

QuickTime™ and a
decompressor
are needed to see this picture.



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the oceanic Aleutian arc is the best place in the
world to study the role of arc magmatism
in forming continental crust

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W Aleutian lavas with compositions ~ continental crust
oceanic Aleutian plutons ~ continental crust

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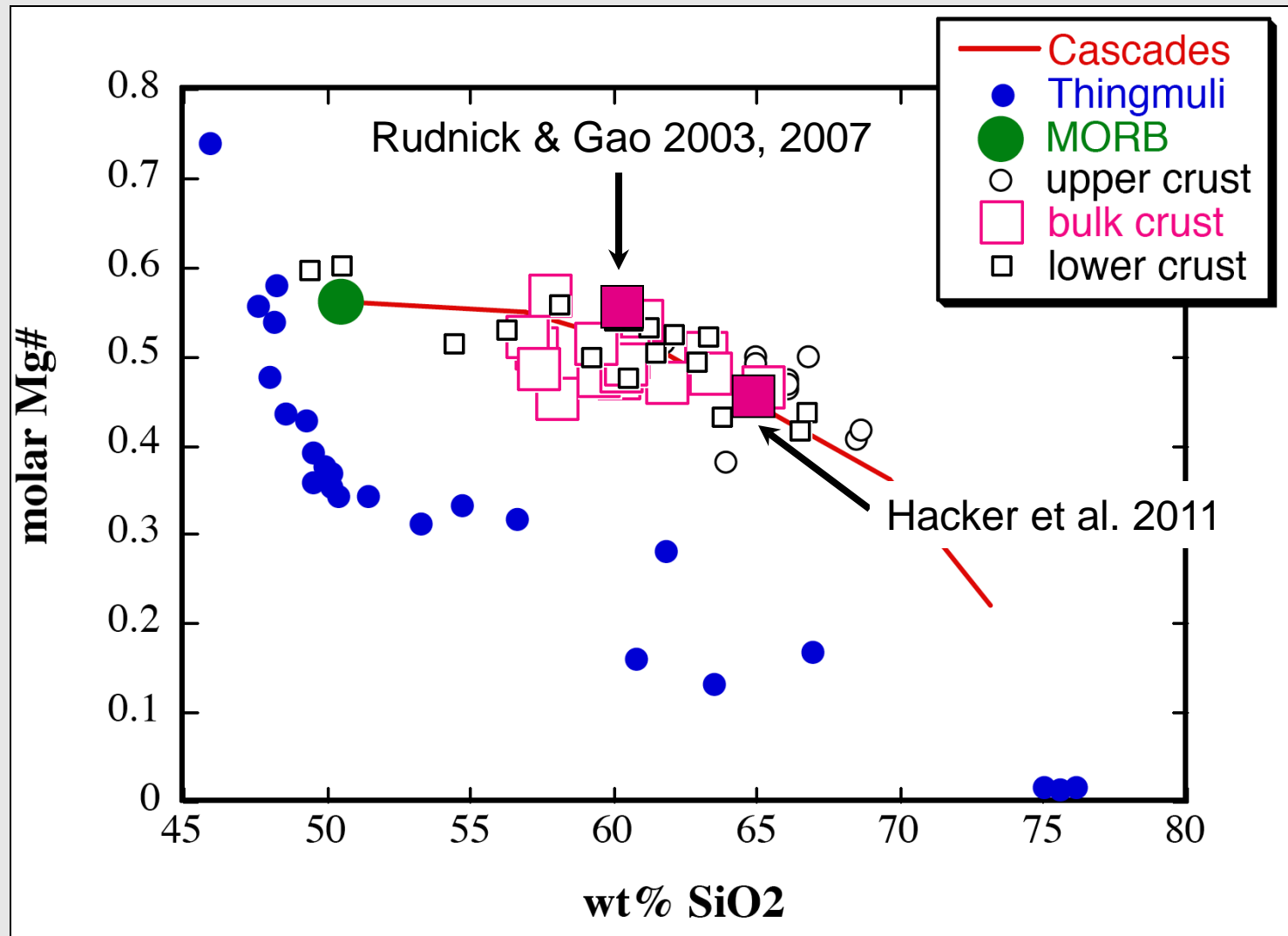


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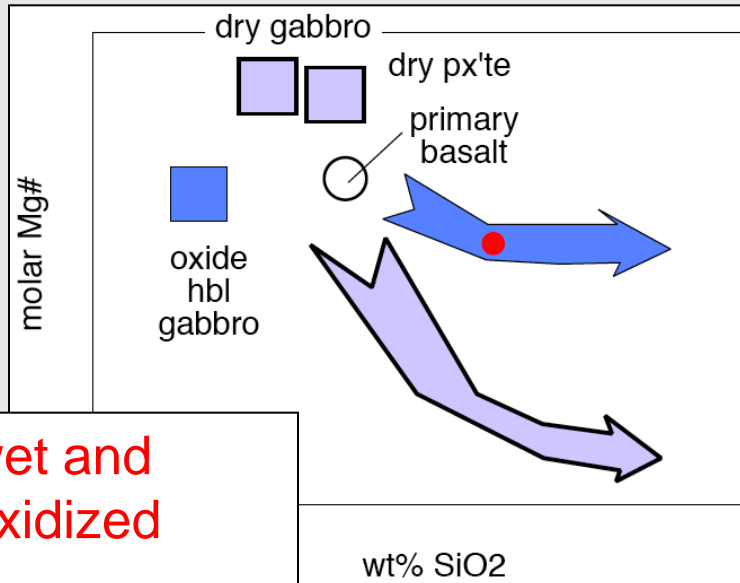
W Aleutian lavas with compositions ~ continental crust

oceanic Aleutian plutons ~ continental crust

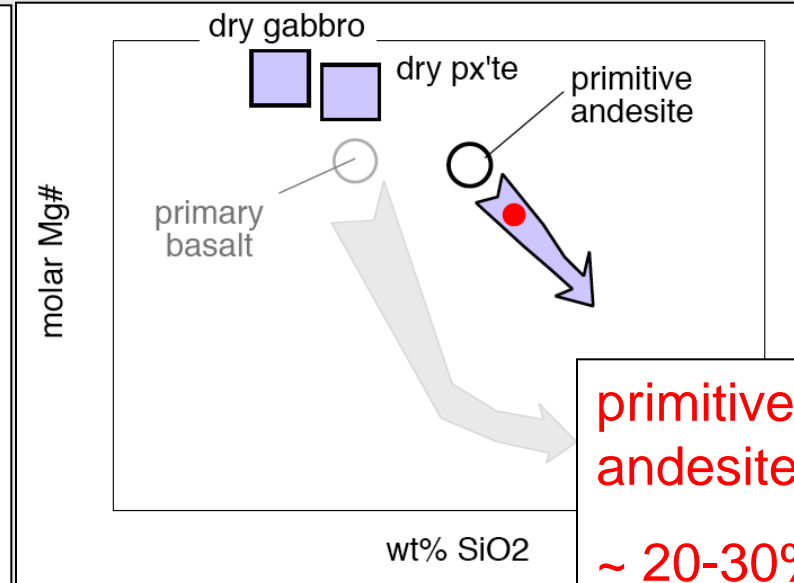
major elements in continental crust like “calc-alkaline” arc andesite & dacite



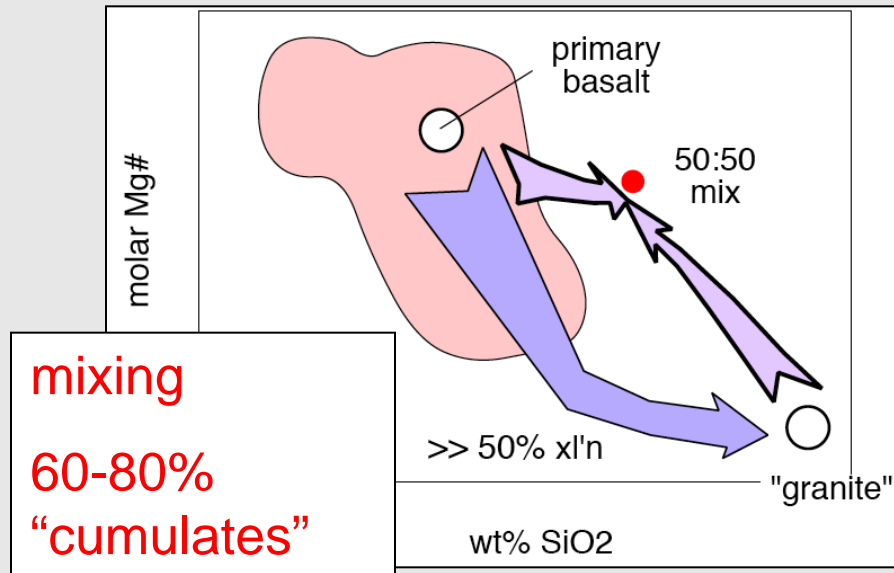
making lavas ~ continental crust



wet and oxidized
50-60%
"cumulates"

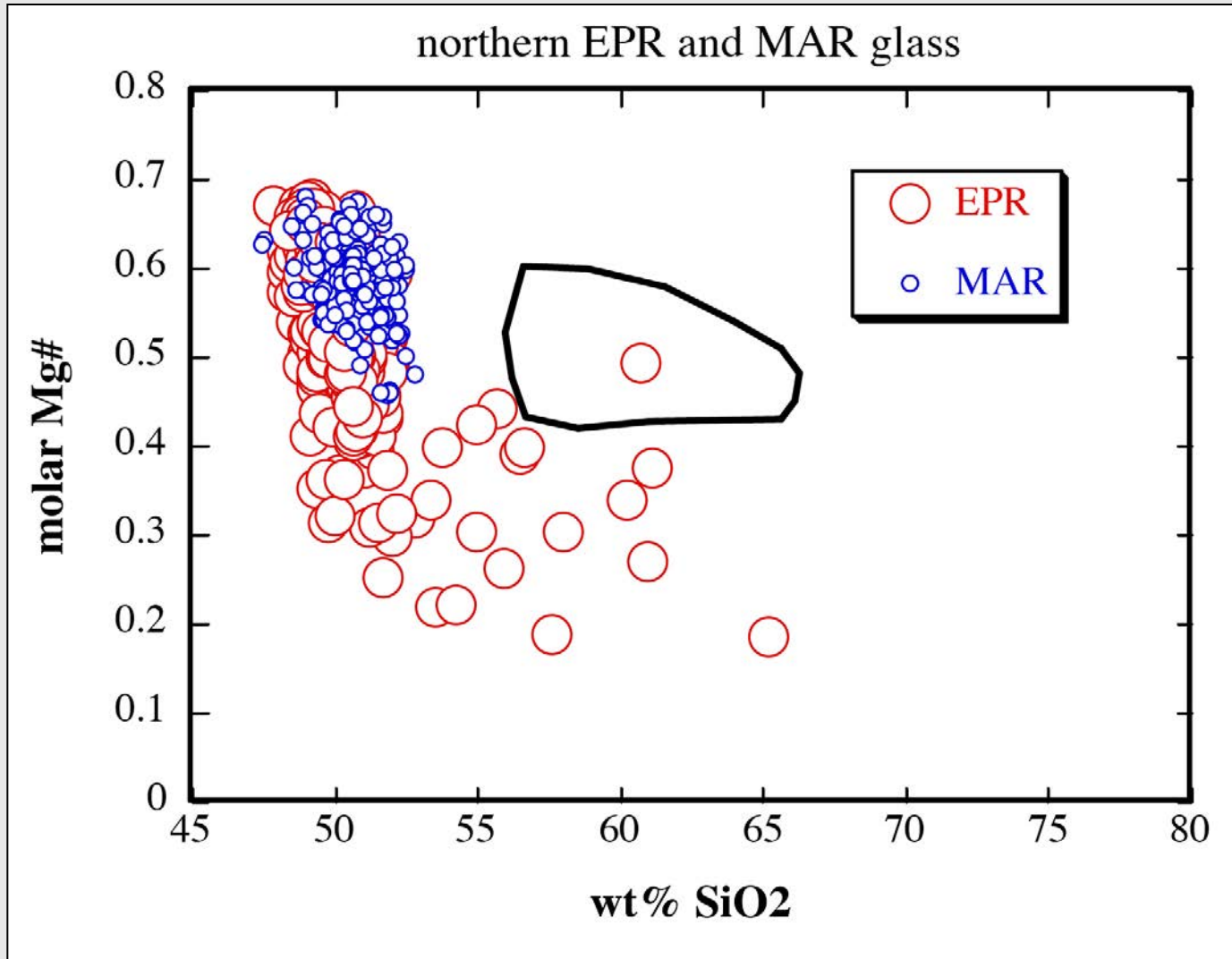


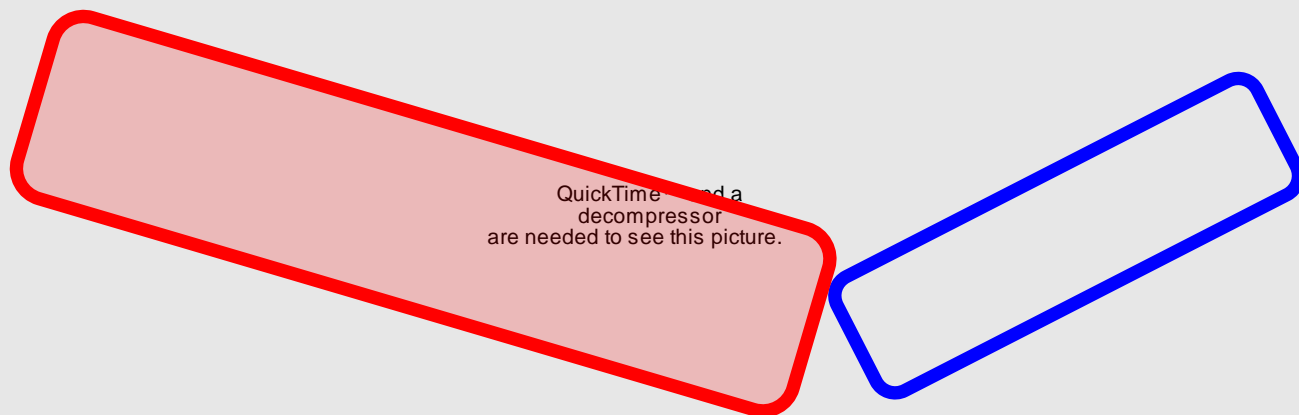
primitive andesite
~ 20-30%
"cumulates"



