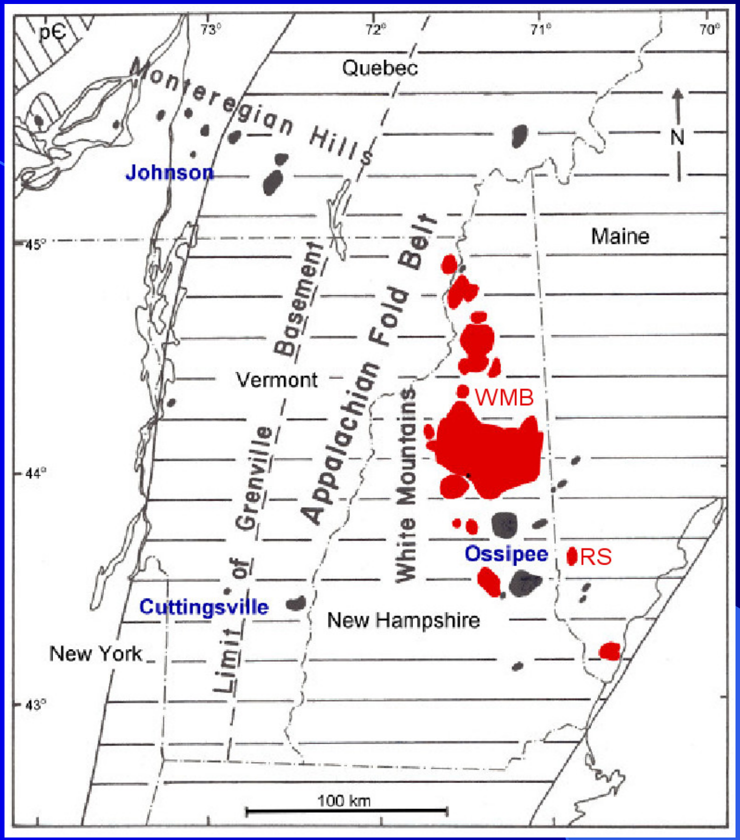
Post CAMP Magmatism: The White Mountain and Monteregian Hills Igneous Provinces, Eastern North America



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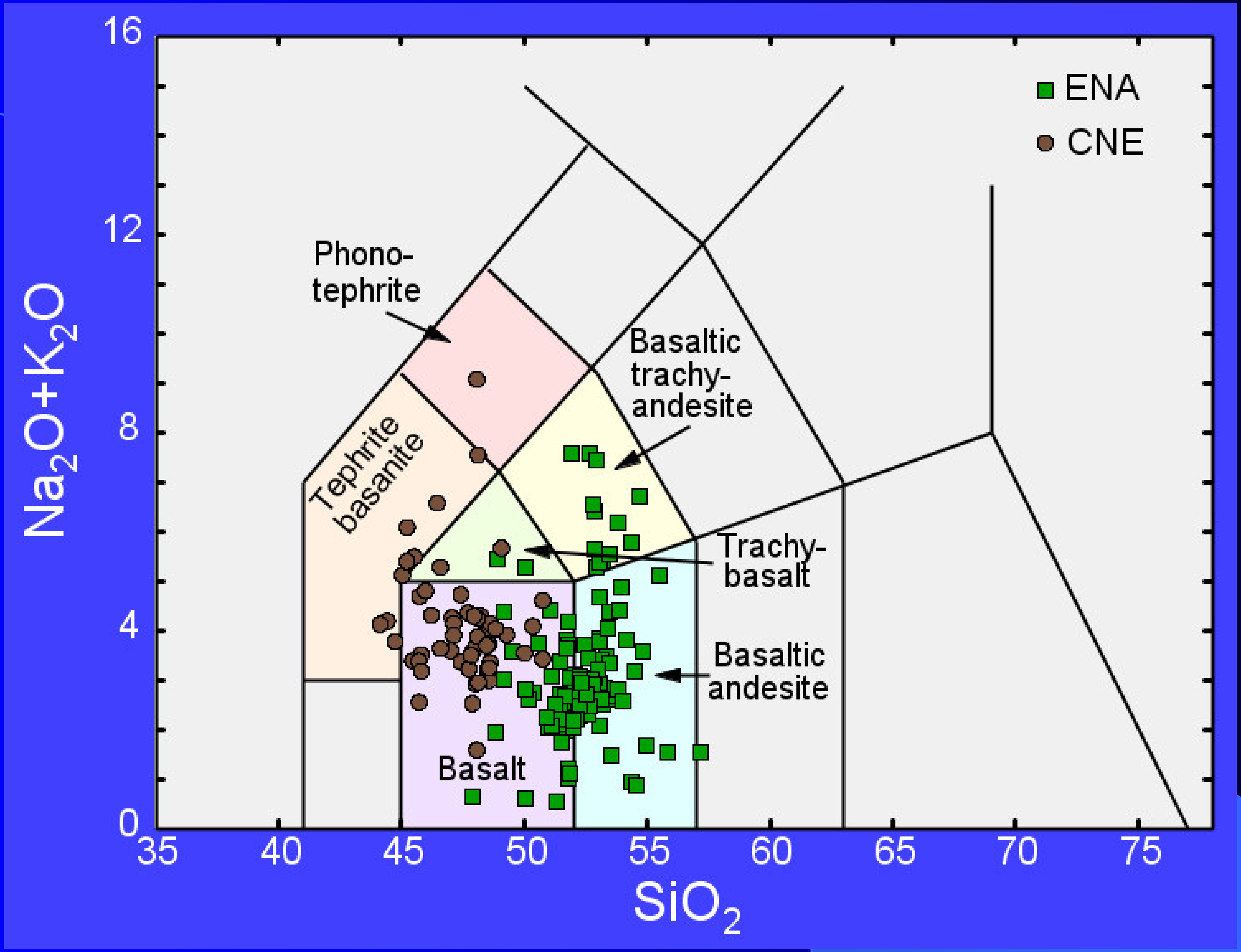
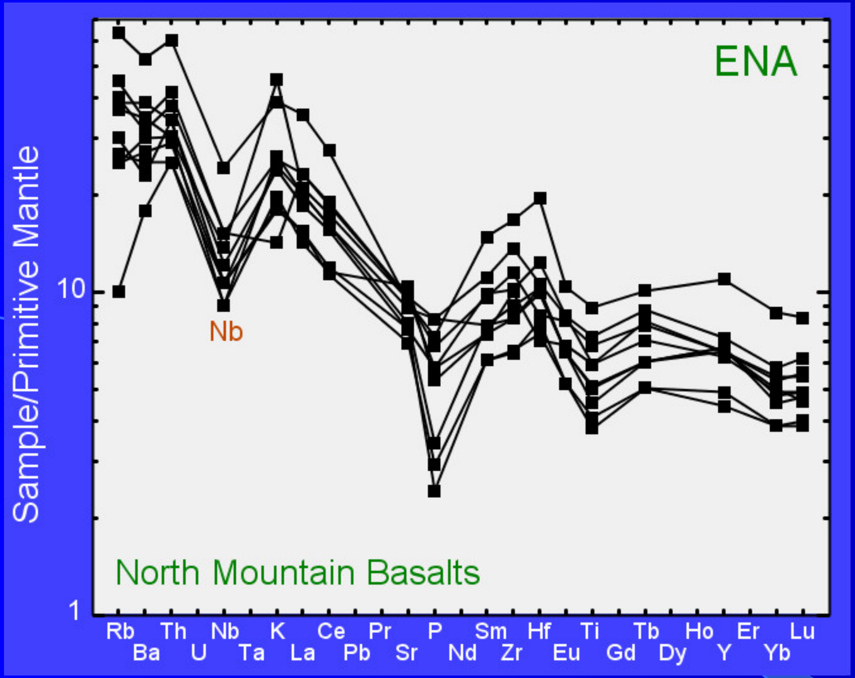
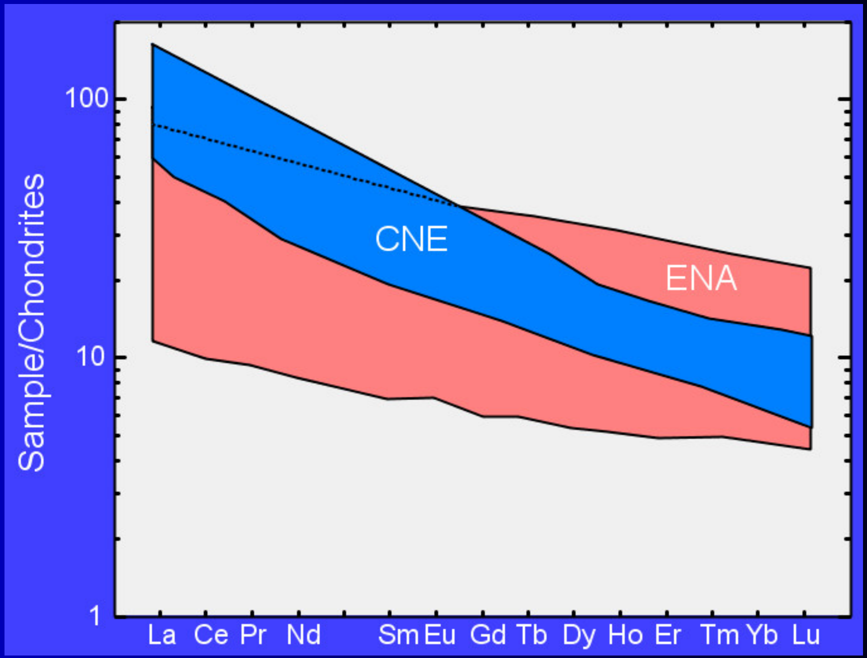
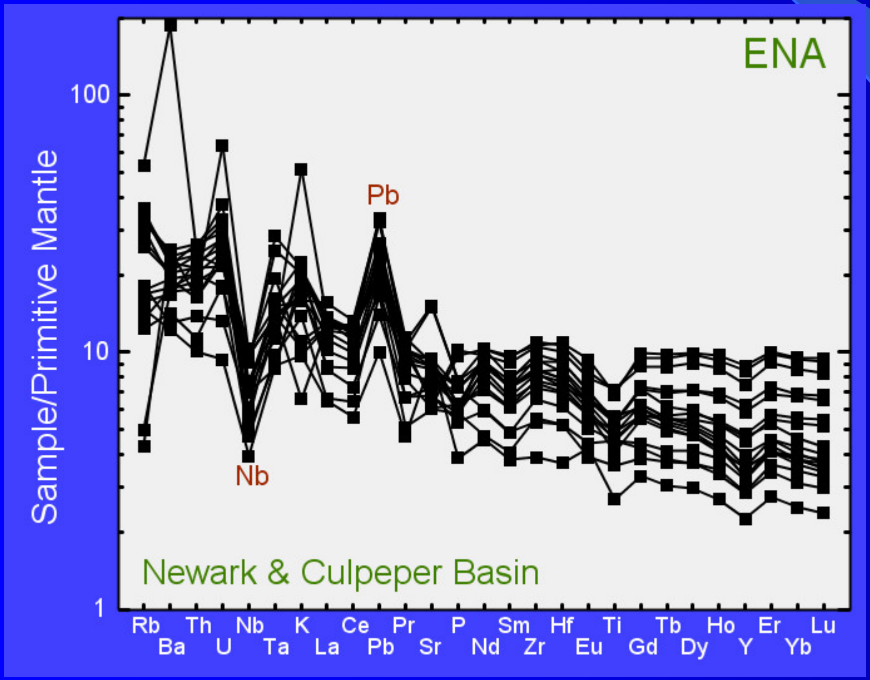
University of Massachusetts, Lowell

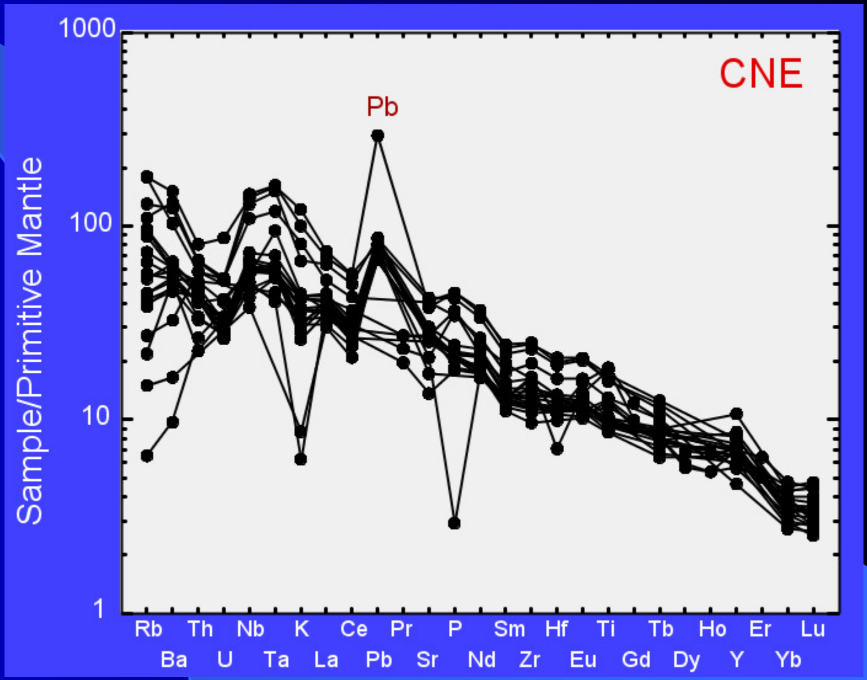
Comparison of the Coastal New England (CNE) and Eastern North America (ENA) suites



