Fractional Crystallization as a Metaphor for a Palimpsest of Colonization

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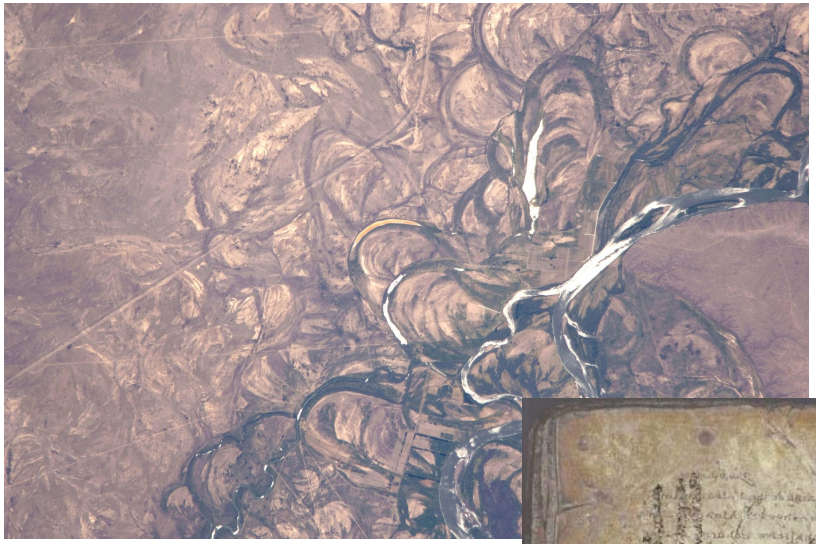
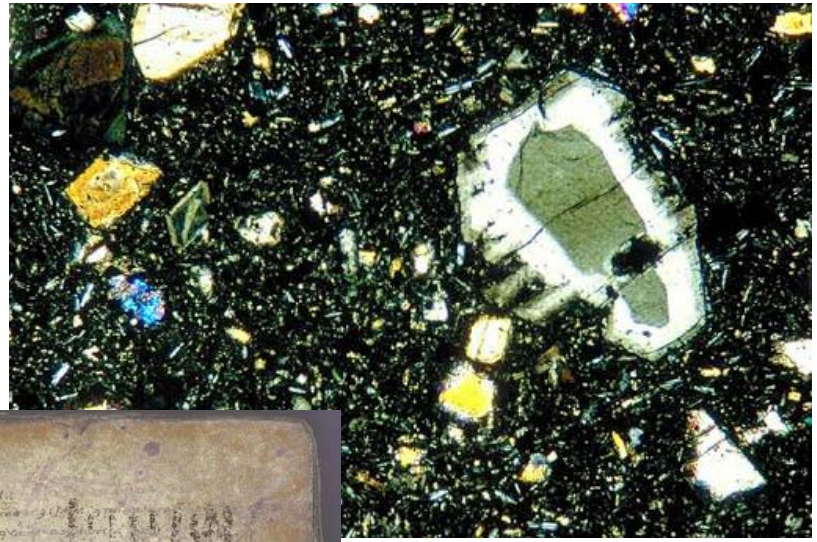
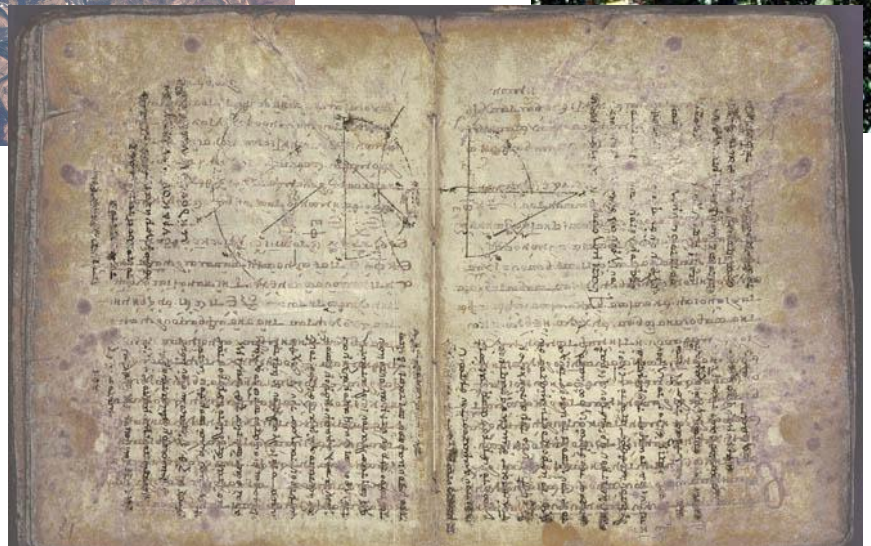
Introduction/Focus Questions