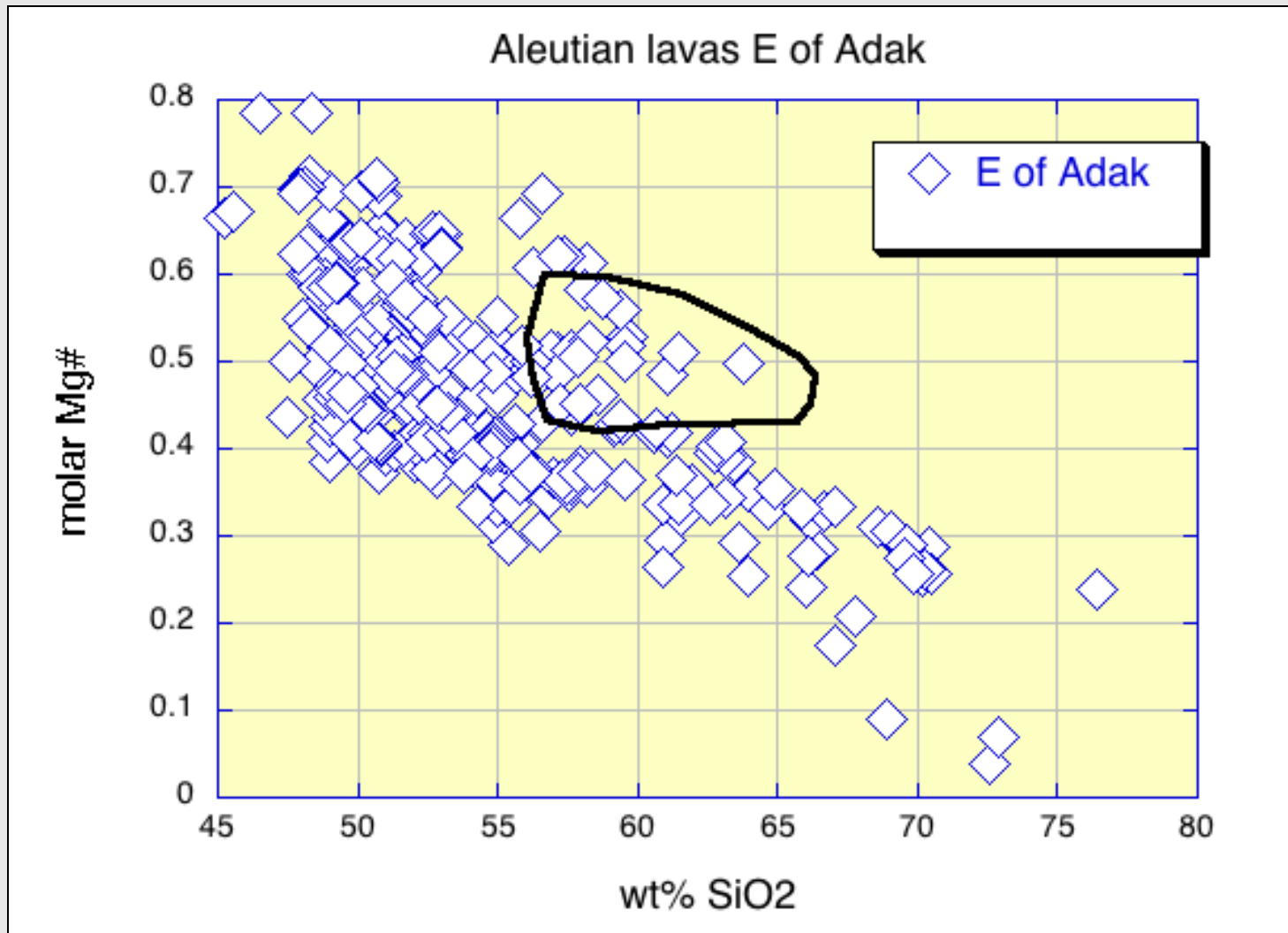
mixing
60-80%
"cumulates"

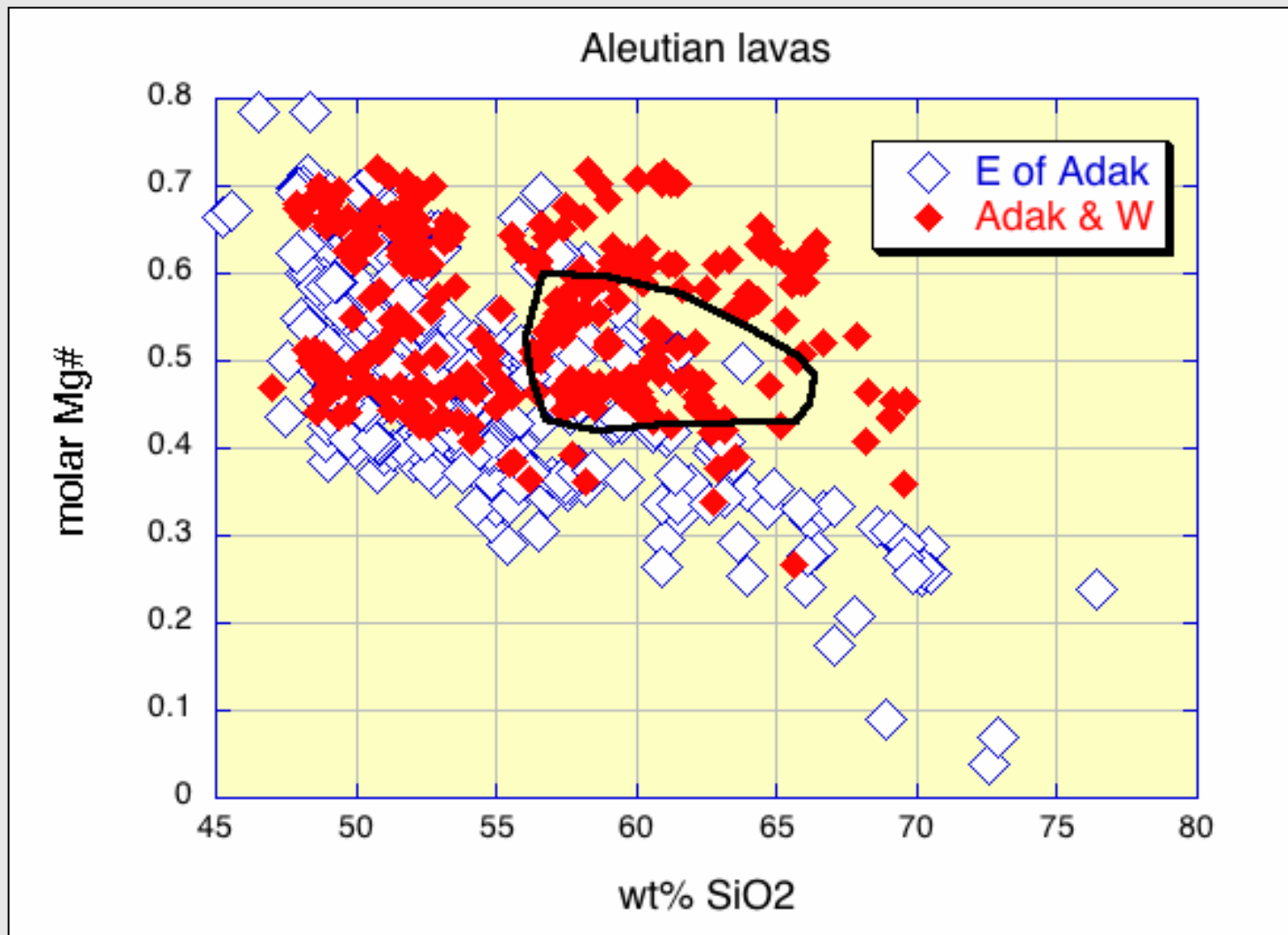
mid-ocean ridge lavas don't "go there"





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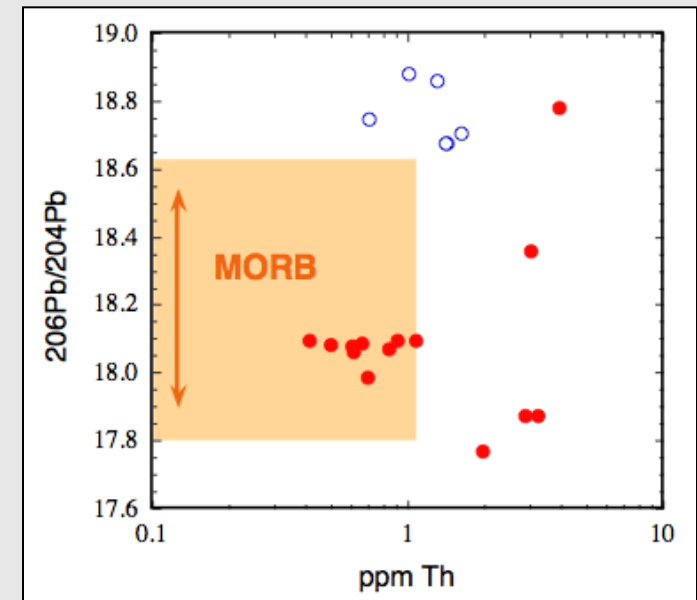
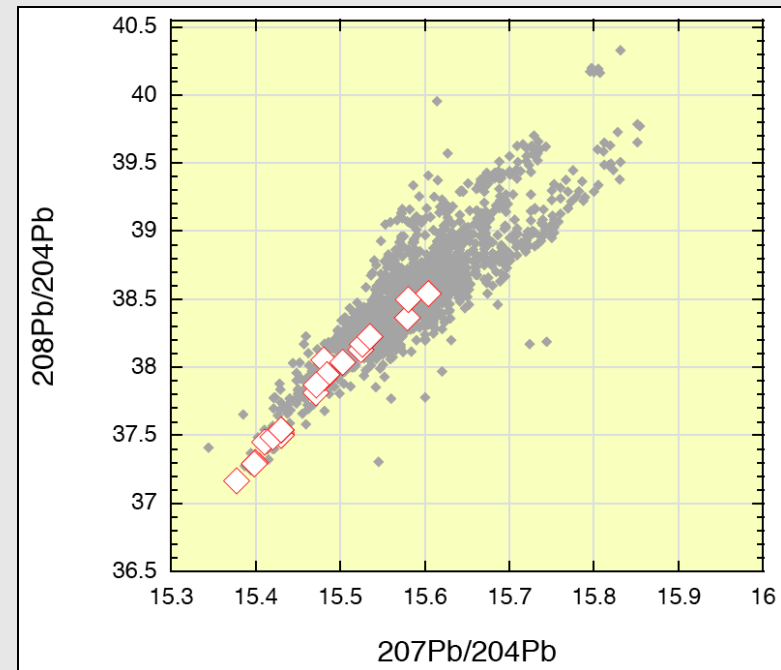
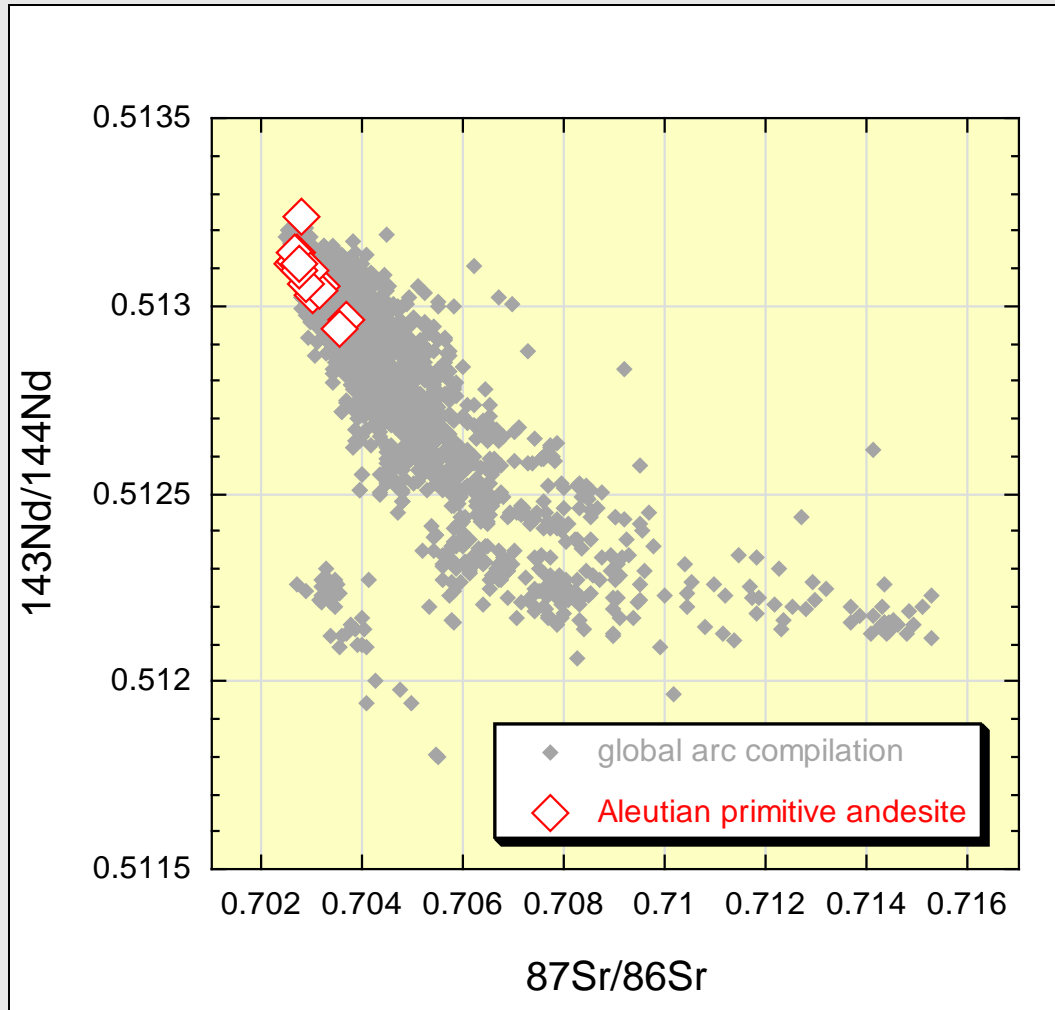