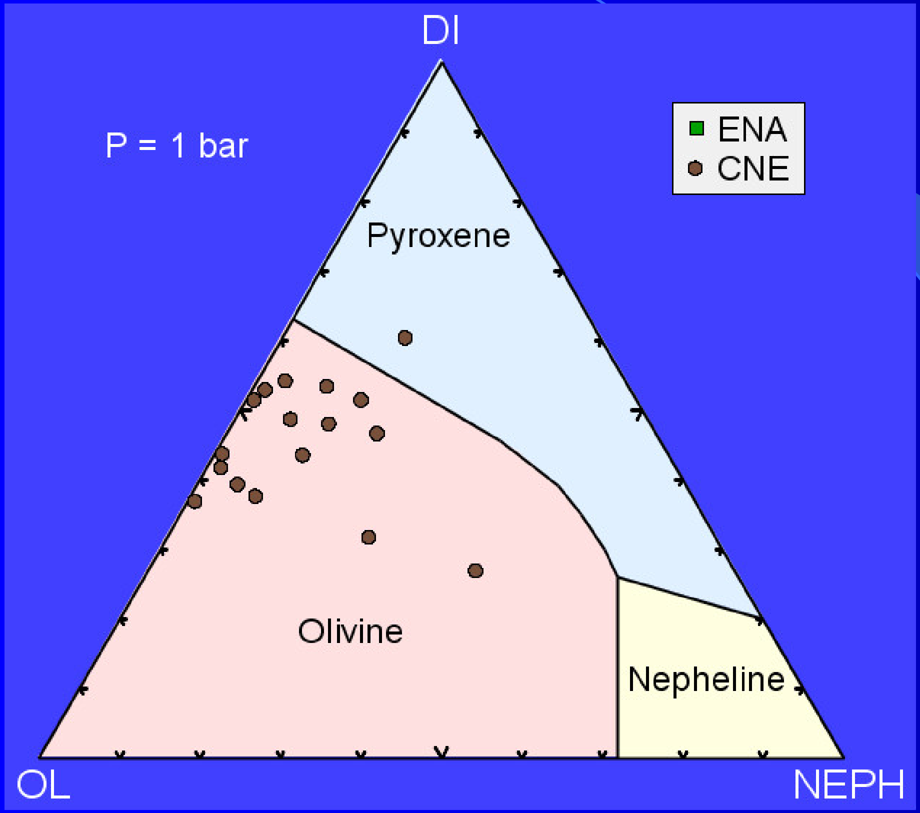

ENA
Sample/Primitive Mantle
Nb
North Mountain Basalts
Rb Ba Th U Nb Ta K La Ce Pb Pr Sr P Nd Sm Zr Hf Eu Ti Gd Tb Dy Ho Y Er Yb Lu

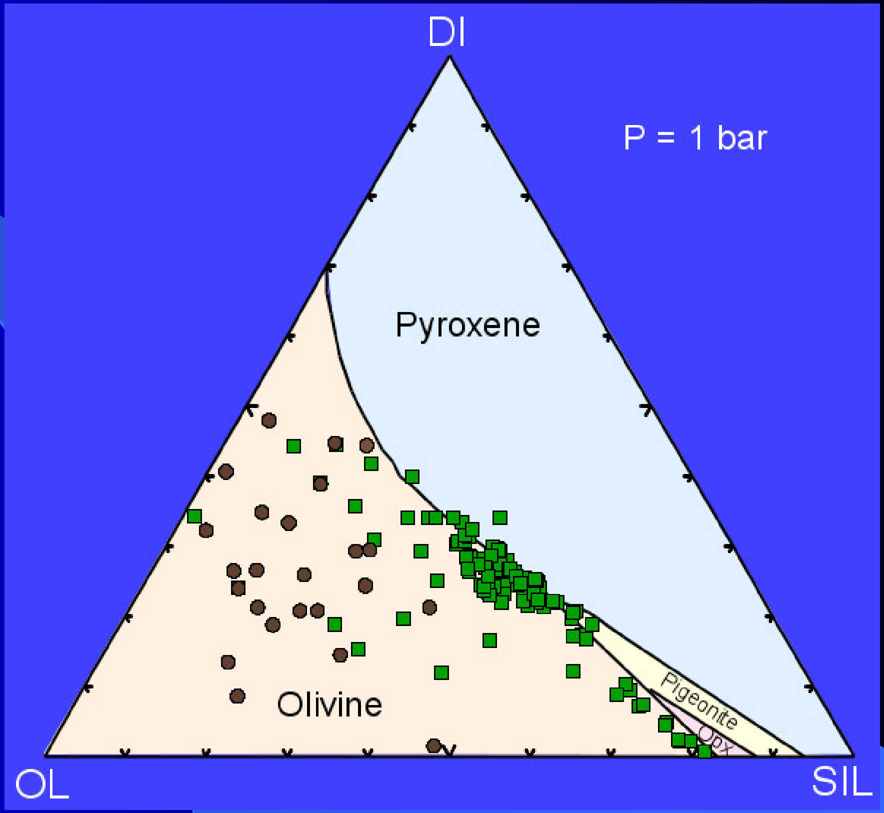

Sample/Chondrites
CNE
ENA
La Ce Pr Nd Sm Eu Gd Tb Dy Ho Er Tm Yb Lu


ENA
Sample/Primitive Mantle
Pb
Nb
Newark & Culpeper Basin
Rb Ba Th U Nb Ta K La Ce Pb Pr Sr P Nd Sm Zr Hf Eu Ti Gd Tb Dy Ho Y Er Yb Lu

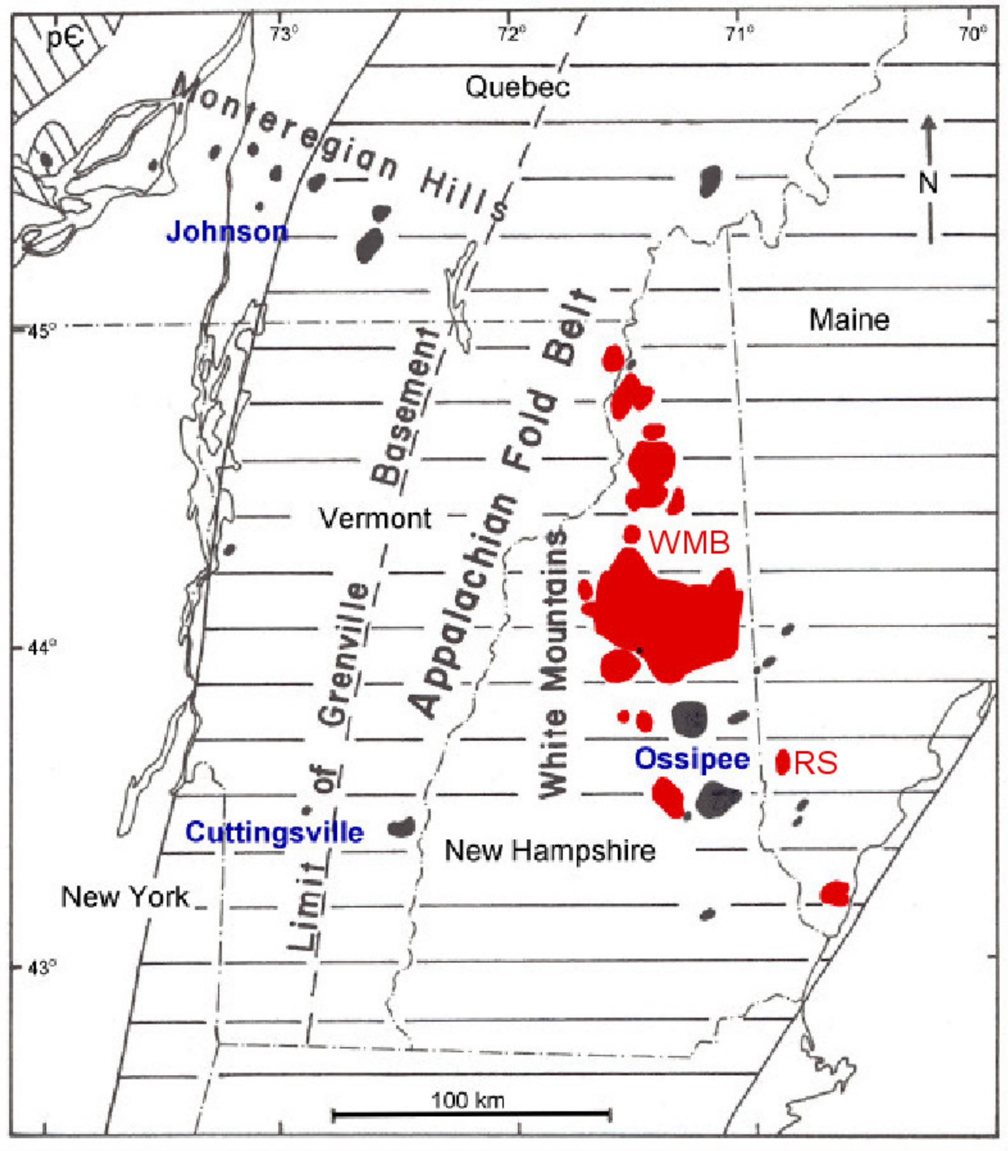

CNE
Sample/Primitive Mantle
Pb
Rb Ba Th U Nb Ta K La Ce Pb Pr Sr P Nd Sm Zr Hf Eu Ti Gd Tb Dy Ho Y Er Yb Lu

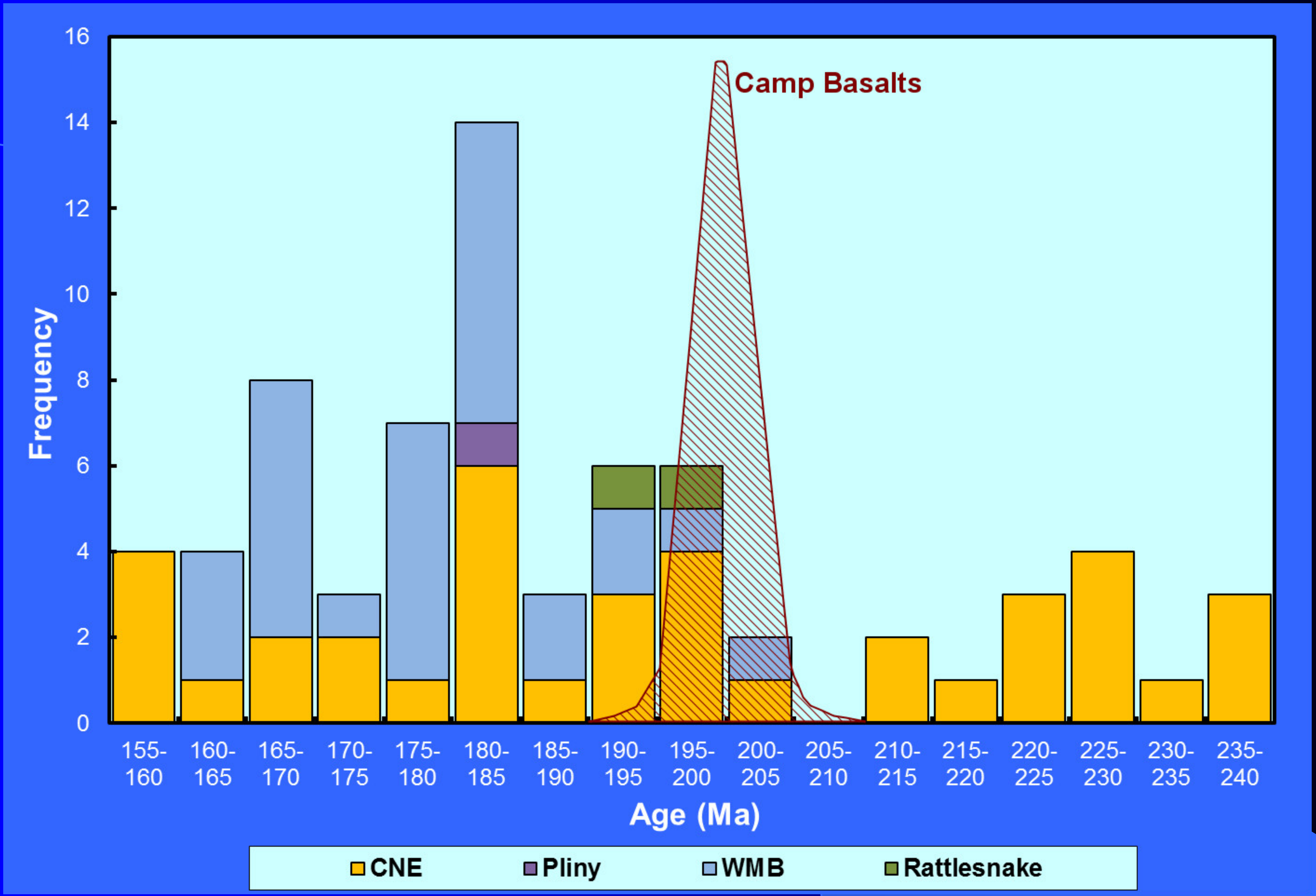
CNE and ENA basalt compositions projected into I bar phase diagrams. The ENA basalts plot on the olivine-pyroxene cotectic. With one exception, on both phase diagrams the CNE basalts plot in the olivine field. Increasing pressure shifts the olivine-pyroxene cotectic towards the olivine corner. The presence of both olivine and pyroxene as liquidus phases would indicate high pressure fractionation.