- **How can the process of fractional crystallization serve as a metaphor for settler colonialism?**
- **How are both of these processes a palimpsest?**
- **How can science and indigeneity be woven together to allow for a full reading (or remapping) of the land?**
- **How can an examination of the geologic processes of the land we occupy lend insight into an un-mapping of that which has been colonized?**

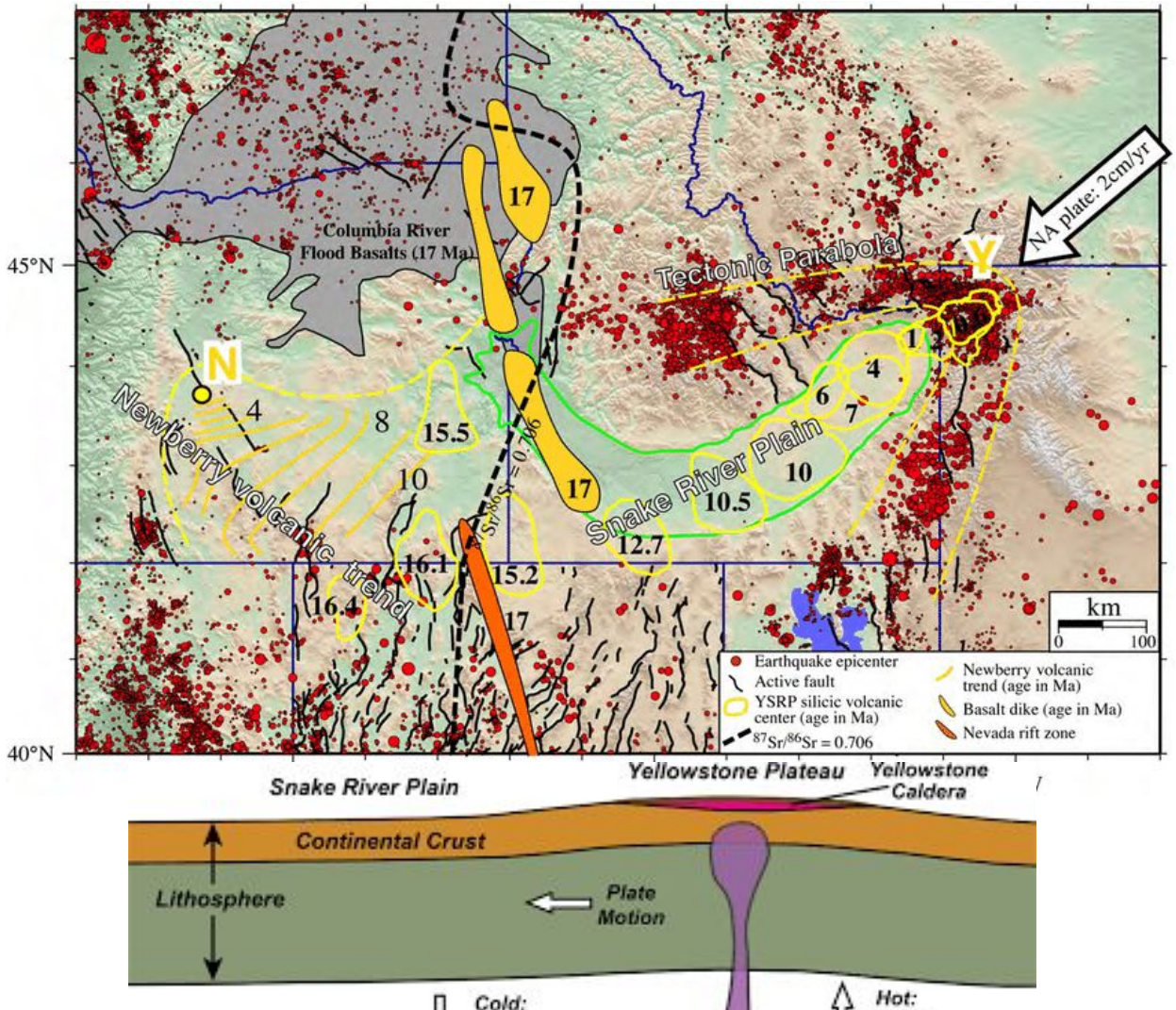
Palimpsest - Something reused or altered but still bearing visible traces of its earlier form