QuickTime™ and a
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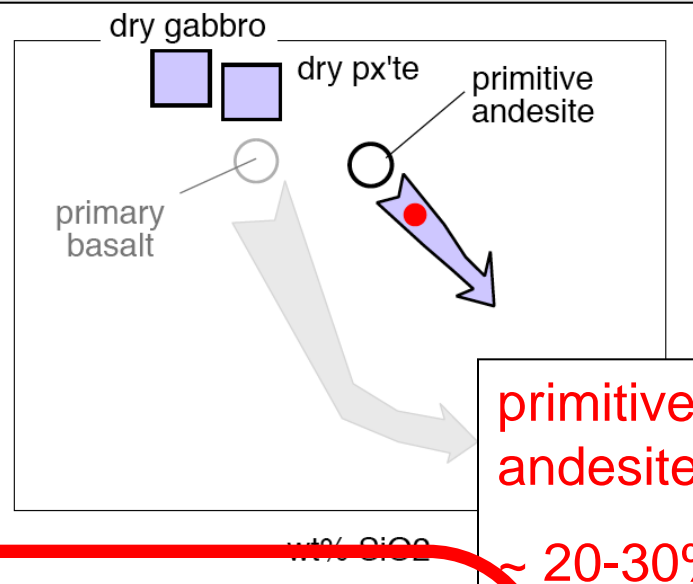
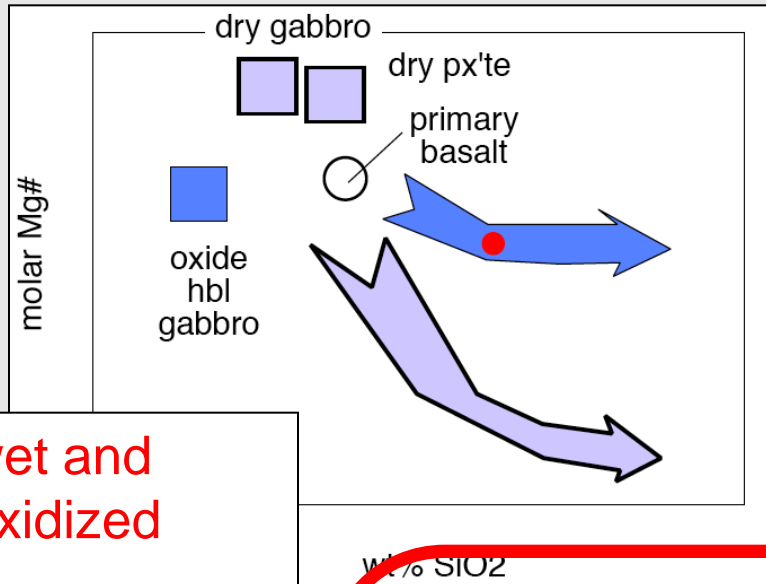
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

lavas with
molar Mg# > 0.5

no recycled continental sediments in W Aleutian primitive andesites

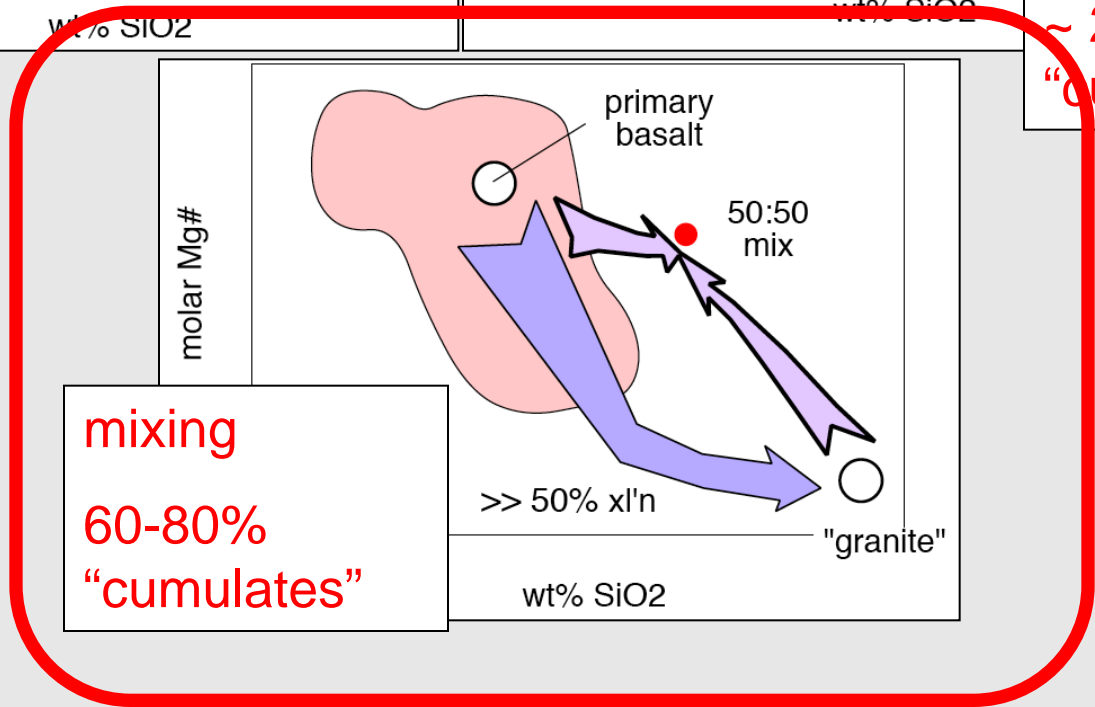


making lavas ~ continental crust



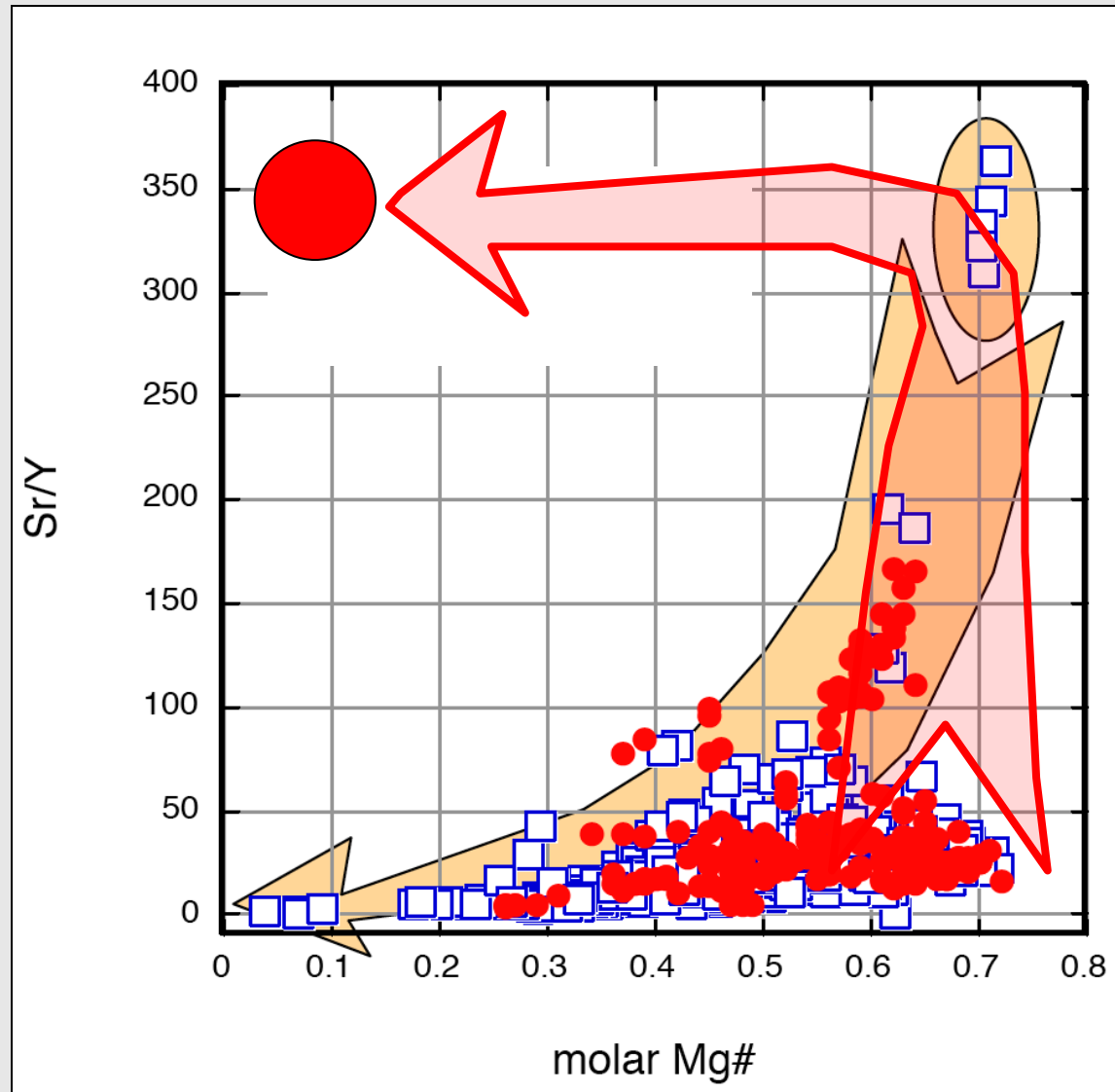
wet and oxidized
50-60%
"cumulates"

primitive andesite
~ 20-30%
"cumulates"

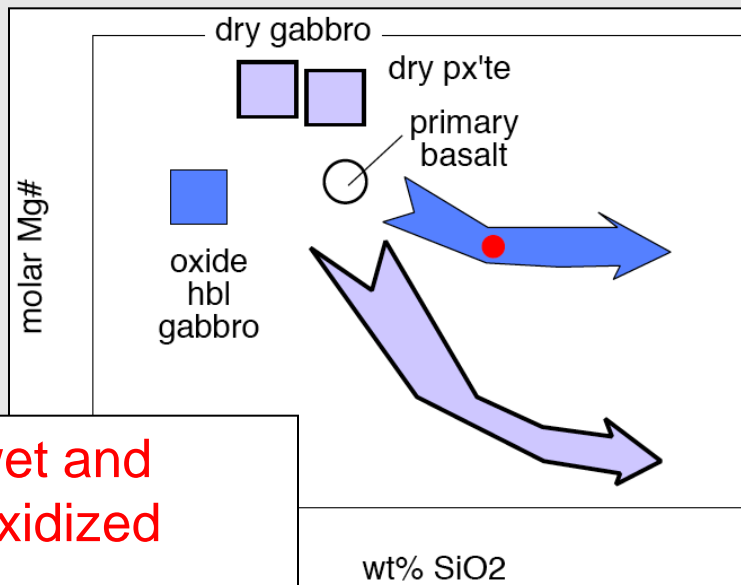


mixing
60-80%
"cumulates"

no enriched "granite" (yet?)