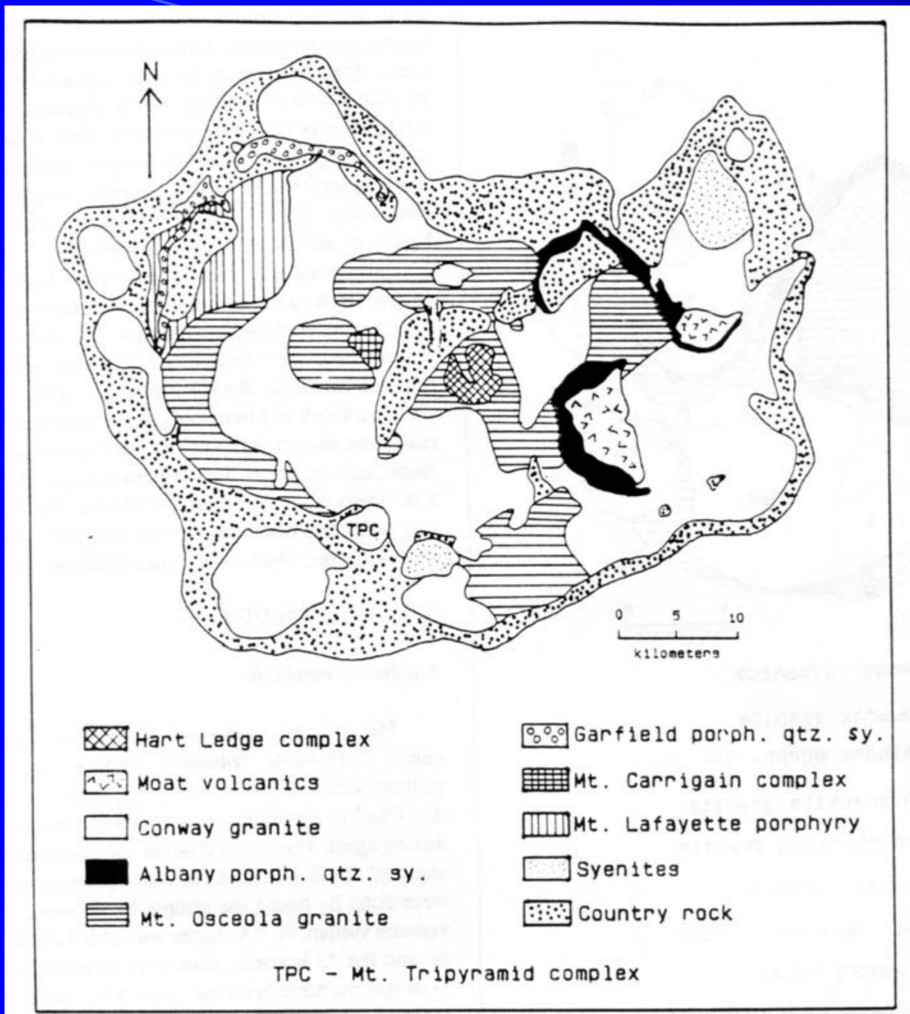
Comparison of the Coastal New England (CNE) and Older White Mountain (OWM) suites

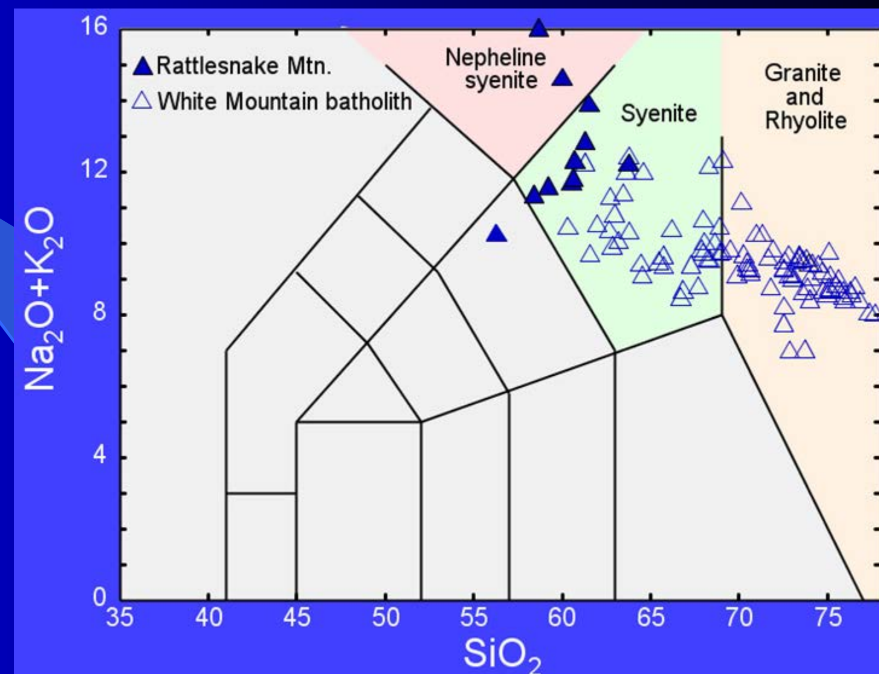




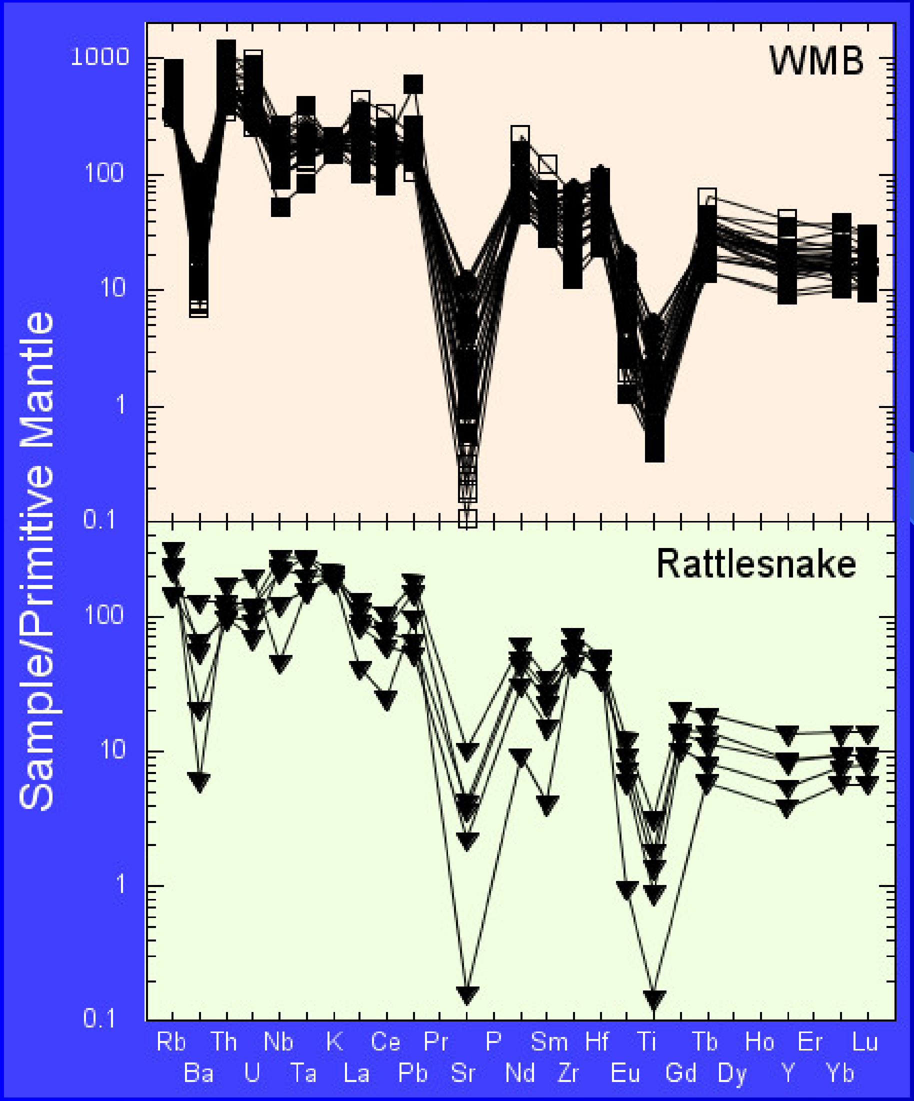
Camp Basalts
Frequency
16
14
12
10
8
6
4
2
0
155-160
160-165
165-170
170-175
175-180
180-185
185-190
190-195
195-200
200-205
205-210
210-215
215-220
220-225
225-230
230-235
235-240
Age (Ma)
CNE
Pliny
WMB
Rattlesnake

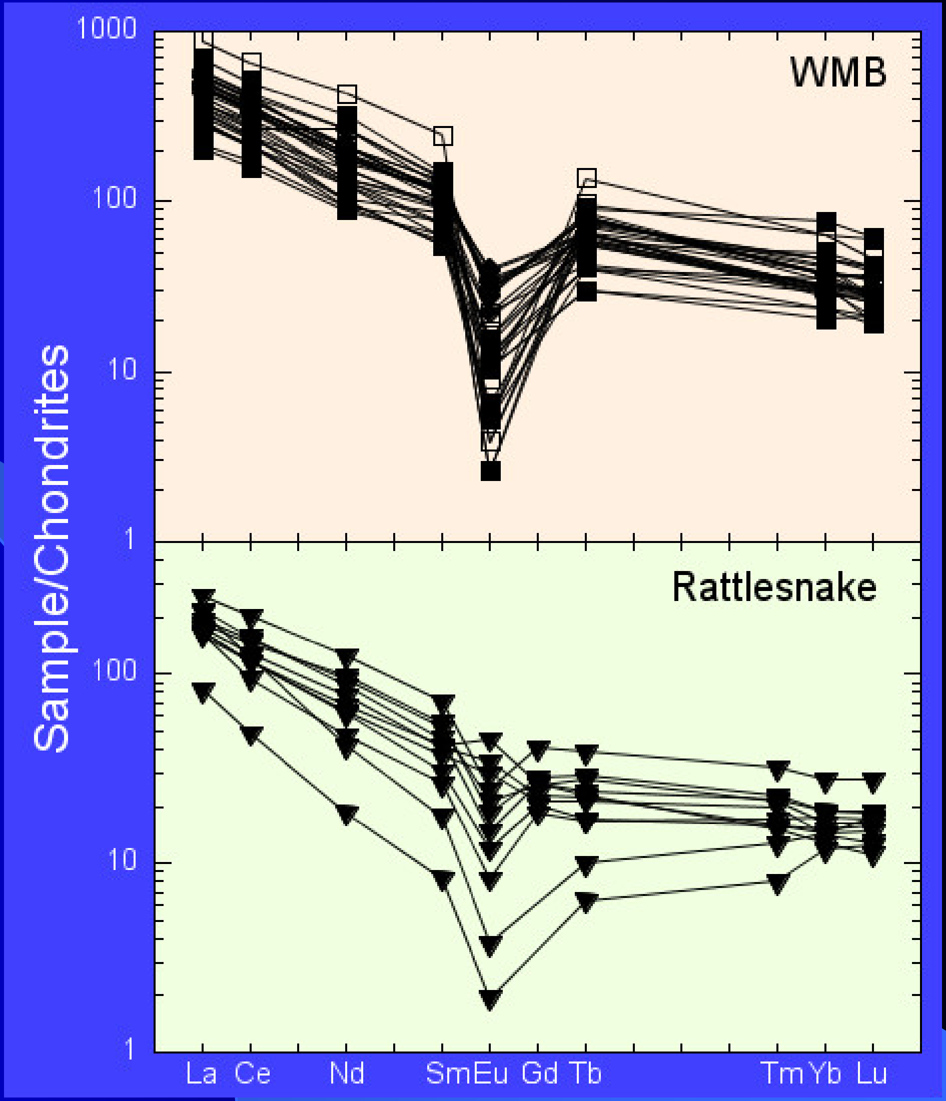
The White Mountain batholith is comprised of syenites, granites, and rhyolites. The Rattlesnake pluton consists of nepheline syenite and syenite. Mafic rocks are absent. In general, mafic rocks are not significant components of the Older White Mountain igneous sequences.



