-1\right)}$$

$F = \frac{M_m}{M_0}$

continuous

$$\int_0^F \frac{C_m}{C_{S0}} dF = \text{Lab 4}$$

hint:  
 $dF = -d(1-F)$

infinately small parcels of melt

"instant" melt

discrete

integral

average =  $\frac{\text{Sum}}{N}$

$\frac{\overline{C_m}}{C_{S0}} = \text{average} = \frac{\text{Sum}}{N} =$

partial melting

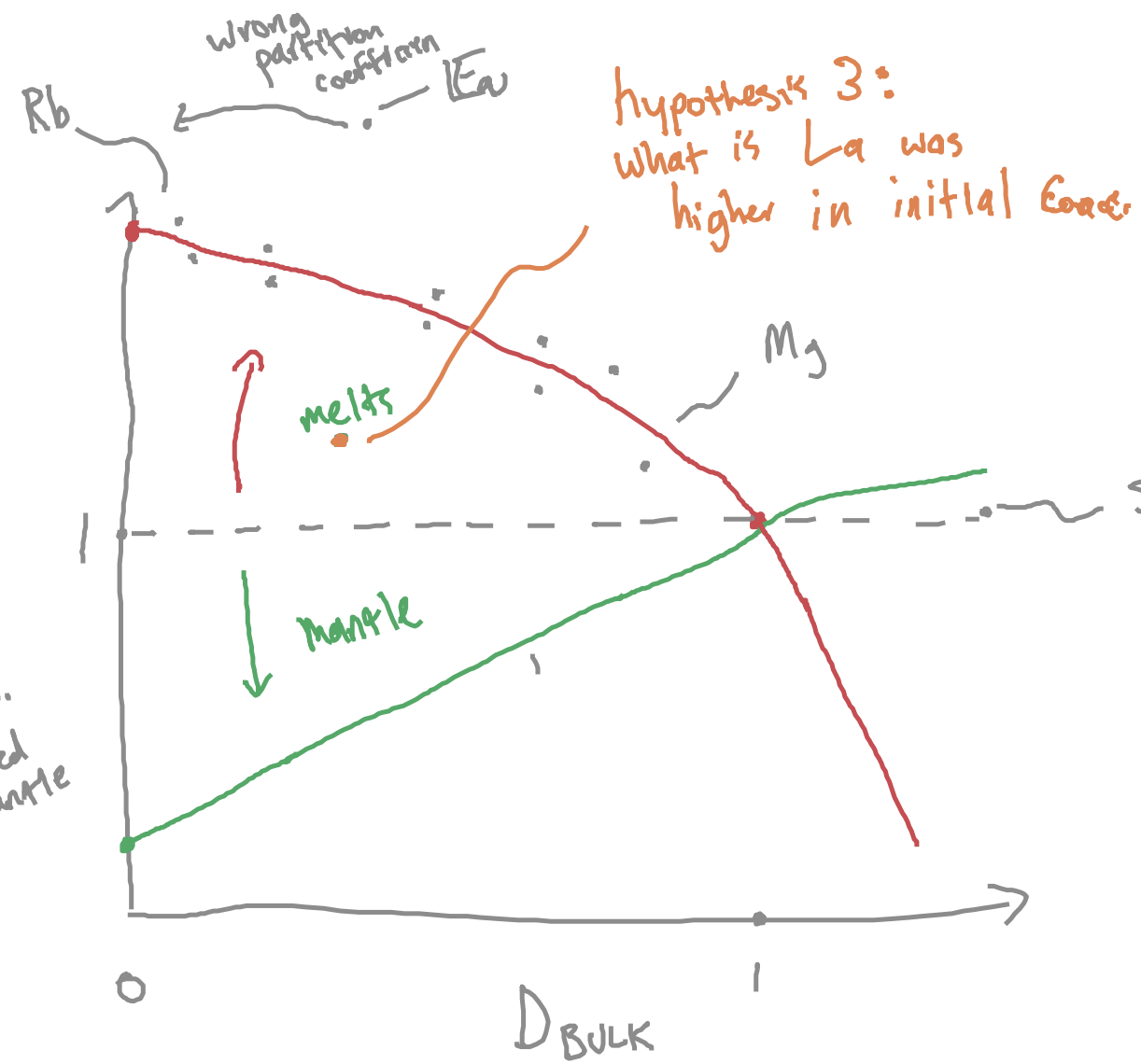
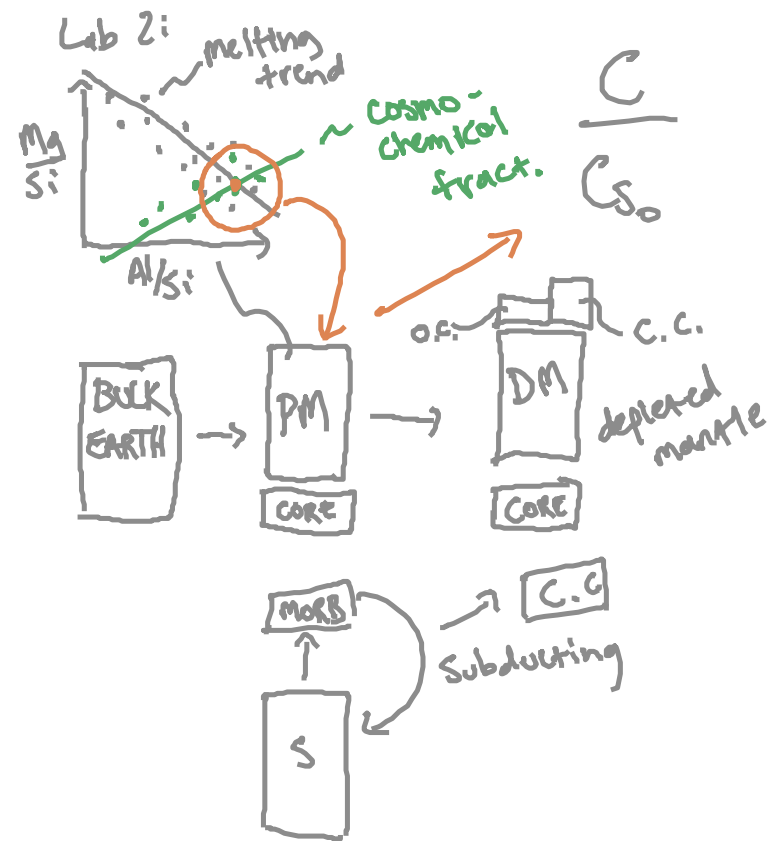
mid-ocean ridge

BASALT

partial melting extracts incompatible elements from the mantle

hypothesis 1: wrong  $D_{BULK}$ ?

hypothesis 2: model too simple



hypothesis 3:  
What is  $L_a$  was  
higher in initial core.

$$D = 1 = \frac{C_S}{C_M}$$