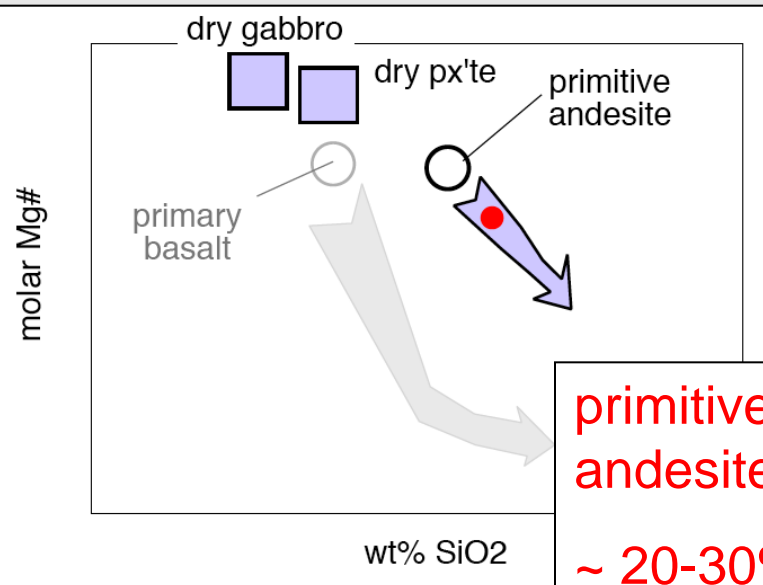
making lavas ~ continental crust



wet and oxidized

50-60%

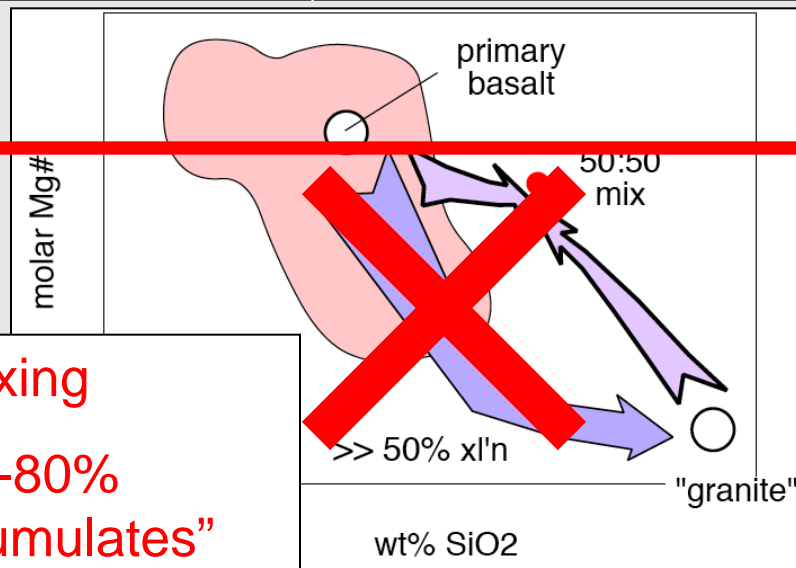
"cumulates"



primitive andesite

~ 20-30%

"cumulates"

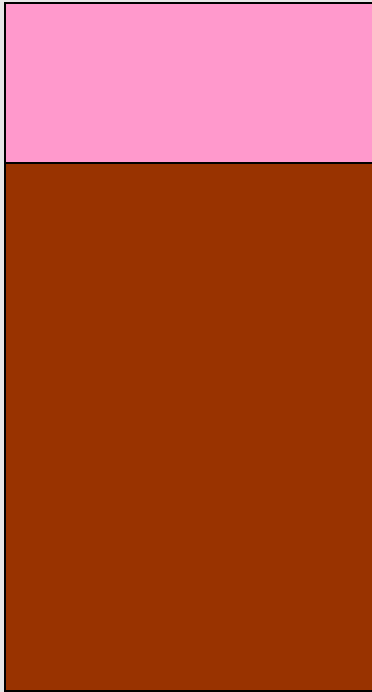


mixing

60-80%

"cumulates"

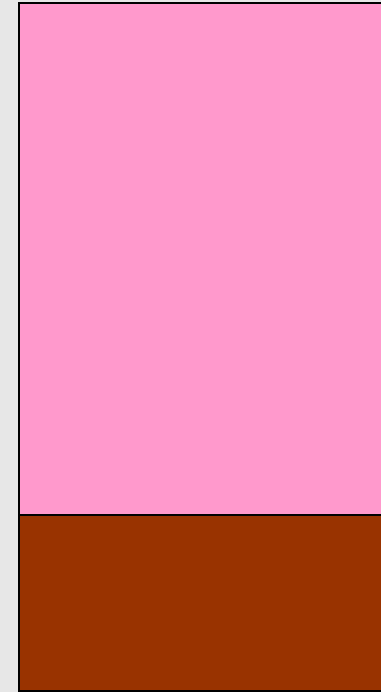
crust formed
from primitive basalt



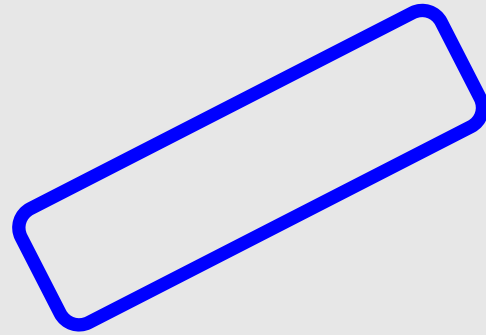
intermediate
andesitic
lavas & plutons

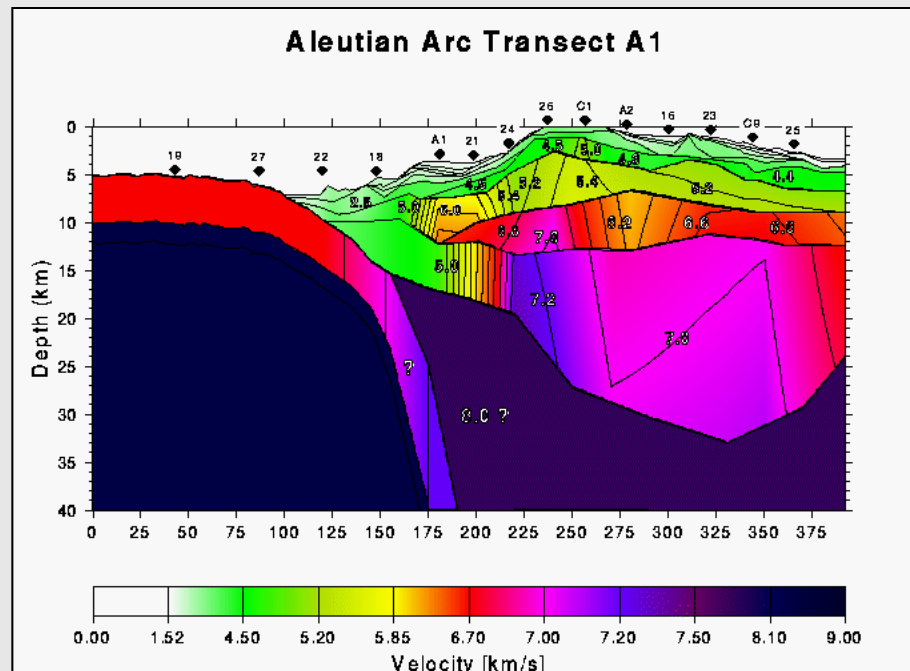
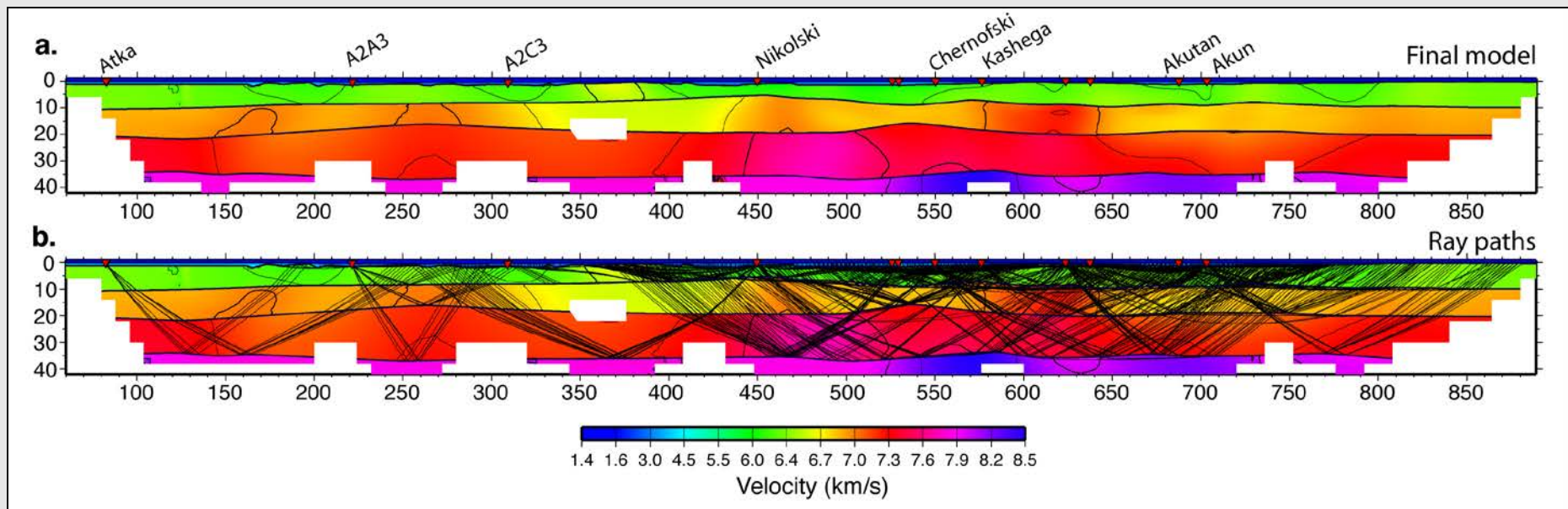
dense, mafic
cumulates

crust formed from
primitive andesite

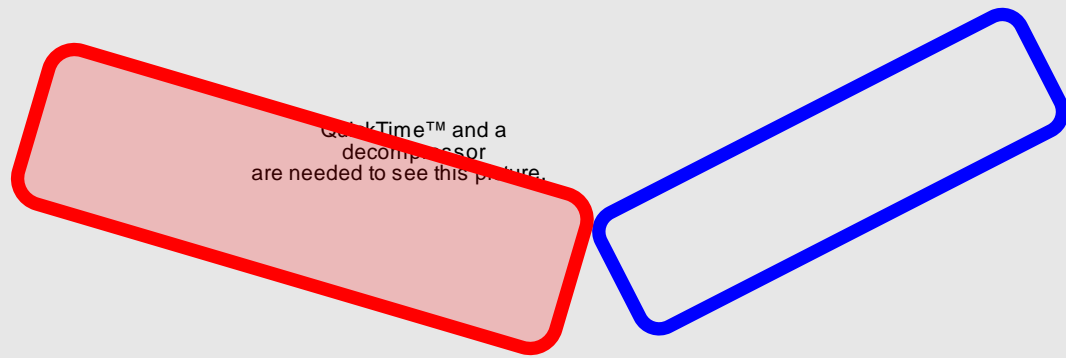


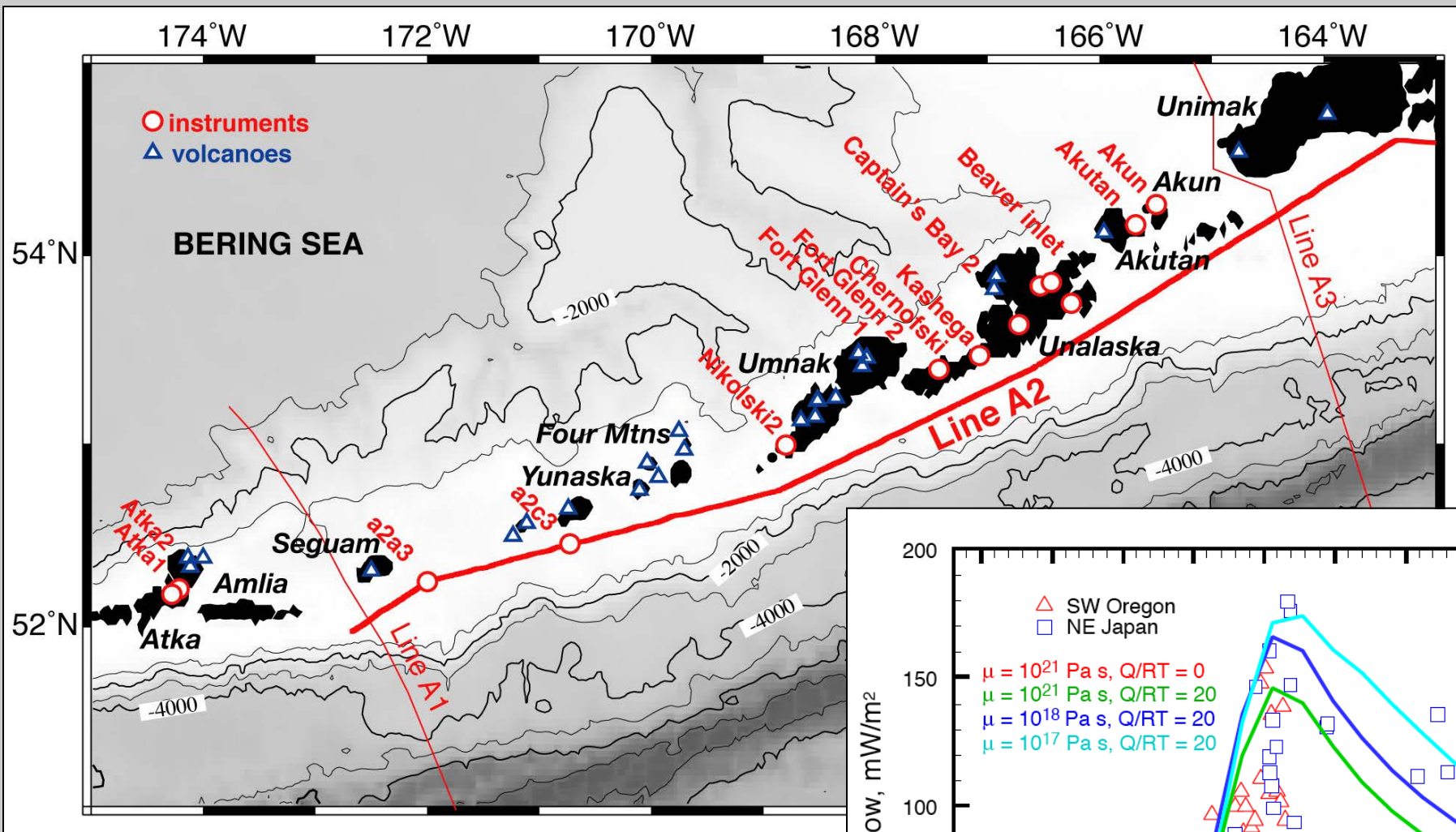
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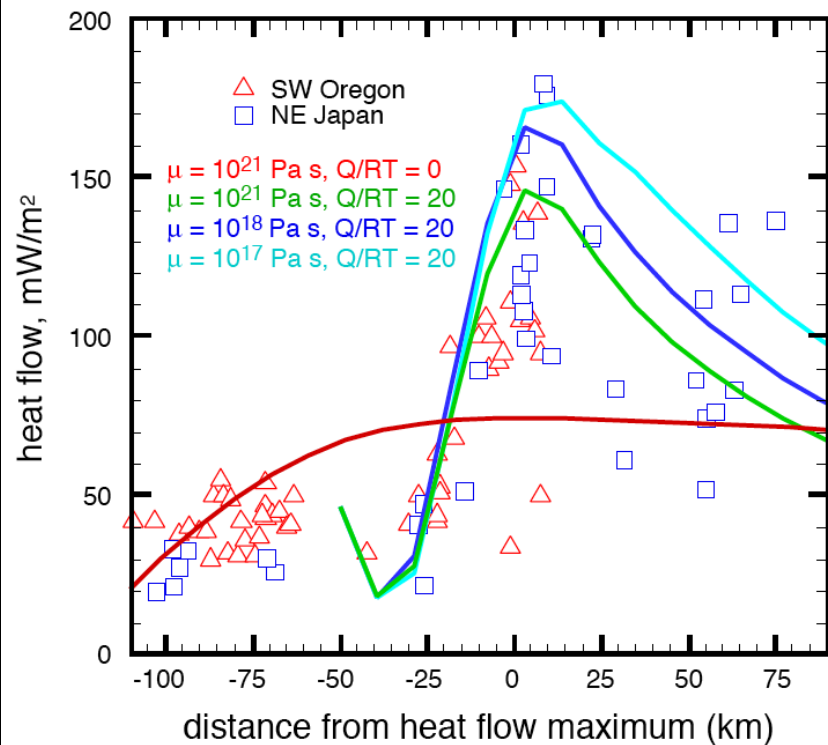
Upper Crust: 6.0 - 6.5 km/s
 Middle Crust: 6.5 - 7.3 km/s
 Lower Crust: 7.3 - 7.6 km/s
 Upper mantle: 7.8 - 8.1 km/s