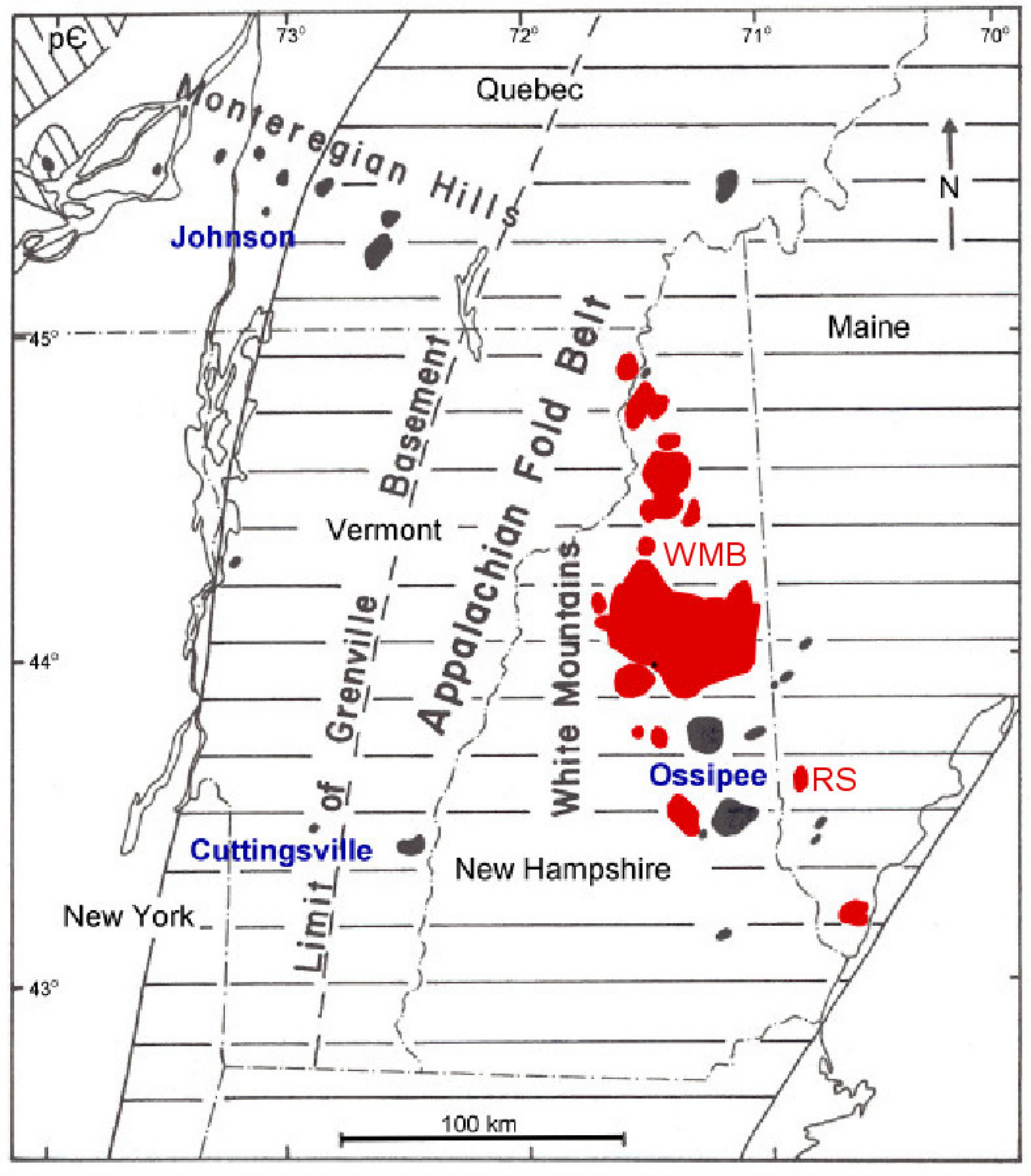


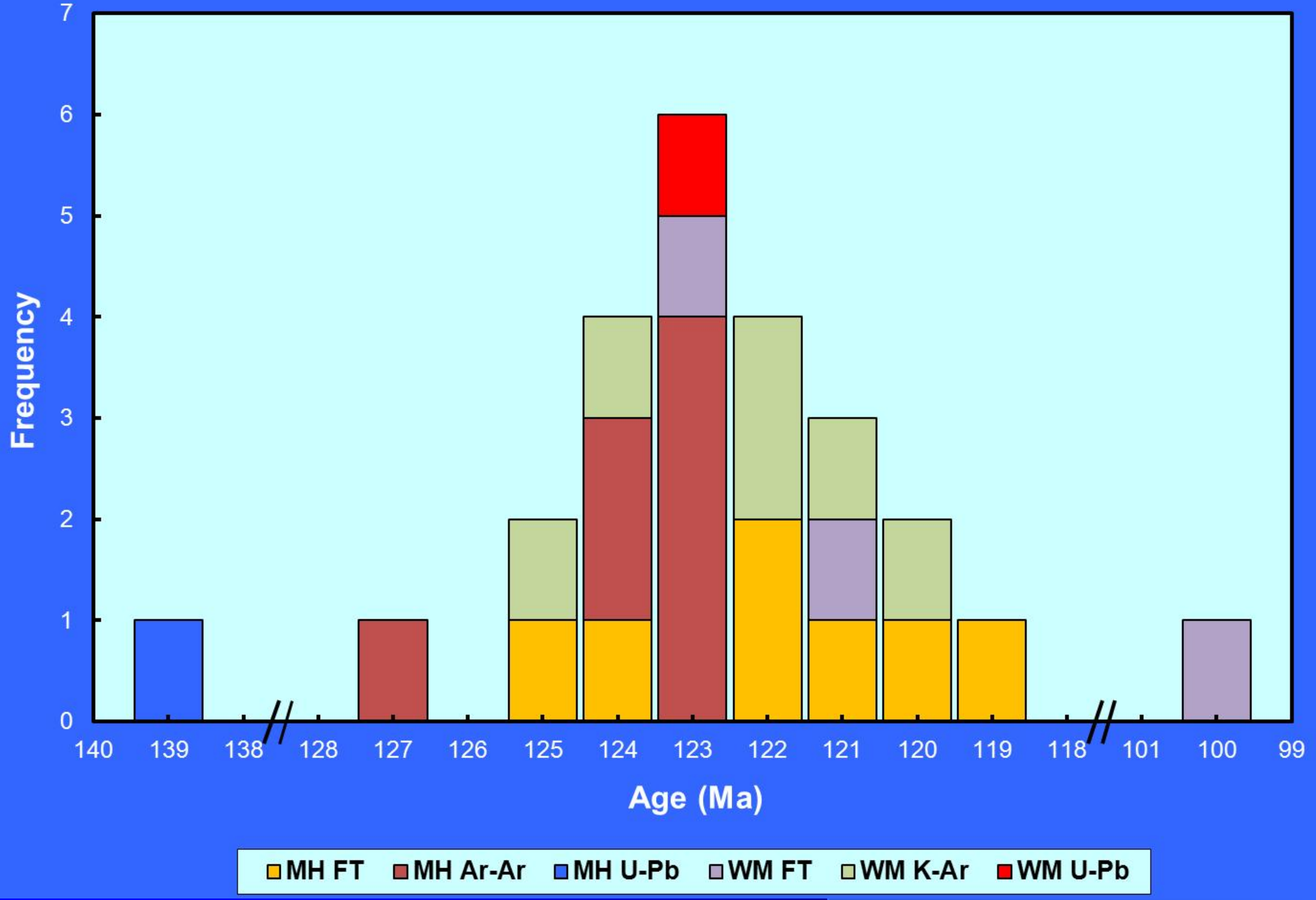
Significant depletions in Ba, Sr, and Eu indicate significant feldspar fractionation. Of note is the small positive Pb anomaly and the small negative Nb anomaly.



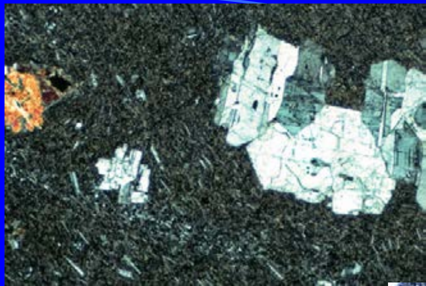


Monteregian Hills and Younger White Mountains – a Tale of Three Plutons – Ossipee, Cuttingsville, and Ossipee.

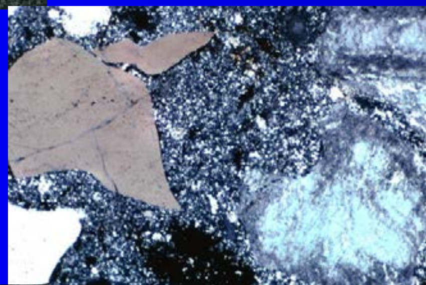



Frequency
Age (Ma)
0
1
2
3
4
5
6
7
140
139
138
128
127
126
125
124
123
122
121
120
119
118
101
100
99
MH FT
MH Ar-Ar
MH U-Pb
WM FT
WM K-Ar
WM U-Pb