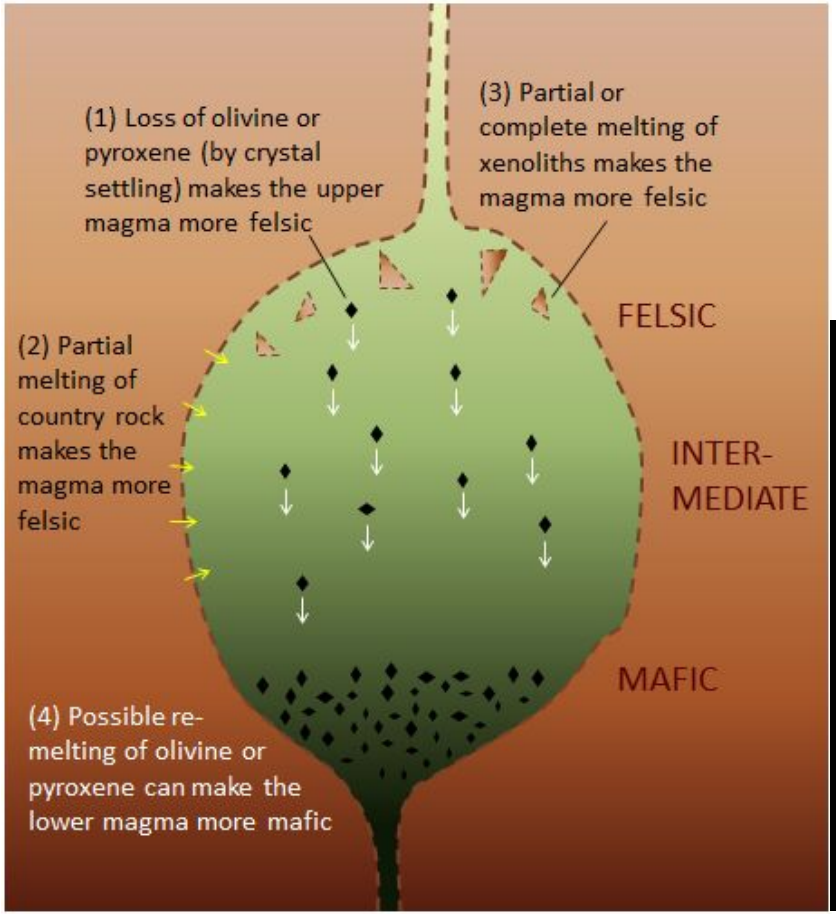




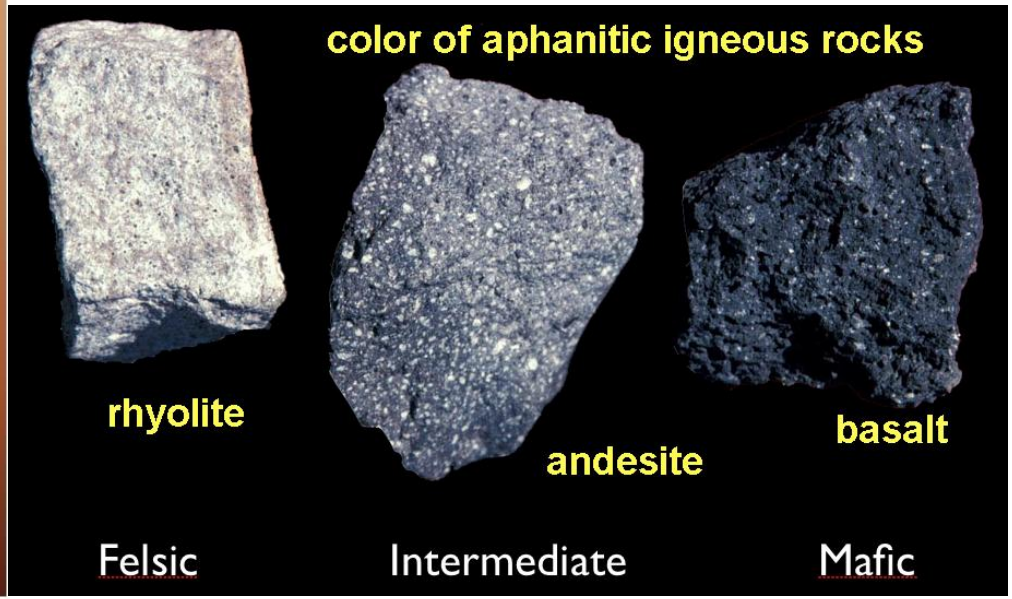
Theoretical Framework - Roxanne Dunbar-Ortiz


45°N
40°N
Columbia River
Flood Basalts (17 Ma)
17
N
Newberry volcanic trend
4
8
15.5
10
16.1
16.4
15.2
17
17
$^{87}Sr/^{86}Sr = 0.706$
Tectonic Parabola
Y
NA plate: 2cm/yr
1
4
6
7
10
10.5
12.7
Snake River Plain
km
0
100
Earthquake epicenter
Active fault
YSRP silicic volcanic center (age in Ma)
$^{87}Sr/^{86}Sr = 0.706$
Newberry volcanic trend (age in Ma)
Basalt dike (age in Ma)
Nevada rift zone
Snake River Plain
Yellowstone Plateau
Yellowstone Caldera
Continental Crust
Lithosphere
Plate Motion
Cold:
Hot:

Mafic and Felsic Concentrations



In a basalt flow, mafic (dark, dense) minerals fractionate out first, leaving felsic (light, less dense) last to crystallize.