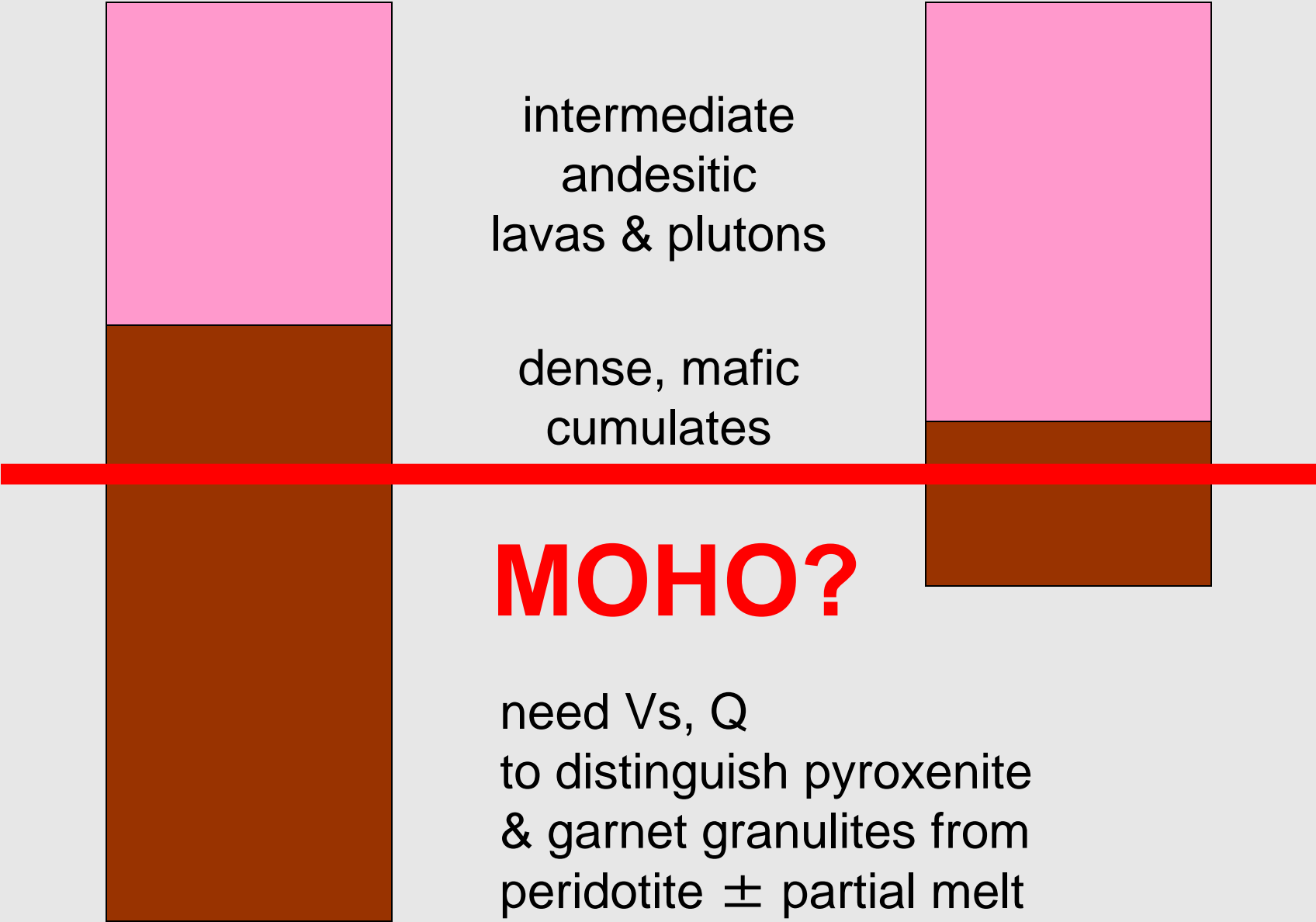




1994 Aleutians Experiment R/V Maurice Ewing

Shillington et al., 2004, Van Avendonk et al., 2004;
Kelemen et al. 2003 AGU Monograph Chapter 13





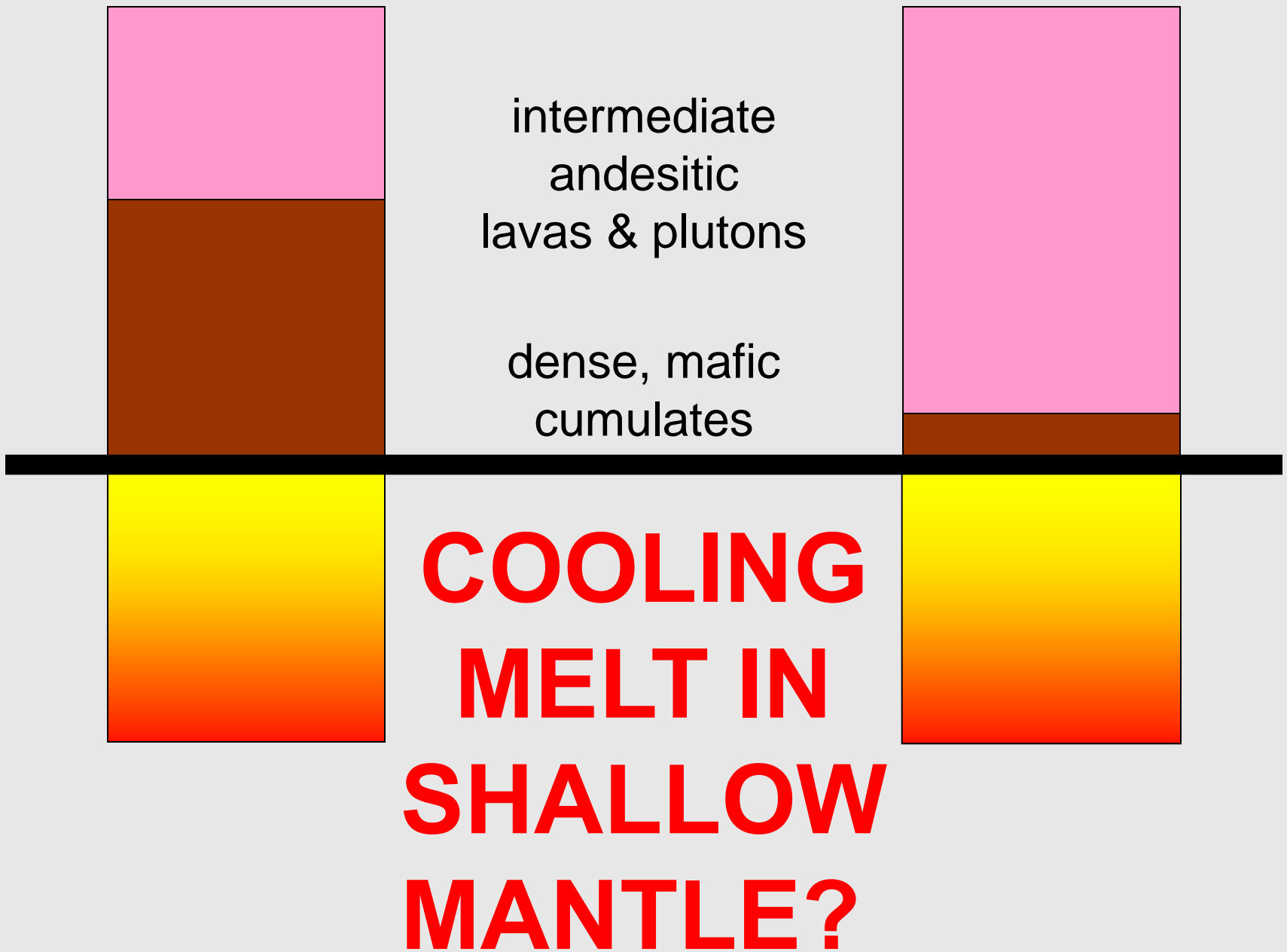
The diagram shows two vertical columns representing different crustal types. The left column is taller, with a pink upper section and a brown lower section. The right column is shorter, also with a pink upper section and a brown lower section. A thick red horizontal line crosses both columns, representing the Moho. Text labels are placed between the columns to describe the layers.

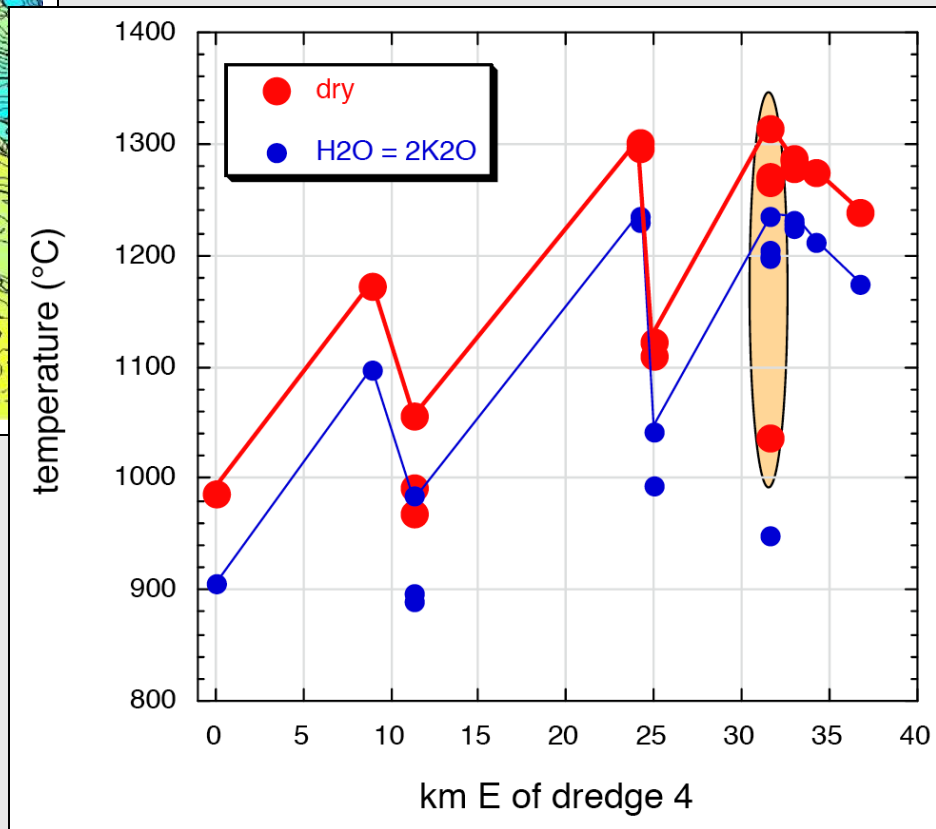
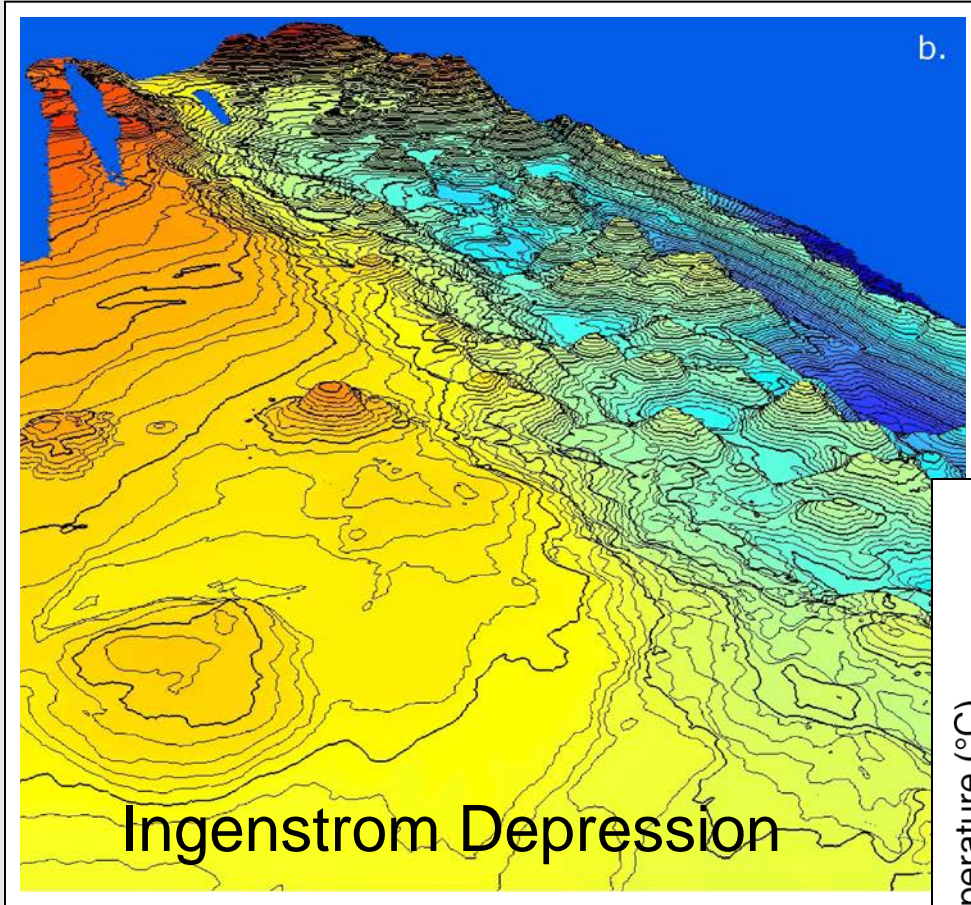
intermediate
andesitic
lavas & plutons