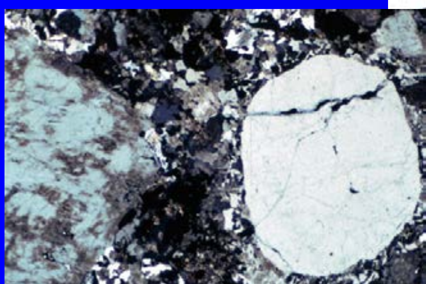
Ossipee ring complex



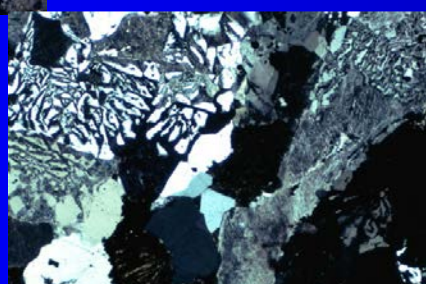
Basalt



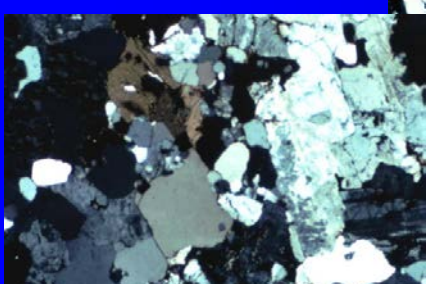
Rhyolite



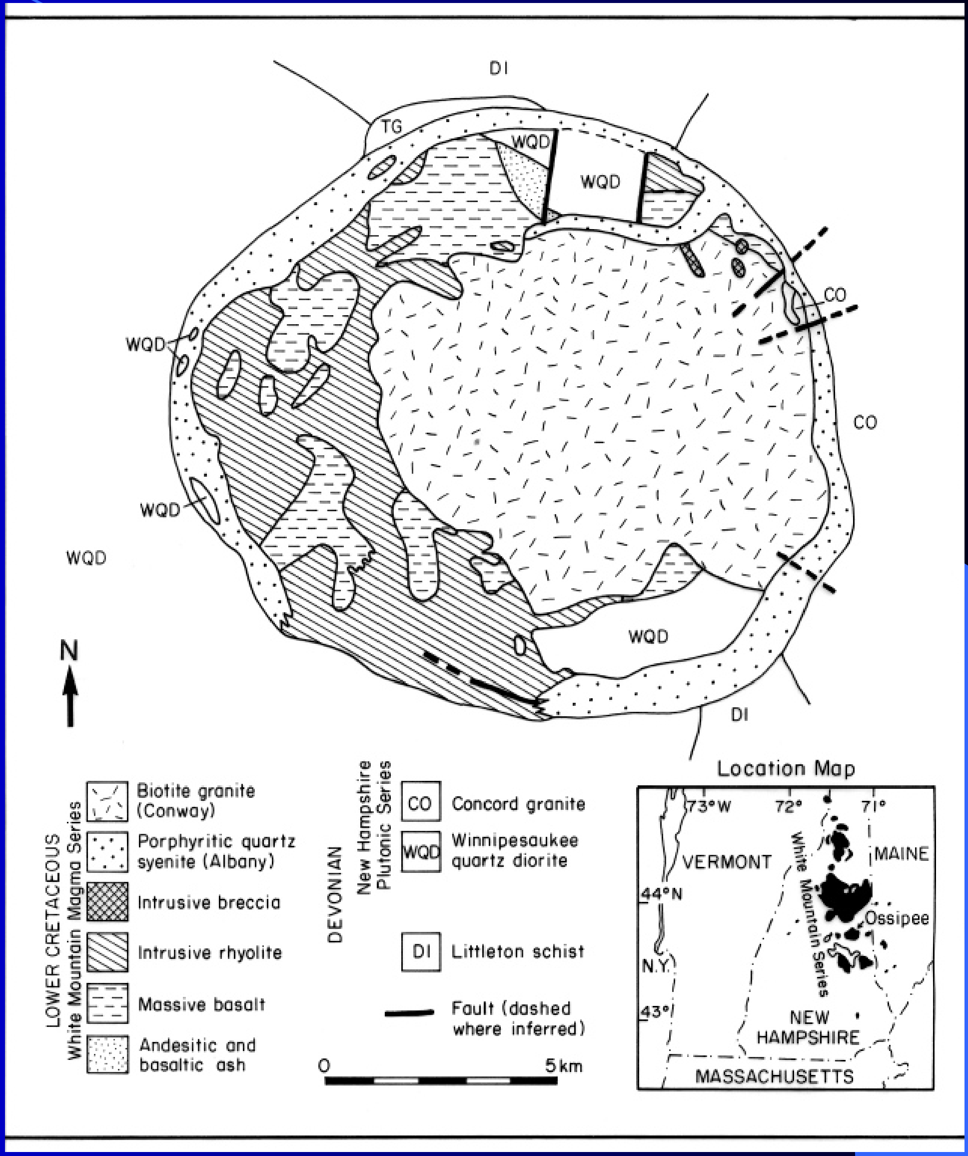
Porphyritic quartz syenite



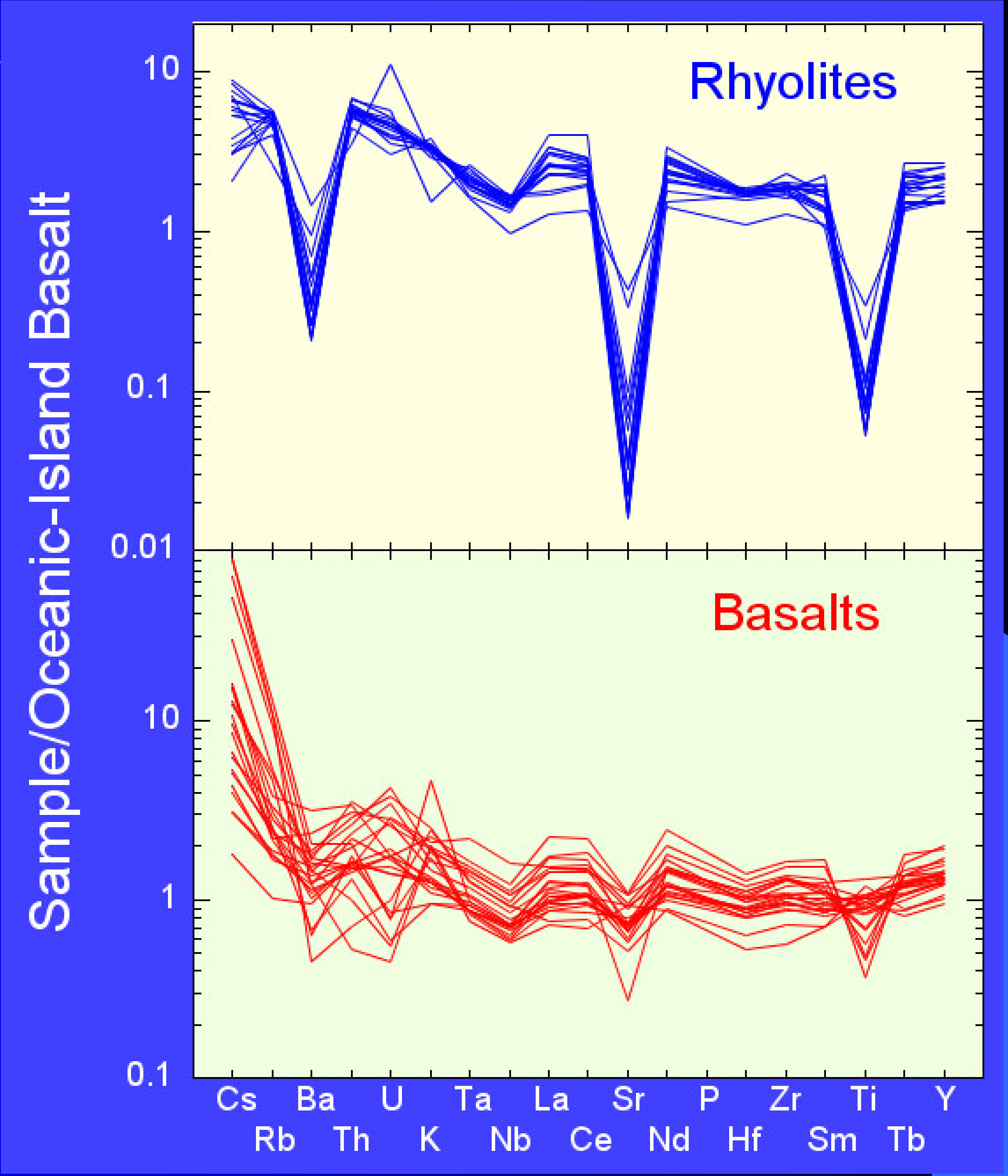
Microgranite



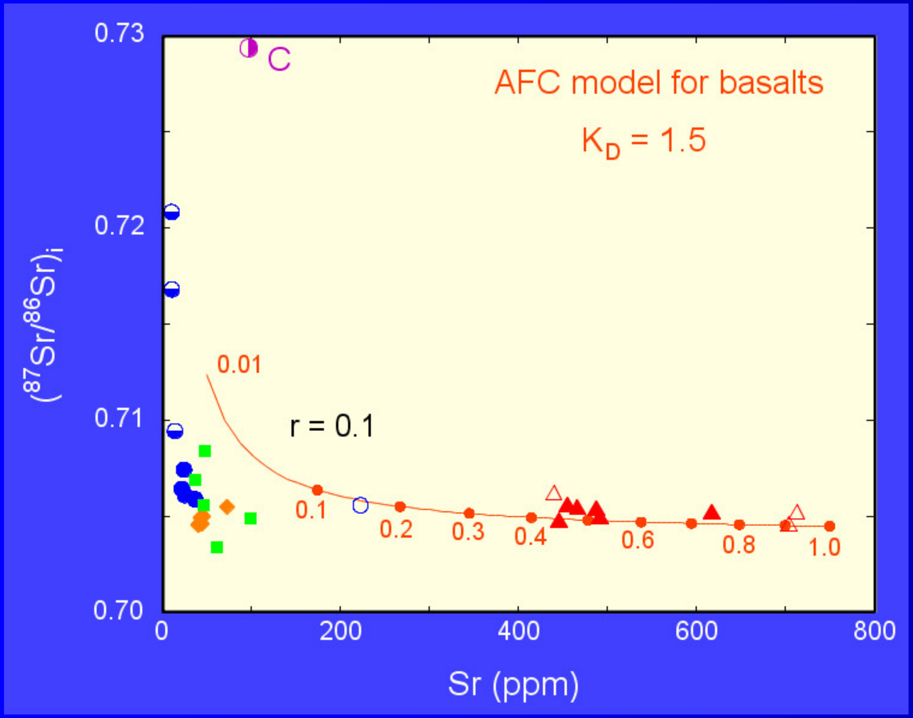
Biotite granite

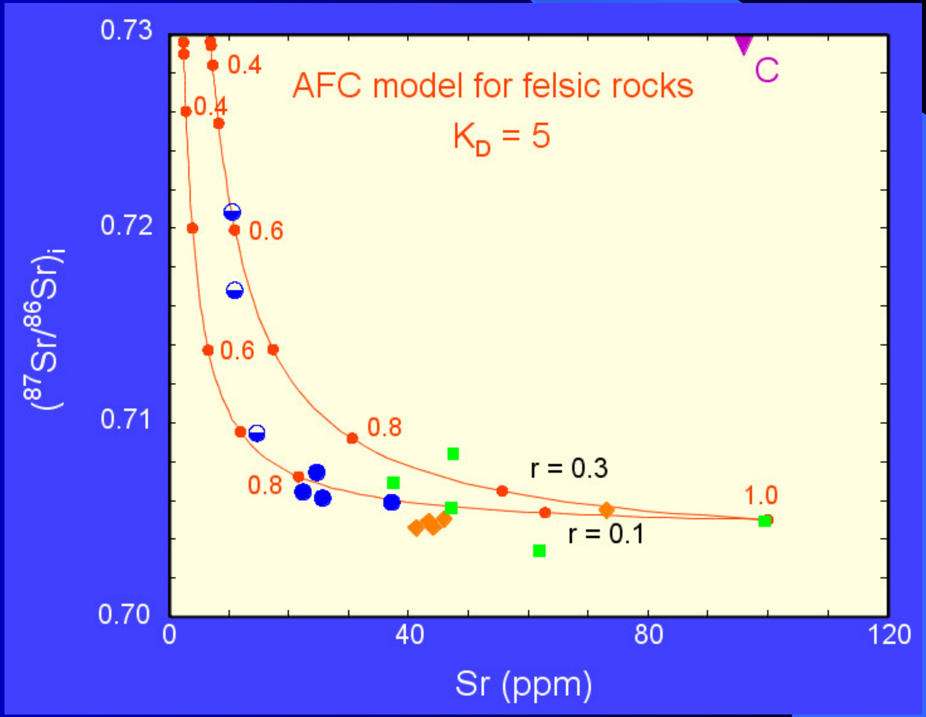


OIB normalized spider diagrams for Ossipee rhyolites and basalts. Note the similarity of both lithologies to OIB. Variations can be explained by the fractionation of alkali feldspar and opaque oxide minerals. Cs enrichment in basalts is due to late-stage hydrothermal alteration as evidence by the partial replacement of plagioclase by epidote.



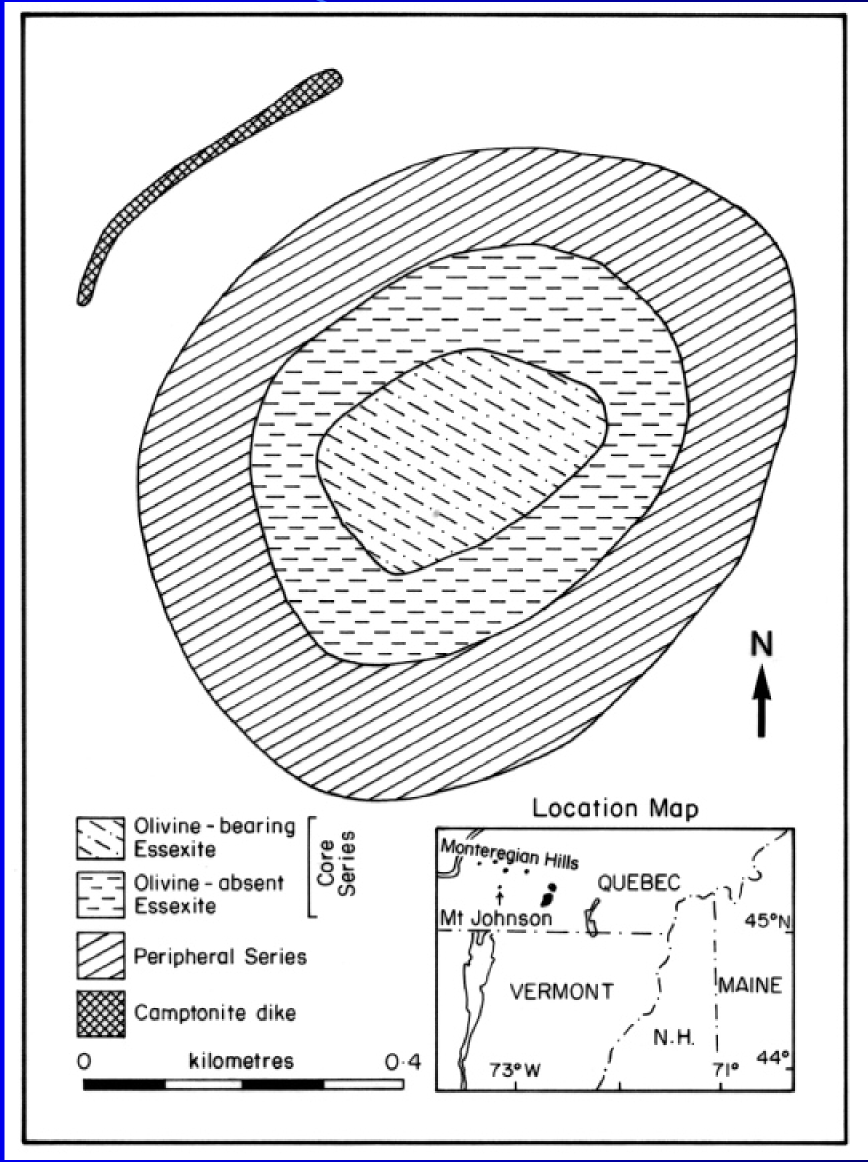
AFC models for basalts and felsic rocks. The isotopic variations require only minor contamination of the melts by country rock.

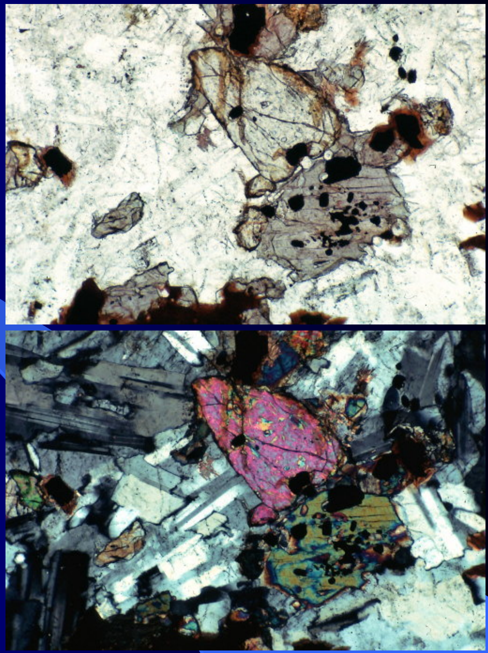




Mont Johnson

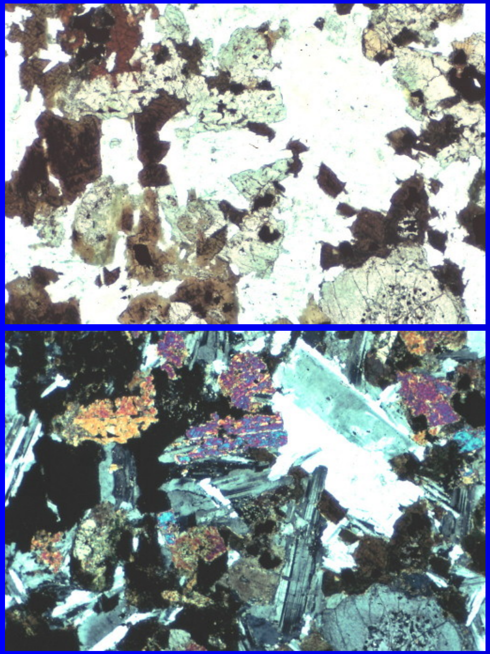
Core series essexite from center of pluton.