Focus area
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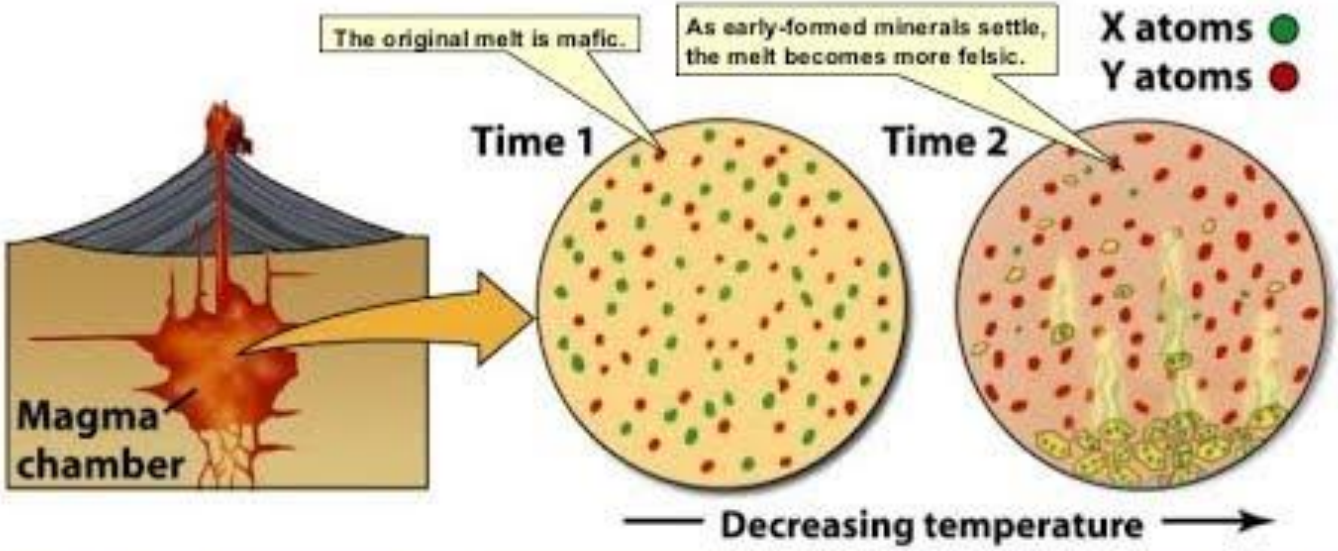
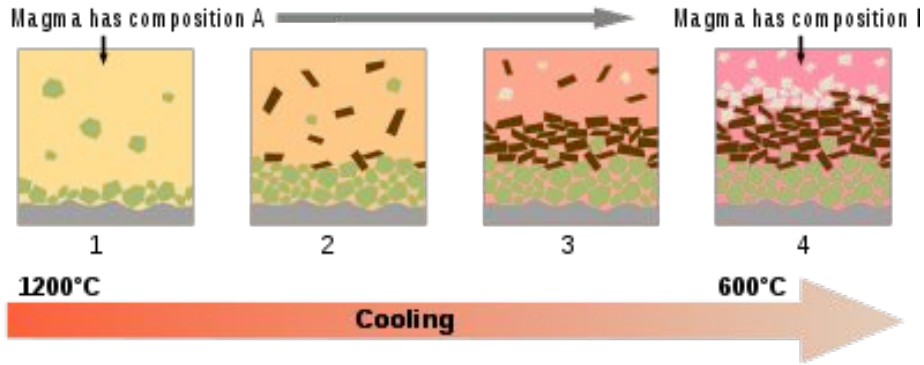
Fractional Crystallization

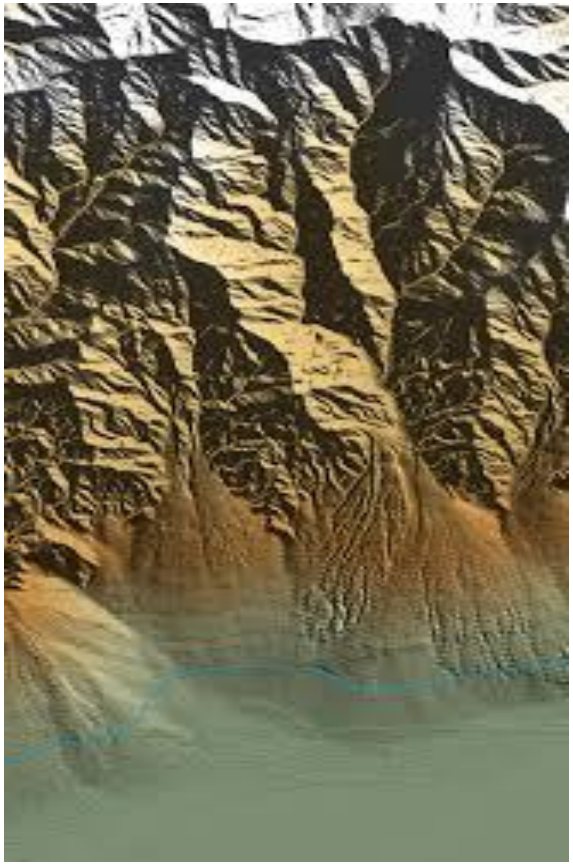
- As magma cools, early crystals settle by gravity.
- Melt composition changes as a result.
  - Fe, Mg, and Ca are removed in early settled solids.
  - Si, Al, Na, and K remain in melt and increase in abundance.