dense, mafic
cumulates

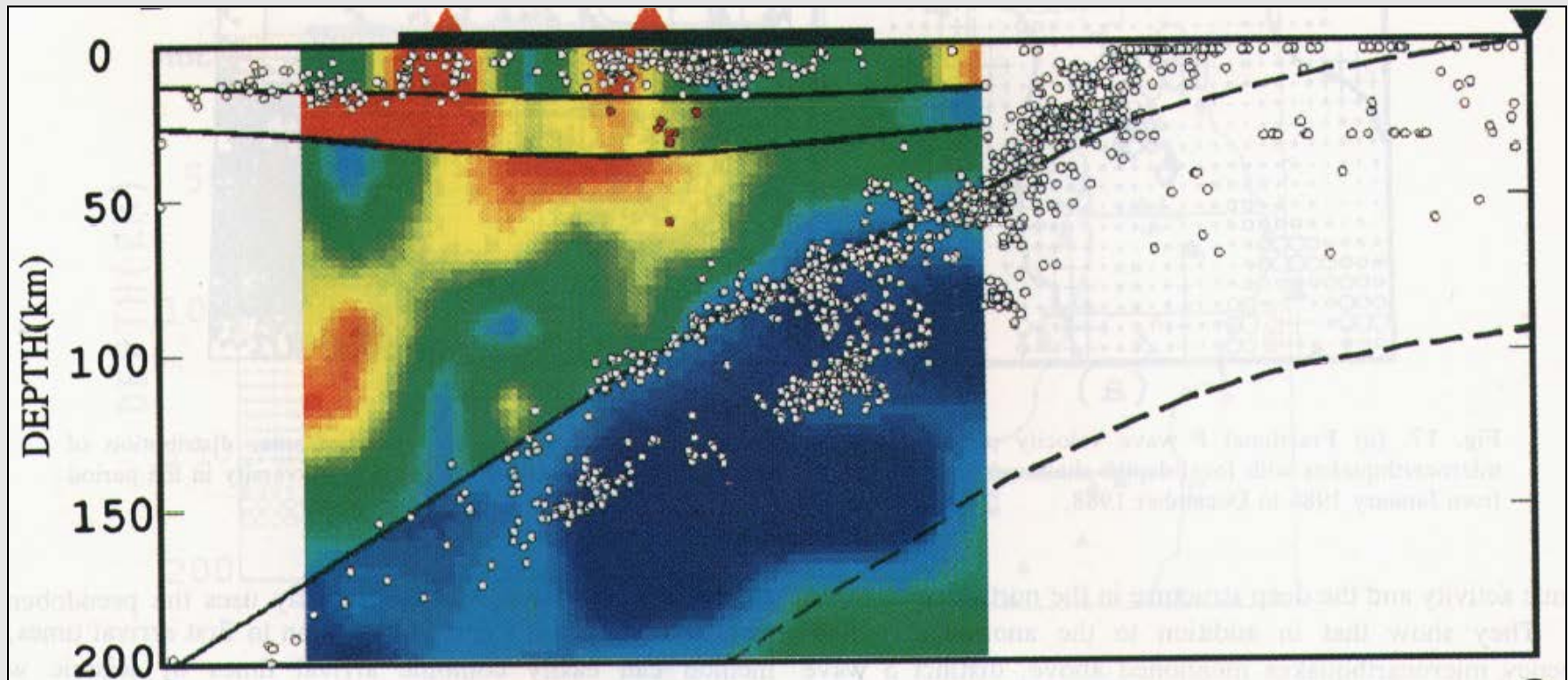
MOHO?

need V_s , Q
to distinguish pyroxenite
& garnet granulites from
peridotite \pm partial melt

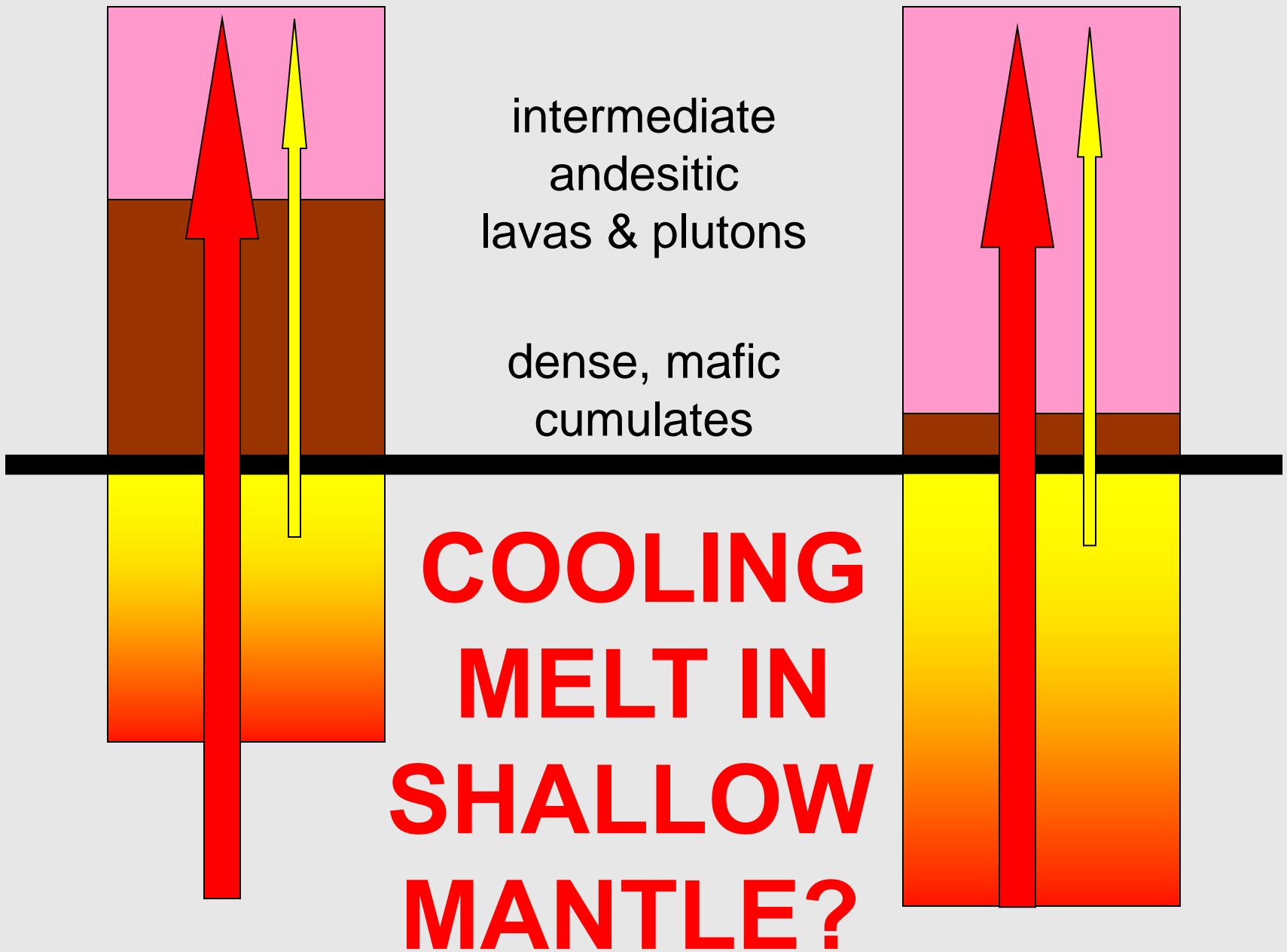




crystal fractionation + reaction just below mantle at the base of arc crust?



(this is NE Japan, no comparable data for the Aleutians!)



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W Aleutian lavas with compositions ~ continental crust

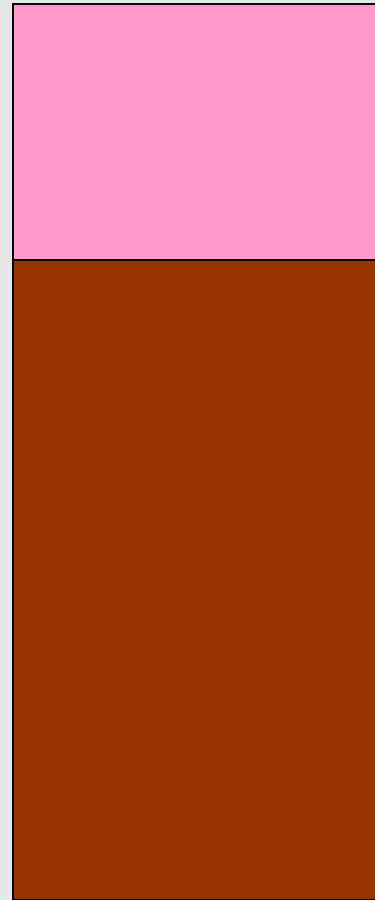
oceanic Aleutian plutons ~ continental crust

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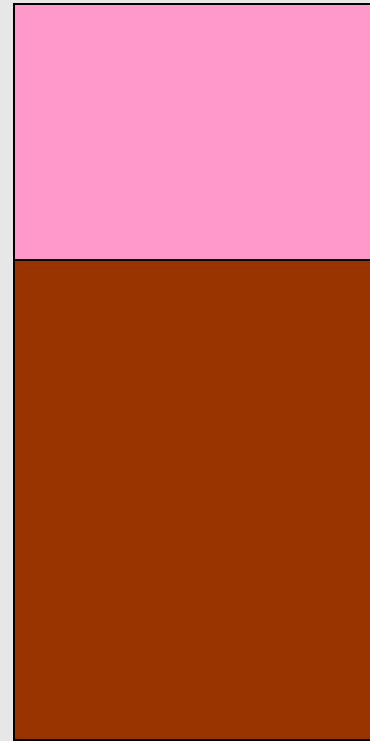
are needed to see th

andesitic
lavas & plutons

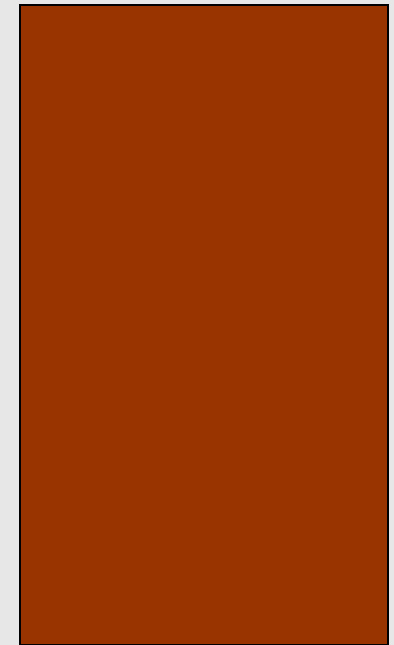
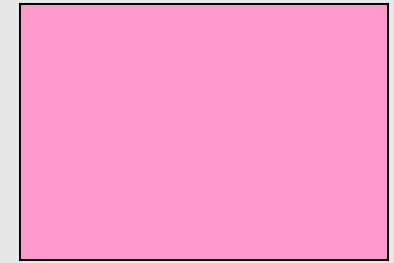
dense, mafic
cumulates