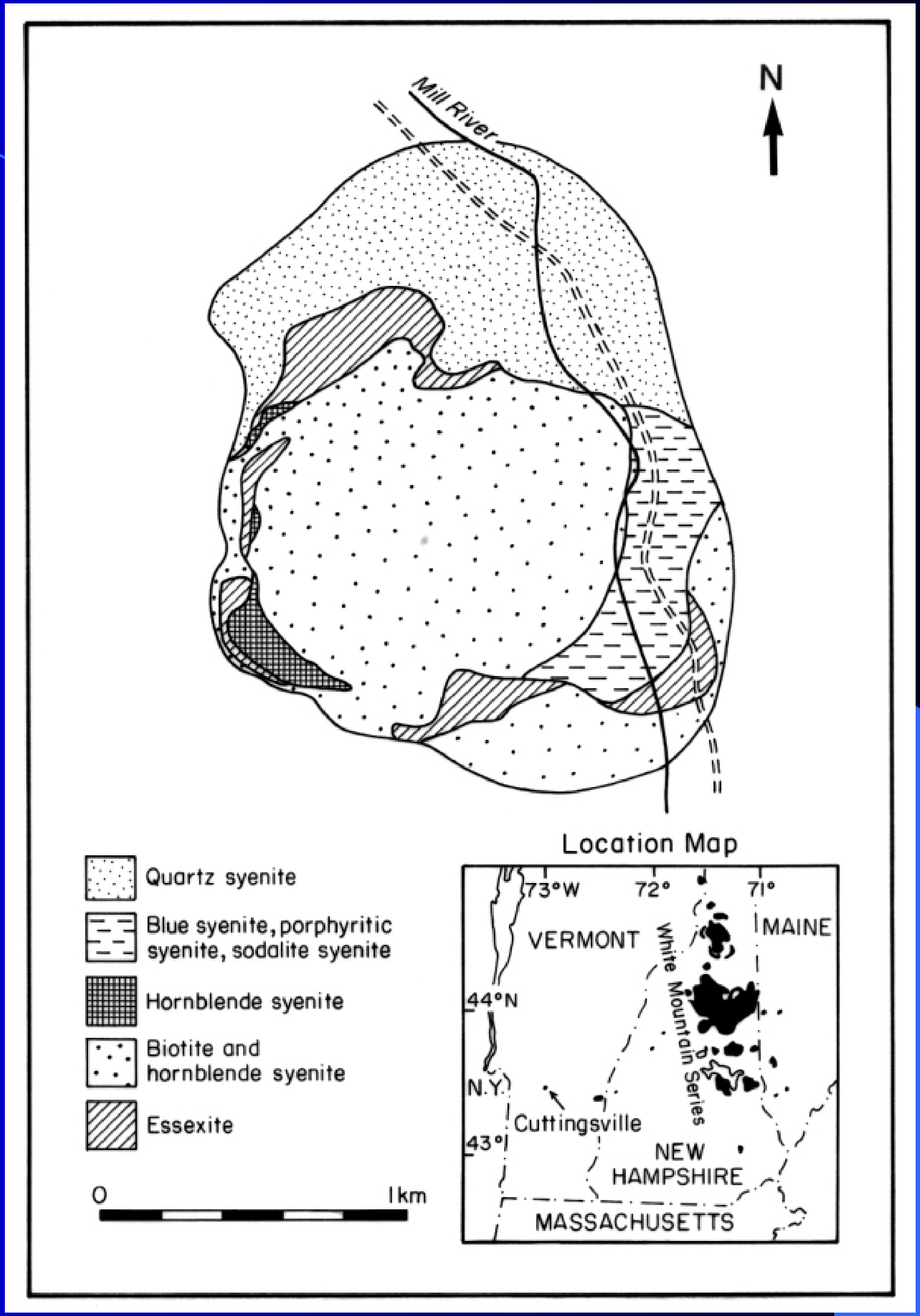


Core series essexite. Width of field of view, 2mm.

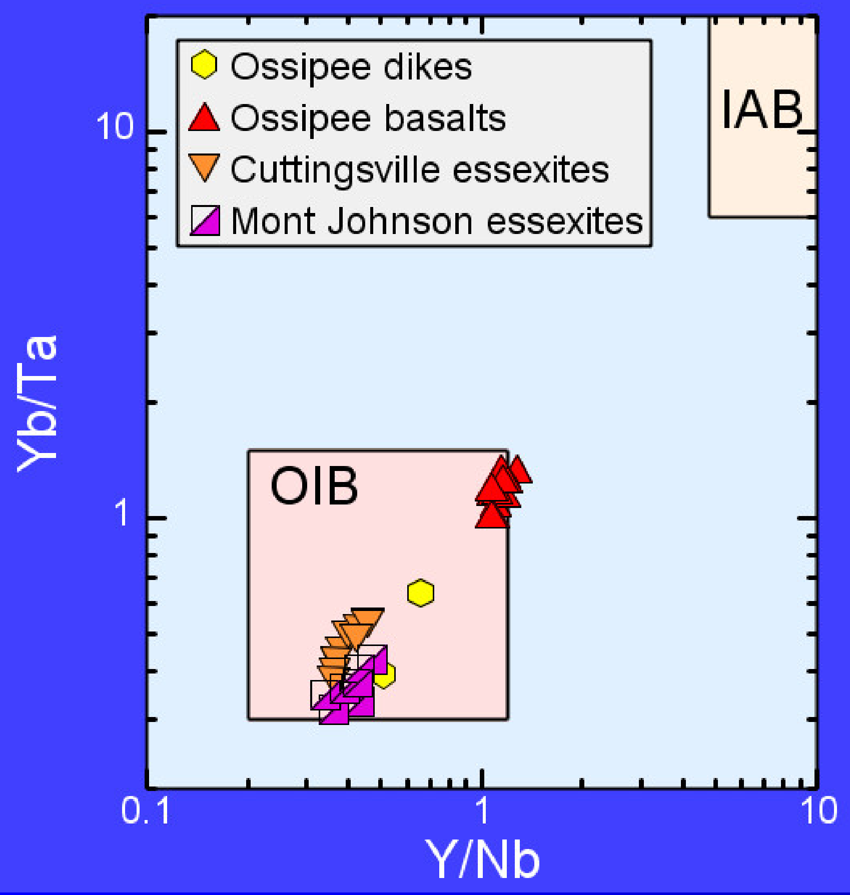
Cuttingsville

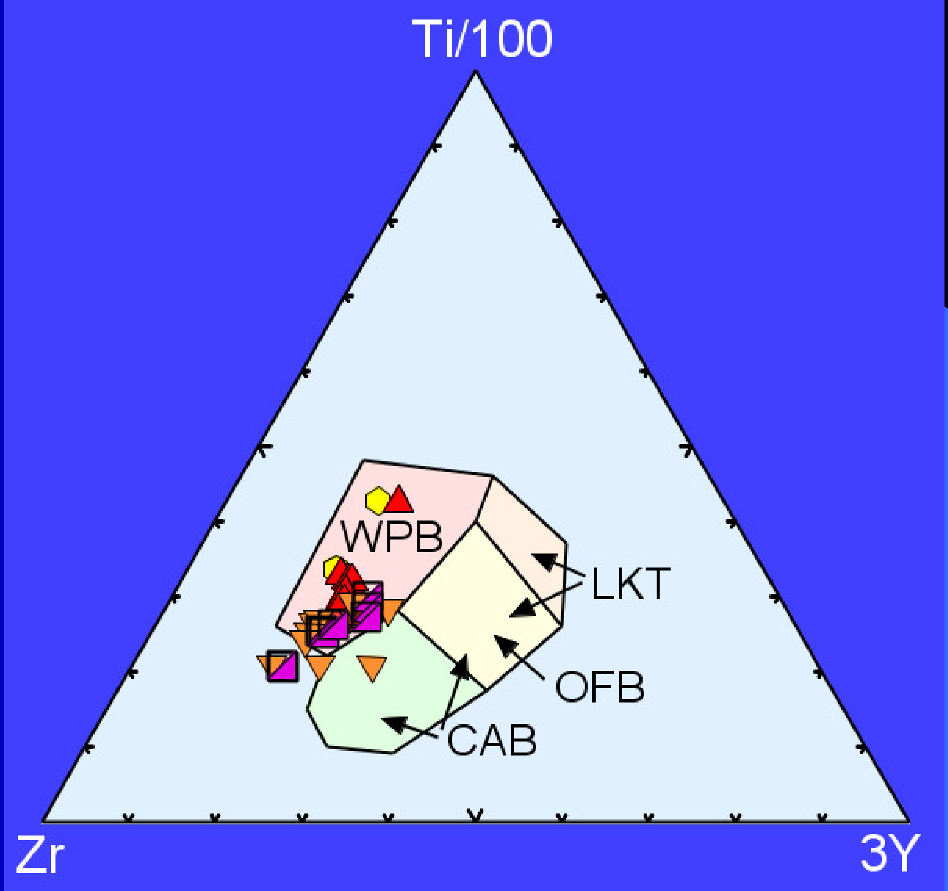


Essexite

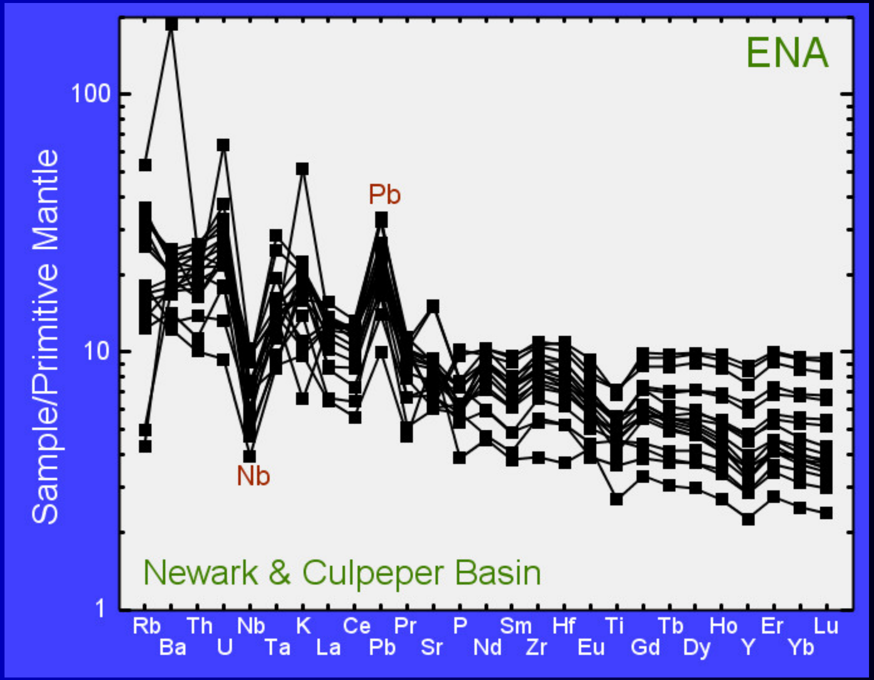


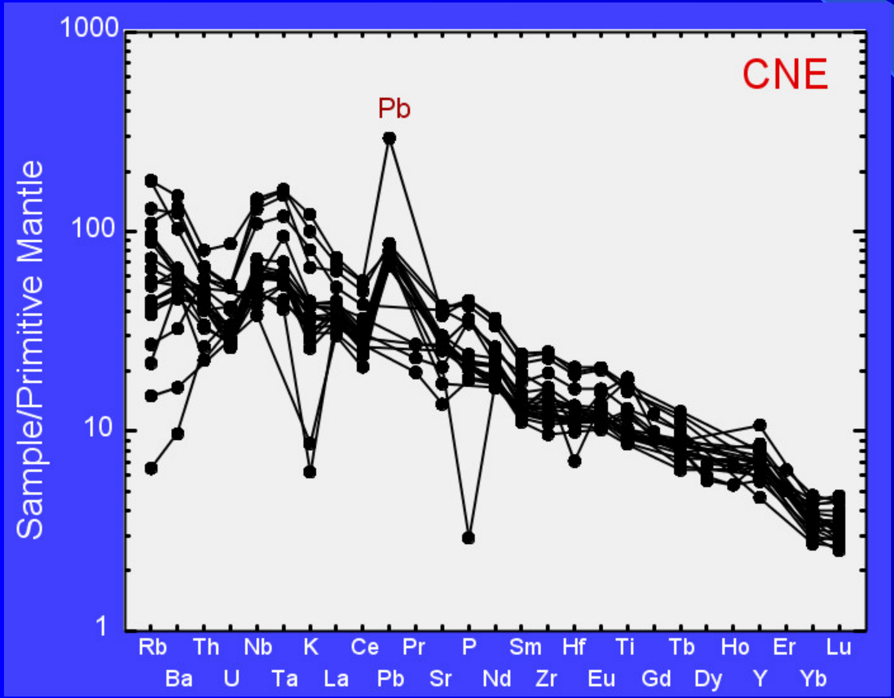
The mafic rocks plot in the OIB and WPB fields on various discrimination diagrams. In the Y/Nb vs Yb/Ta diagram the Ossipee basalts plot towards the IAB field (but still within the OIB field), an indication of minor crustal contamination.