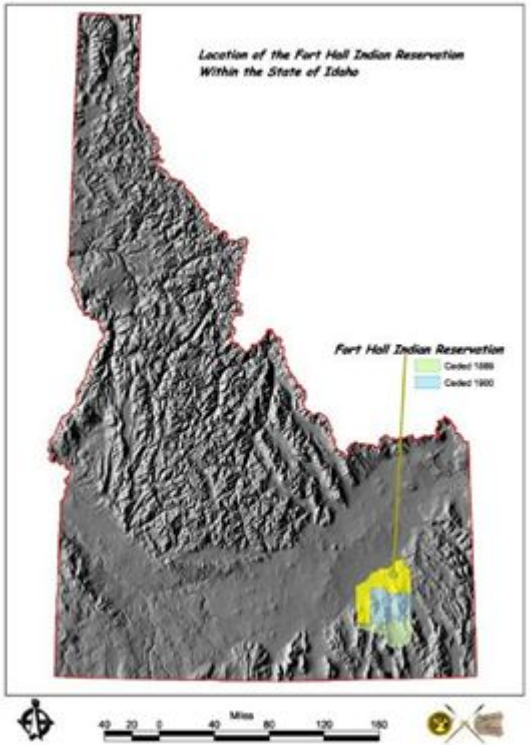


Fractional Crystallization and Fractionation of Native Land



Geologic Metaphors by Historians

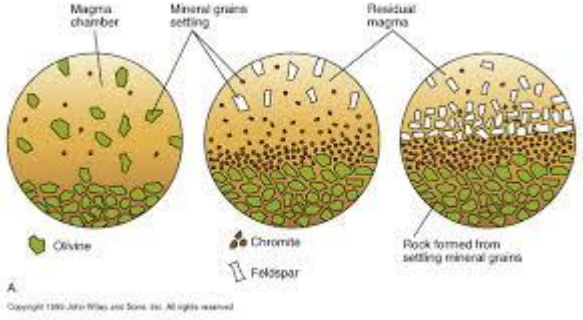




Basaltic Volcanism and Settler Colonialism

With every piece that is removed, the concentration of certain chemicals is reduced if not depleted altogether.

Not only had the Shoshone-Bannocks been forced off their land to the Fort Hall reservation, but then the reservation land was fractionated out and sold to white settlers for industrial farming.



Wallrock (assimilant)

Elemental concentration in wallrock
C_a

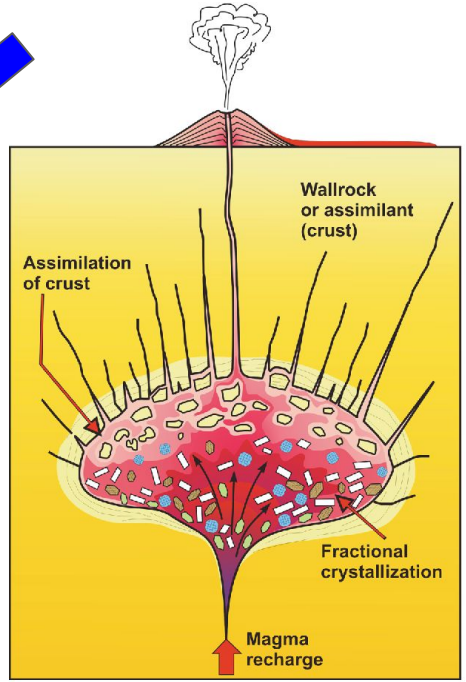
Isotope ratio in the wallrock
ε_a

Bulk solid/liquid partition coefficient of an element between crystallizing phases and magma
D

The difference between stable isotopic ratios of crystals and magma
Δ
$\Delta = \delta_{crystals} - \delta_{magma}$
$\approx 1000 \ln \alpha$

Where α is the fractionation factor.