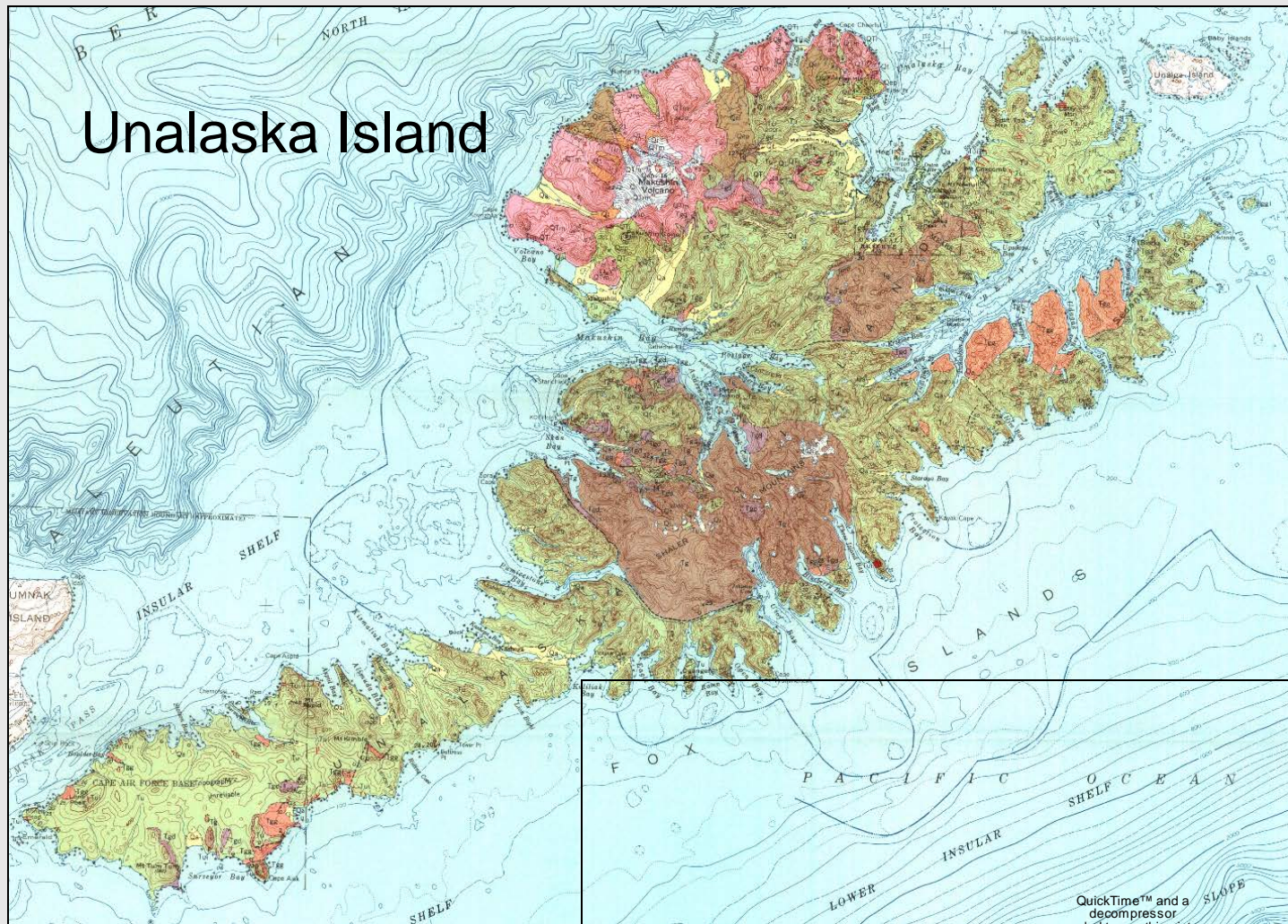
delamination,
foundering

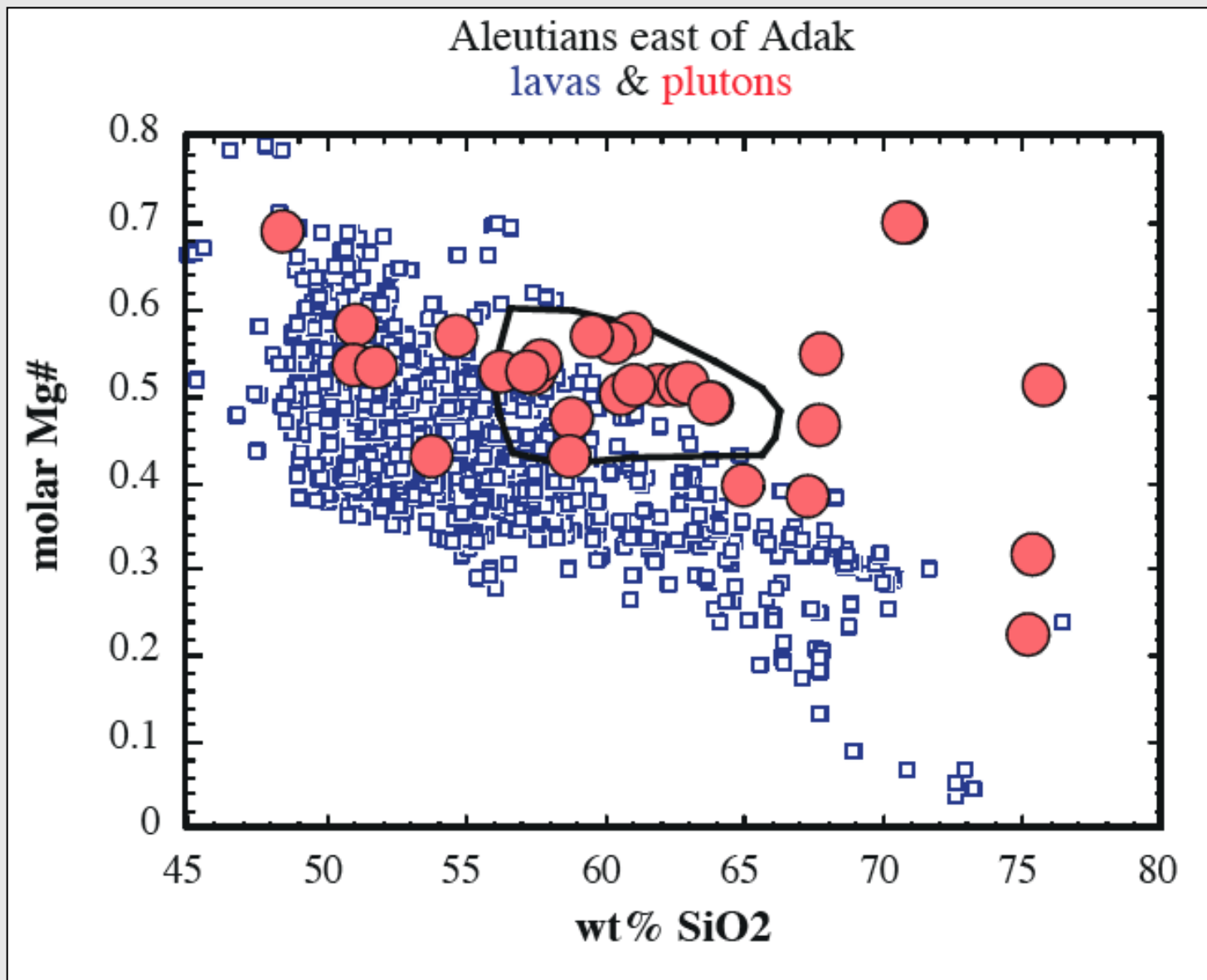


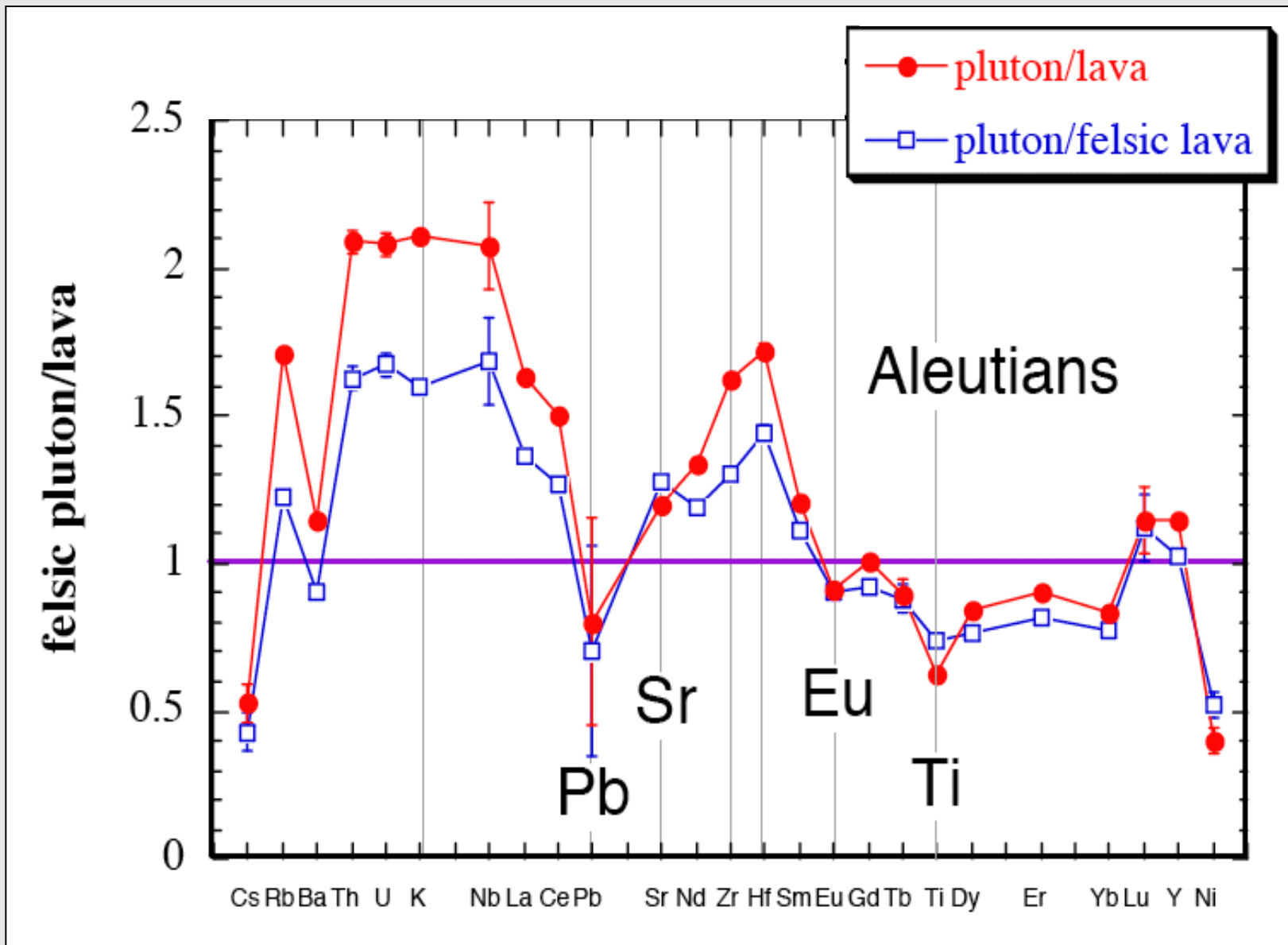
relamination



Unalaska Island







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“There are no ICP-MS trace element analyses for any Aleutian plutons. Other than USGS U/Pb data for 4 samples, there are no Pb or Hf isotope ratios. There are 11 Sr isotope ratios and 2 Nd isotope ratios for Aleutian plutons east of Adak (Perfit et al. 1980; McCulloch & Perfit 1981).”

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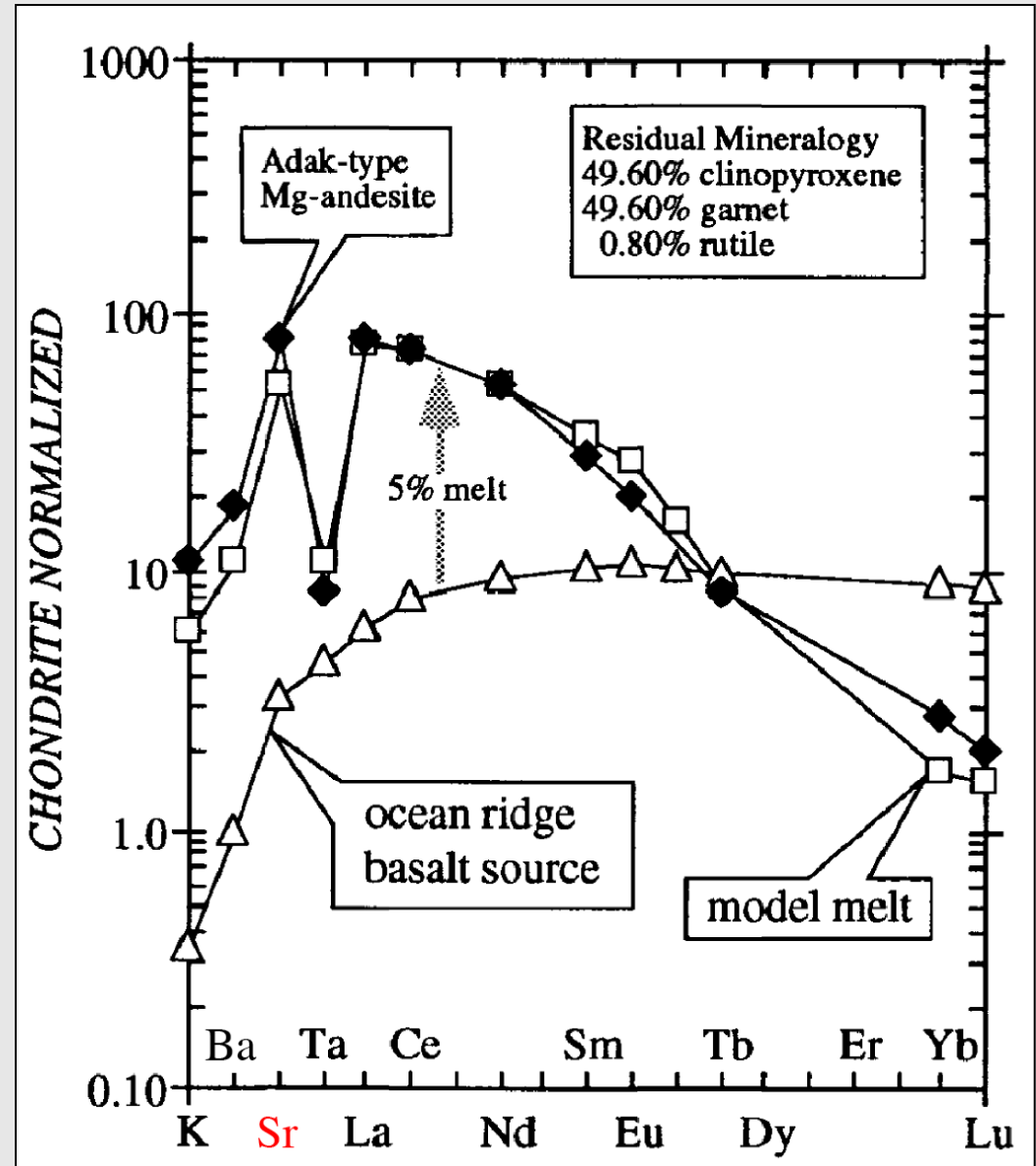
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let's go!