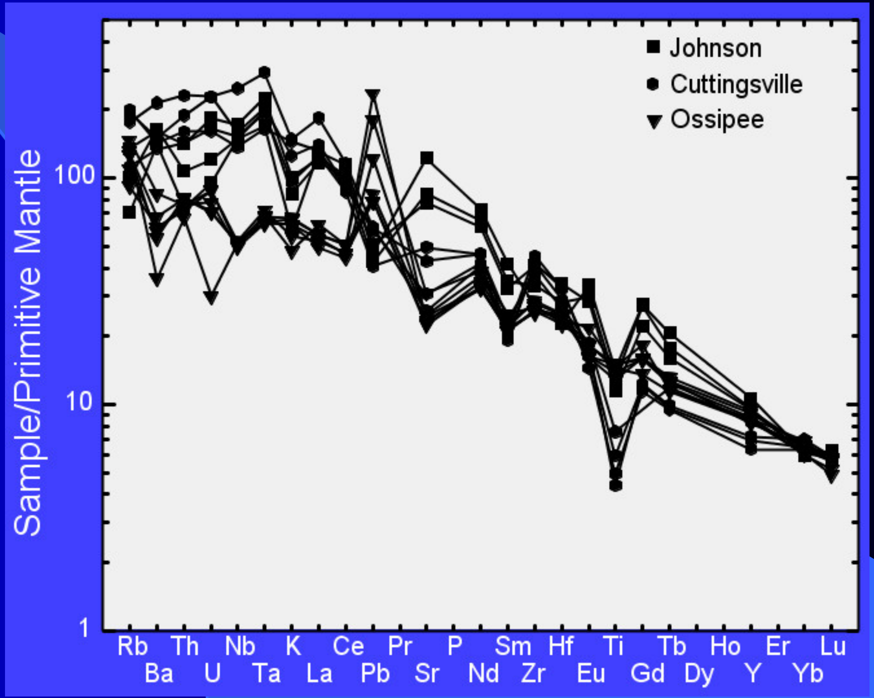




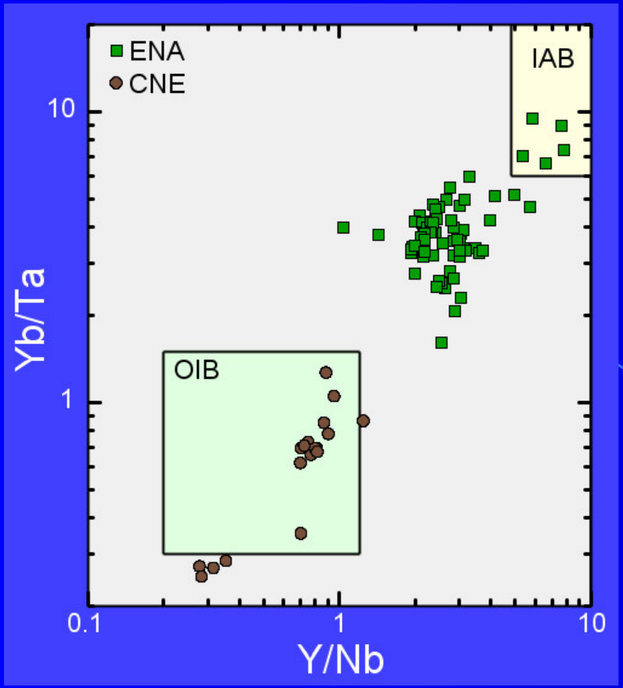
Comparison of ENA, CNE and MHWM elemental chemistry. Note the Nb depletion in ENA. CNE and MHWM patterns show Nb depletions and enrichments. Prominent positive Pb anomaly in ENA and CNE, but absent in MHWM except for Ossipee which was emplaced into the folded Appalachians. The Pb enrichment *may* represent crustal interaction.

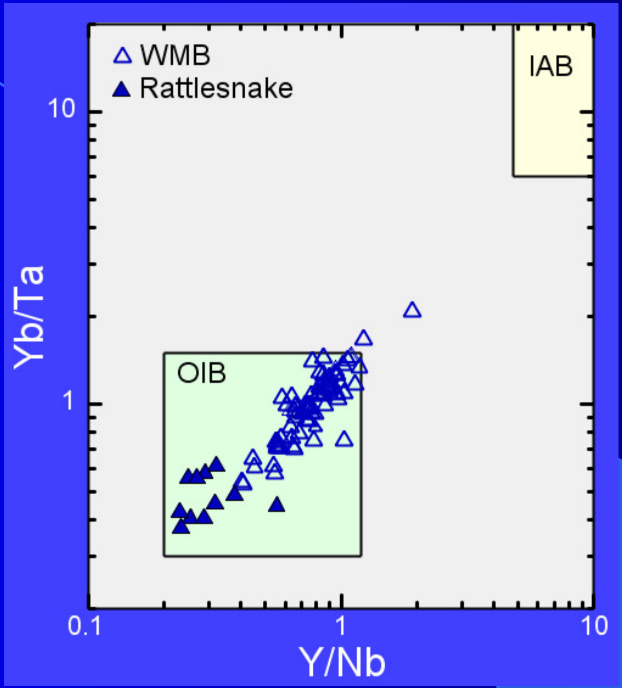


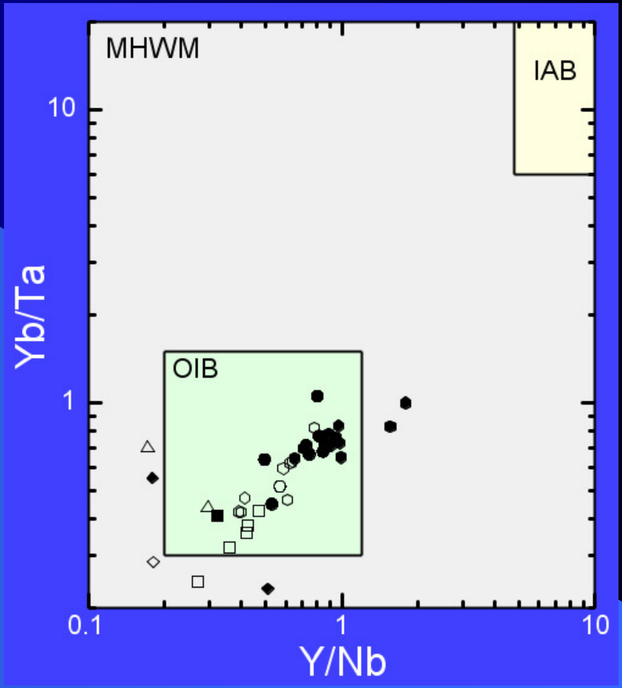




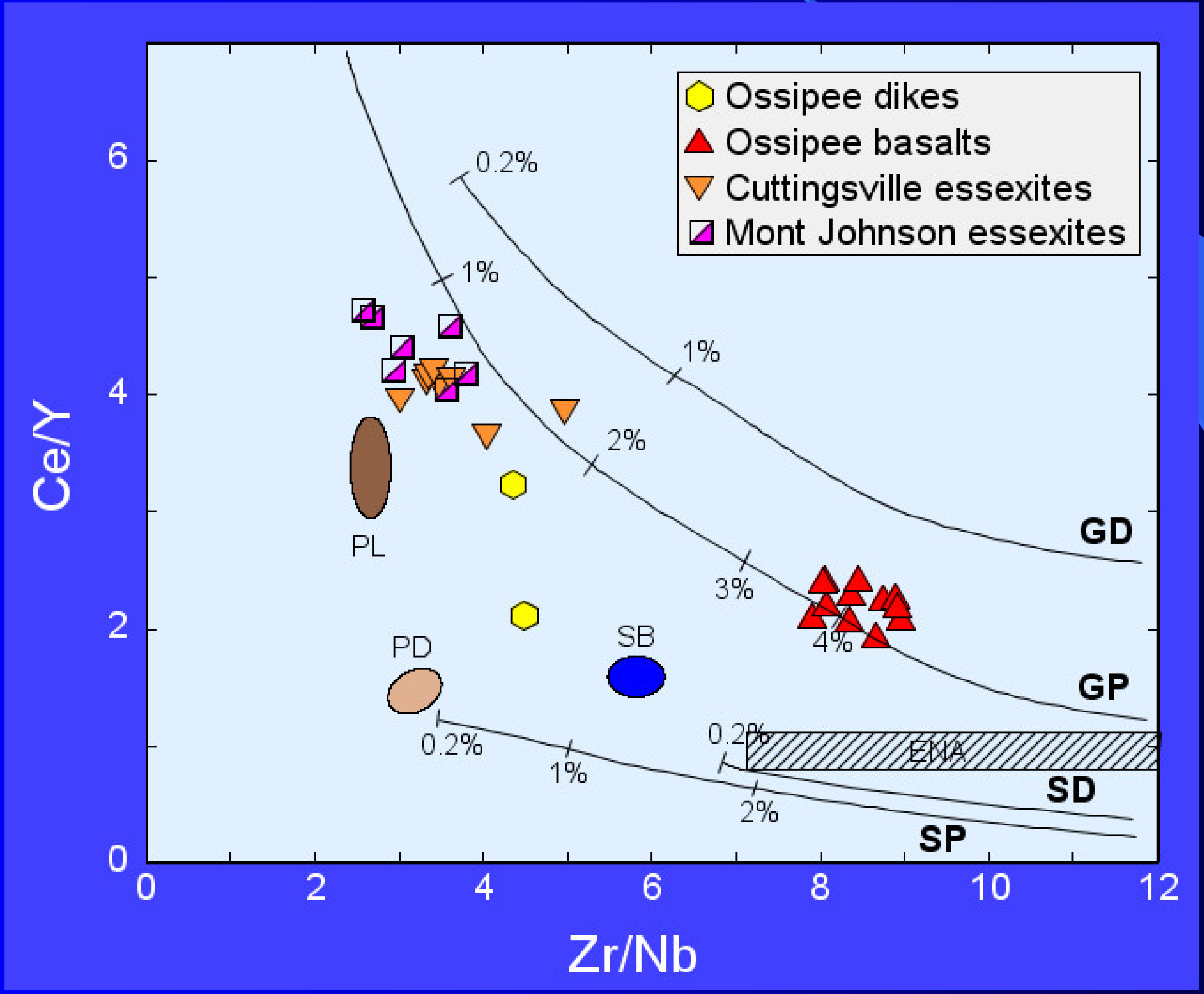
Y/Nb versus Yb/Ta. CNE, OWM and MHWM all fall in the OIB field. The ENA samples plot towards and in the IAB field.