Initial stable isotope ratio in the wallrock (assimilant)
δ_a



Mass assimilation rate (mass/unit time): $\dot{M}_a$

Fractional crystallization rate : $\dot{M}_c$

Ratio of mass assimilation rate to fractional crystallization rate: $r = \frac{\dot{M}_a}{\dot{M}_c}$

$z = \frac{r + D - 1}{r - 1}$

Magma

Mass of magma
M_m

Initial mass of magma
M_m^0

The fraction of magma remaining
$F = \frac{M_m}{M_m^0}$

Elemental concentration in magma
C_m

Initial elemental concentration in magma
C_m^0

Elemental concentration in crystallizing phases
DC_m

Isotope ratio in magma
ε_m

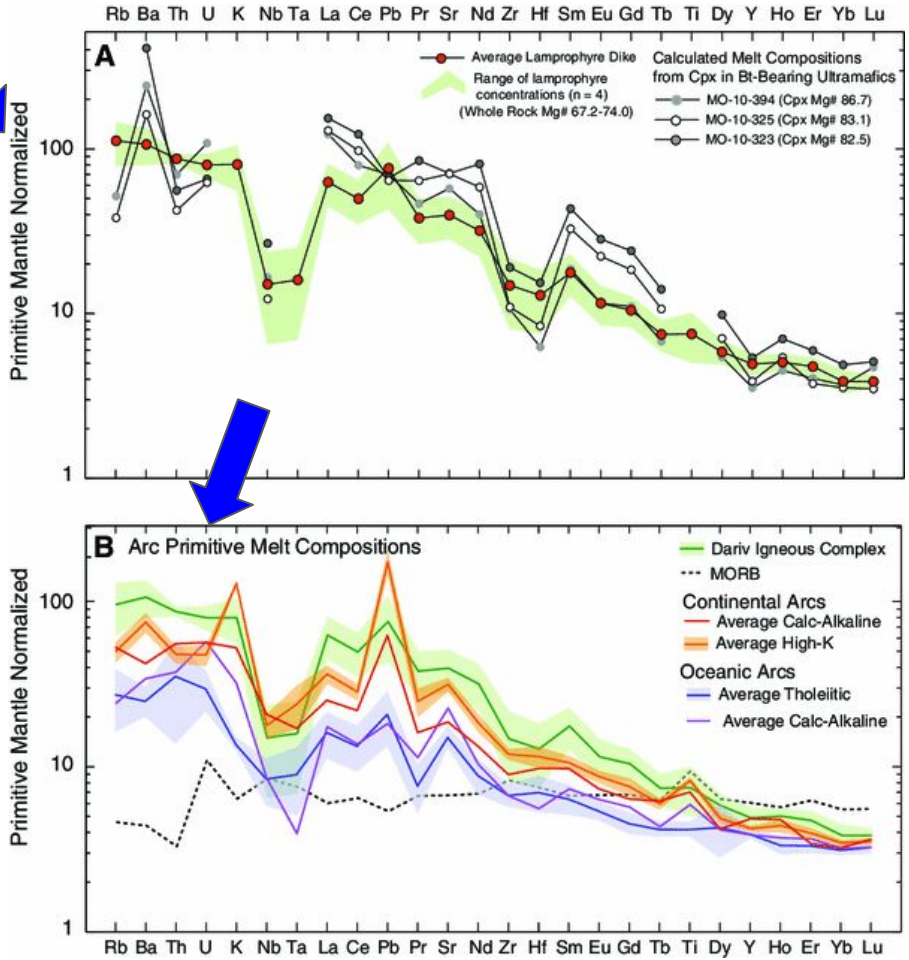
Initial isotope ratio in magma
ε_m^0

Stable isotopic ratio in magma
δ_m

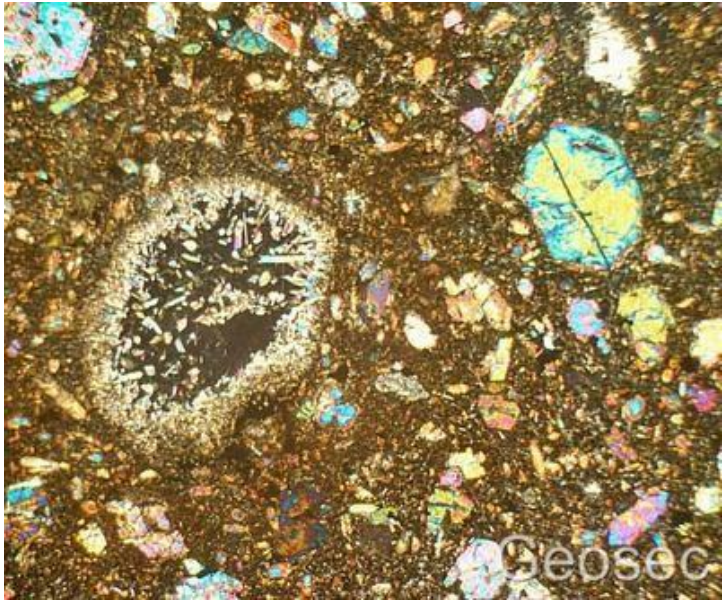
Initial stable isotope ratio in magma
δ_m^0

