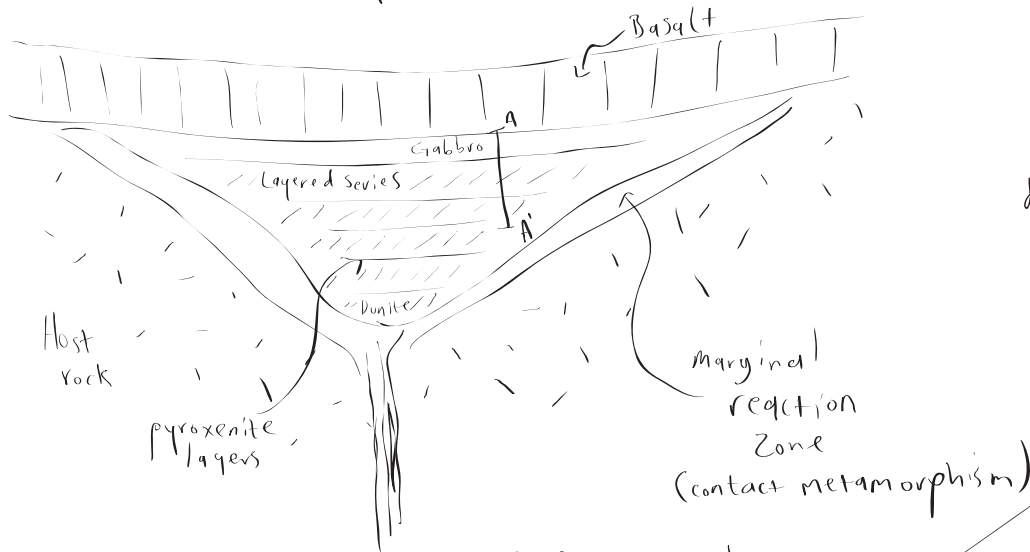fractional crystallization
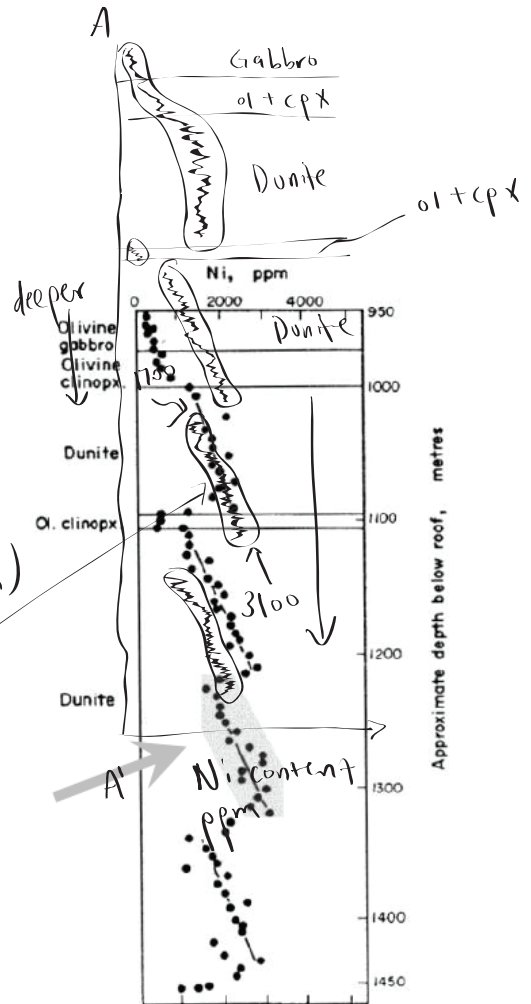
$$\frac{CM}{Cm_0} = F^{D-1} \quad \text{or} \quad \frac{Cs}{Cm_0} = DF^{D-1}$$

Example of crystal cumulates

Muskox layered intrusion

. Variation in the Ni content of rocks of part of the Muskox intrusion, Northwest Territories, Canada. (After Irvine and Smith, 1967)

Henderson, Inorganic Chemistry", 1984

Host rock

pyroxenite layers

Marginal reaction zone (contact metamorphism)

Assume $D^{Ni}_{Bulk} = 15$

If fractional crystallization, how much of the melt solidified?

(What is F?)

$$DF^{(D-1)} = \frac{Cs}{Cm_0} \leftarrow \text{also } C_{L_0}, \quad D = \frac{Cs_0}{C_{L_0}}$$

$$\cancel{D}F^{(D-1)} = \frac{Cs}{\left(\frac{Cs_0}{D}\right)}$$

$$15 \curvearrowright F^{(D-1)} = \frac{Cs}{Cs_0} \begin{array}{l} \leftarrow 1700 \\ \leftarrow 3100 \end{array}$$

$$F^{14} = \frac{1700}{3100}$$

$$F = \left(\frac{1700}{3100}\right)^{/14} = 0.958$$

or ~4% melt solidifies