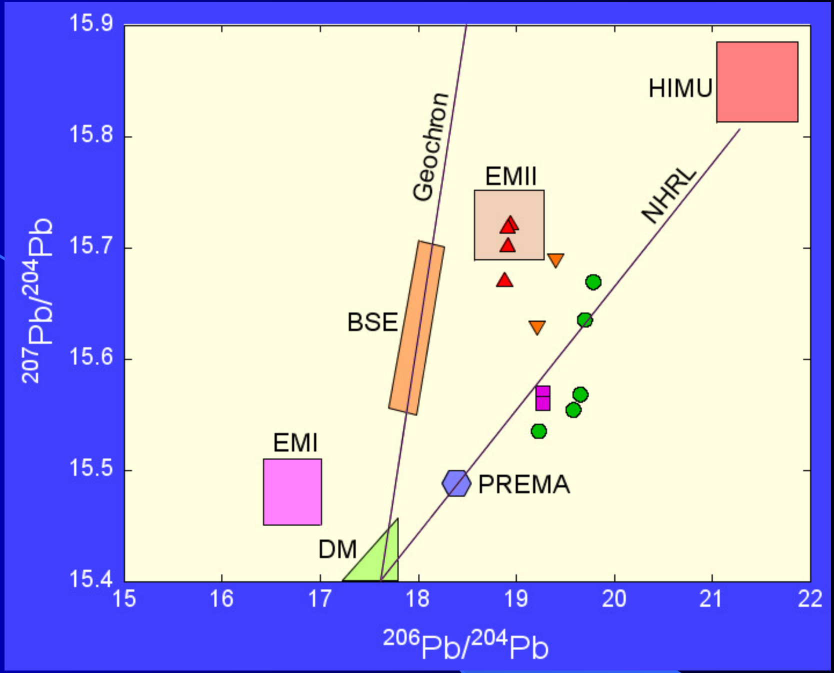


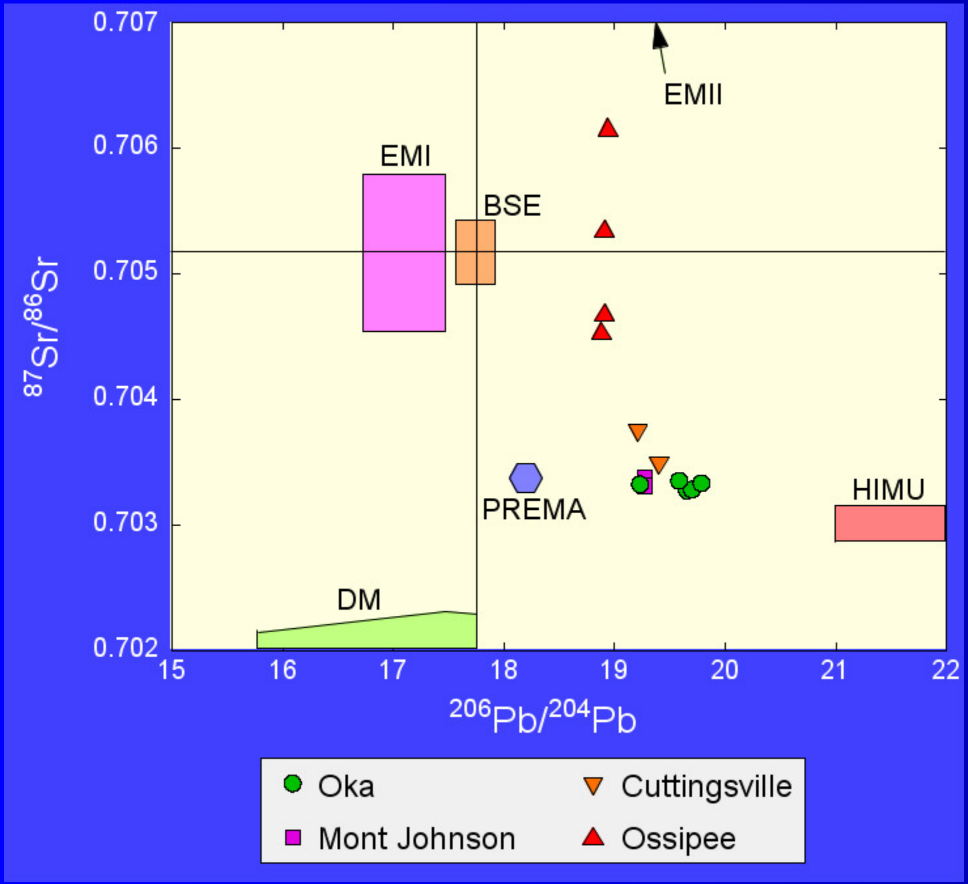


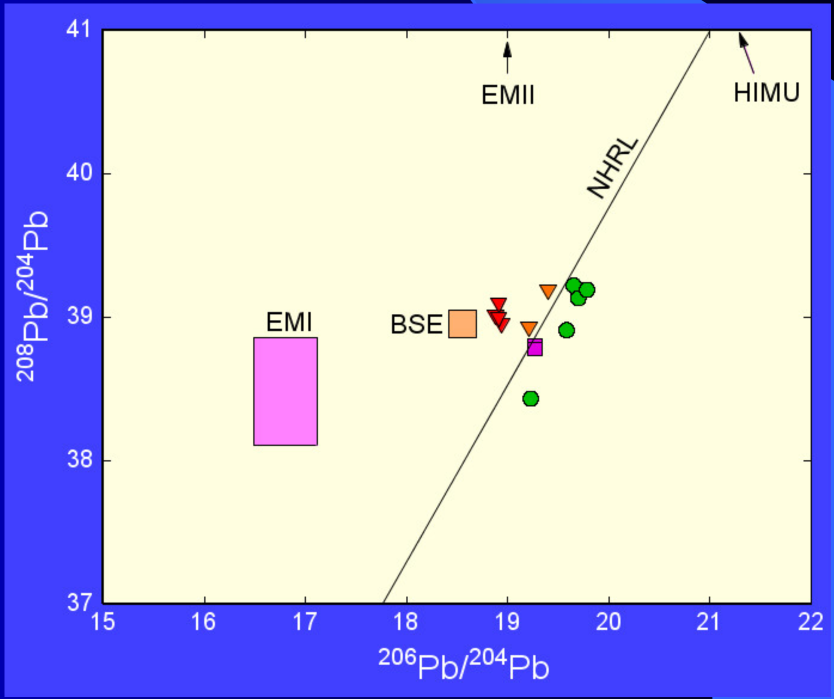
Melting models for various mantle sources. Note that the MHWM mafic rocks fall along the Garnet Peridotite (GP) curve and are apparently related by variable degrees of melting of the same source. The ENA basalts plot in the general area of melts formed in equilibrium with a Depleted Spinel (SD) lherzolite mantle. The CNE dikes fall between the curves perhaps suggesting a mixed garnet-spinel source.

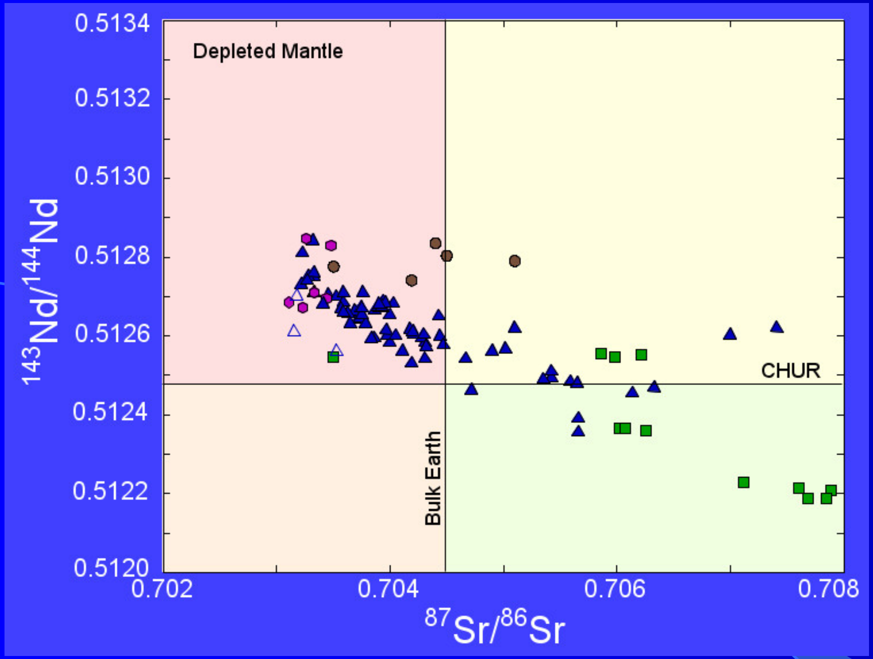


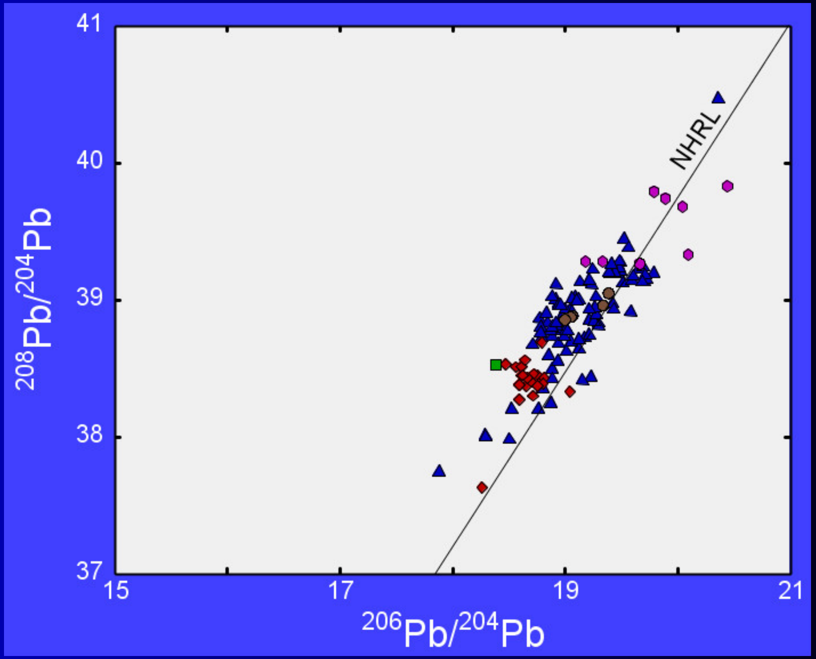
Sr and Pb isotopic relationships for the mafic silicate rocks and the Oka sovites.

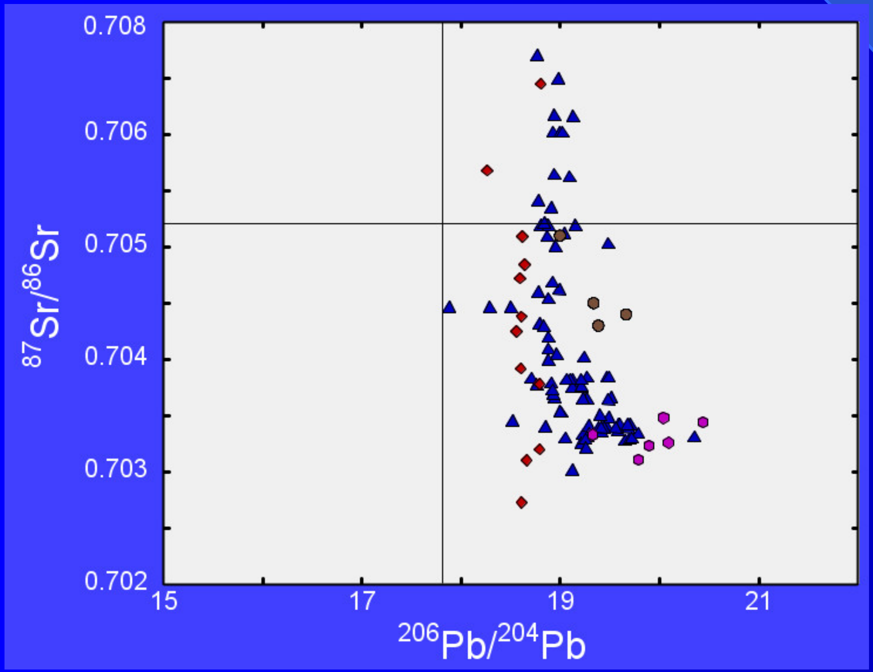


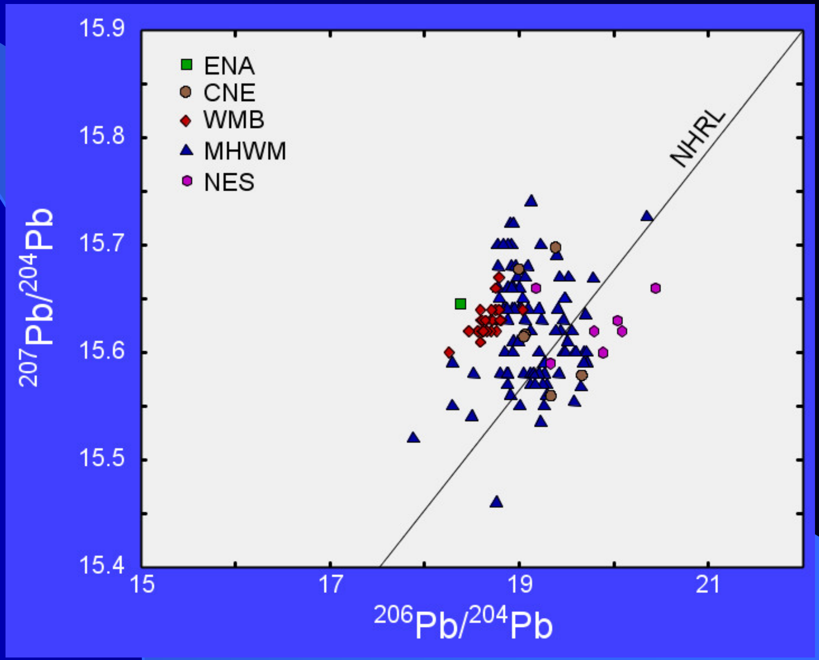





Depleted Mantle
CHUR
Bulk Earth
0.5134
0.5132
0.5130
0.5128
0.5126
0.5124
0.5122
0.5120
0.702
0.704
0.706
0.708
$^{143}Nd/^{144}Nd$
$^{87}Sr/^{86}Sr$


NHRL
41
40
39
38
37
15
17
19
21
$^{208}Pb/^{204}Pb$
$^{206}Pb/^{204}Pb$


0.708
0.706
0.705
0.704
0.703
0.702
15
17
19
21
$^{87}Sr/^{86}Sr$
$^{206}Pb/^{204}Pb$


ENA
CNE
WMB
MHWM
NES
NHRL
15.9
15.8
15.7
15.6
15.5
15.4
15
17
19
21
$^{207}Pb/^{204}Pb$
$^{206}Pb/^{204}Pb$