Minerals

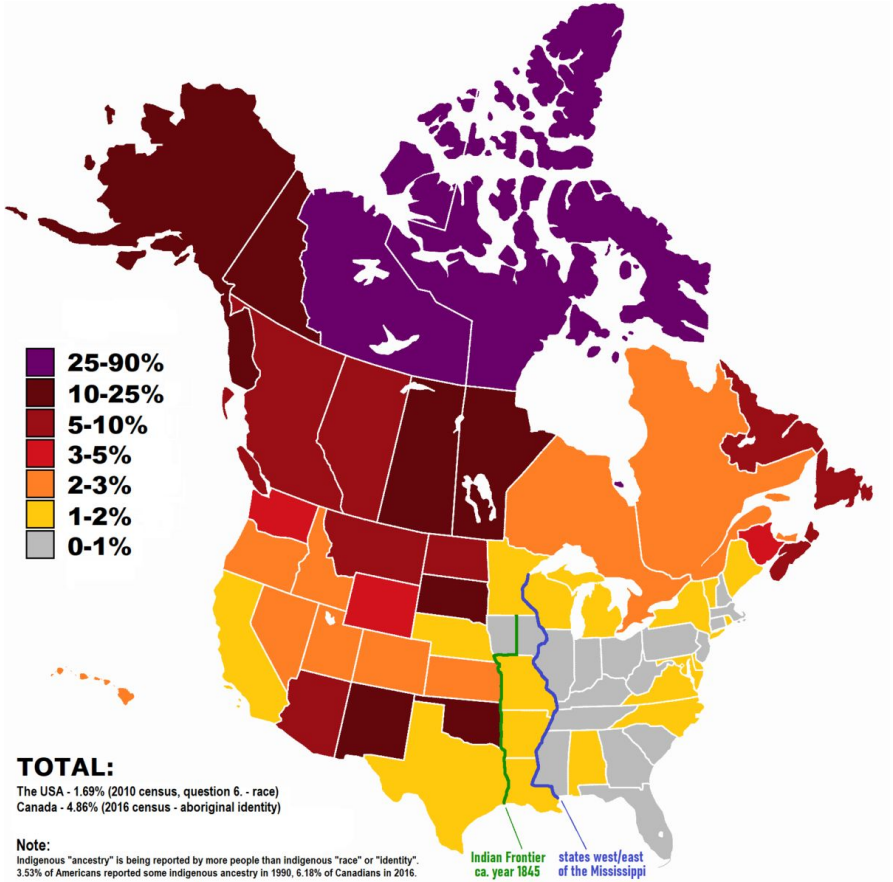
Olivine Plagioclase Pyroxene Amphibole



Geologic and Indigenous Palimpsests



Mafic and Felsic Fractionation and Indigeneity



If assimilation is the end goal, then, the so-called magma chamber of blood lineage in the United States would fractionate out the mafic (dark) until only the felsic (white) remained.

Implications for Unsettling

- Settler colonists must be made to feel unsettled in a land that is not ours.

- We must unsettle our beliefs in land as property.

- What if, instead of focusing our gaze on something for which we have already formed a conclusion we instead shift the gaze back onto ourselves to determine how it is we got here in the first place?

Implications for Unsettling

- To examine the land separate from its people is to omit sections of data that may change the story a scientist tells.

- Like a scripted palimpsest, the stories and energies of tribes like the Shoshone-Bannock continue to fill in the interstitial spaces between the fractionated crystals of colonization.

- It is only if we examine every element, present and past, that the land may tell the whole story.

References

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