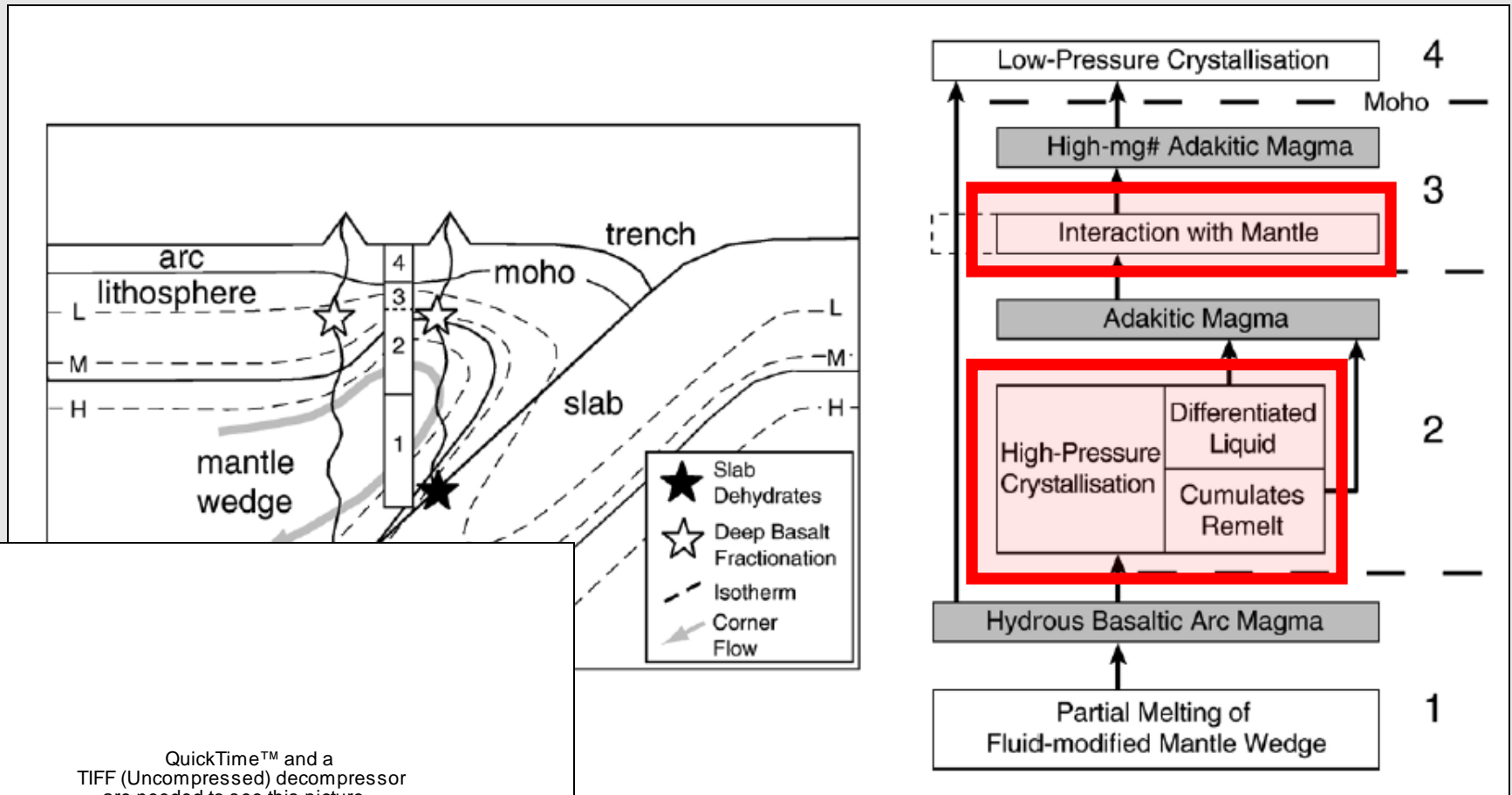
eclogite melt reacting with mantle

Kay, JVGR 1978
Yogodzinski et al., 1995

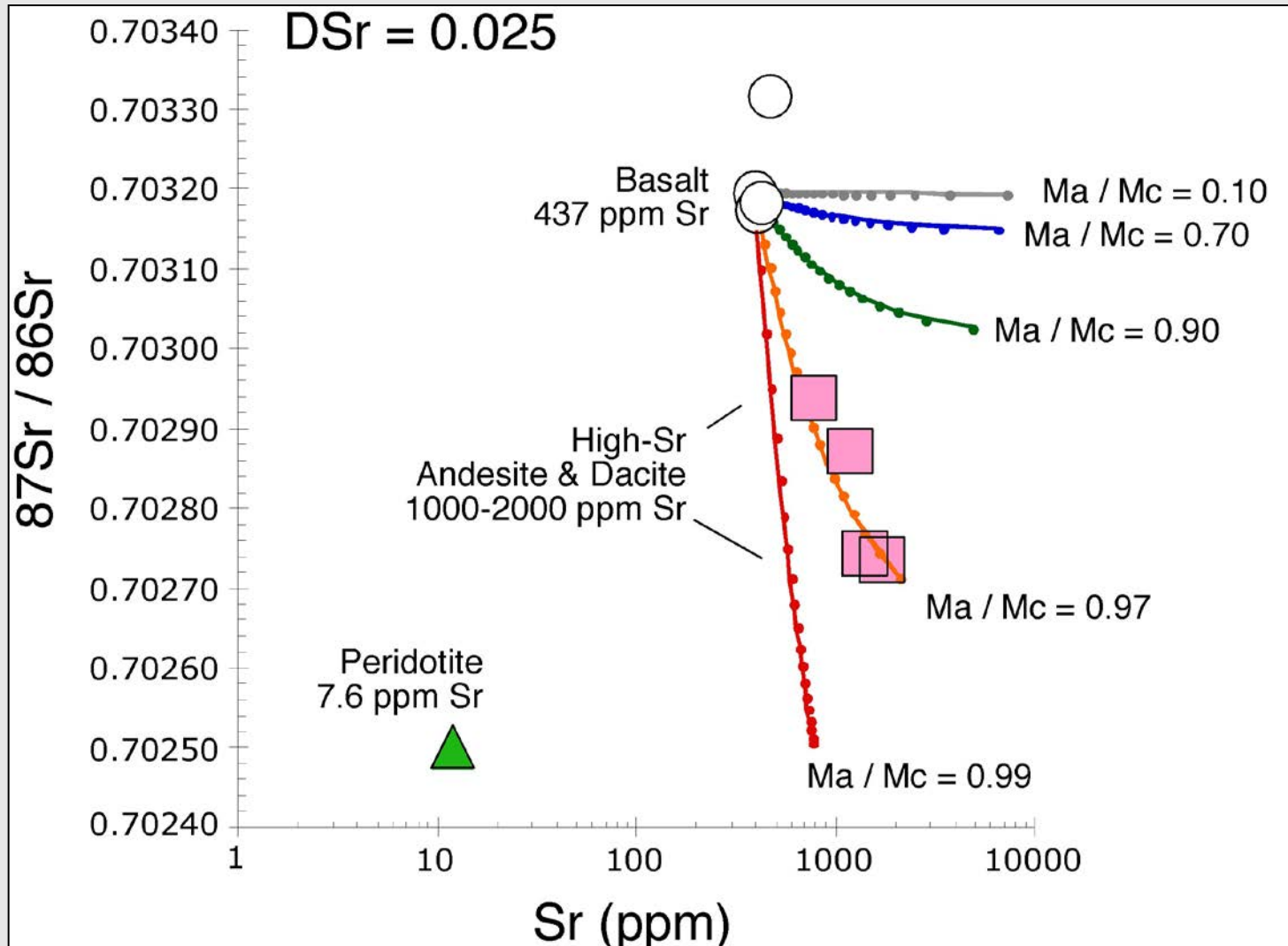
primitive andesites
with >100 ppm Ni
and Mg# >70%
form via reaction
between melts of
subducting eclogite
and residual peridotite
in the mantle wedge



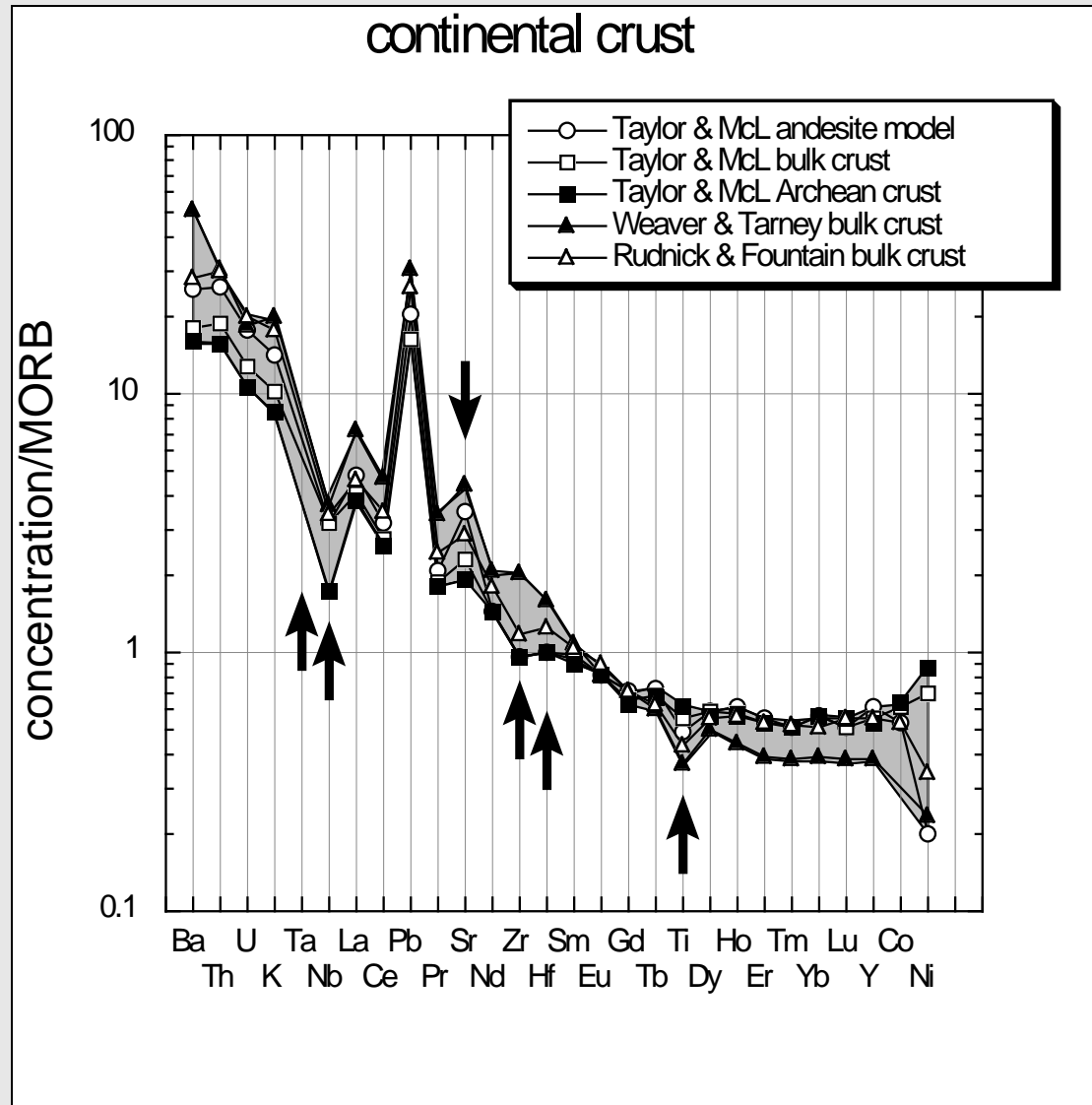
fractionation + reaction w mantle at base of crust



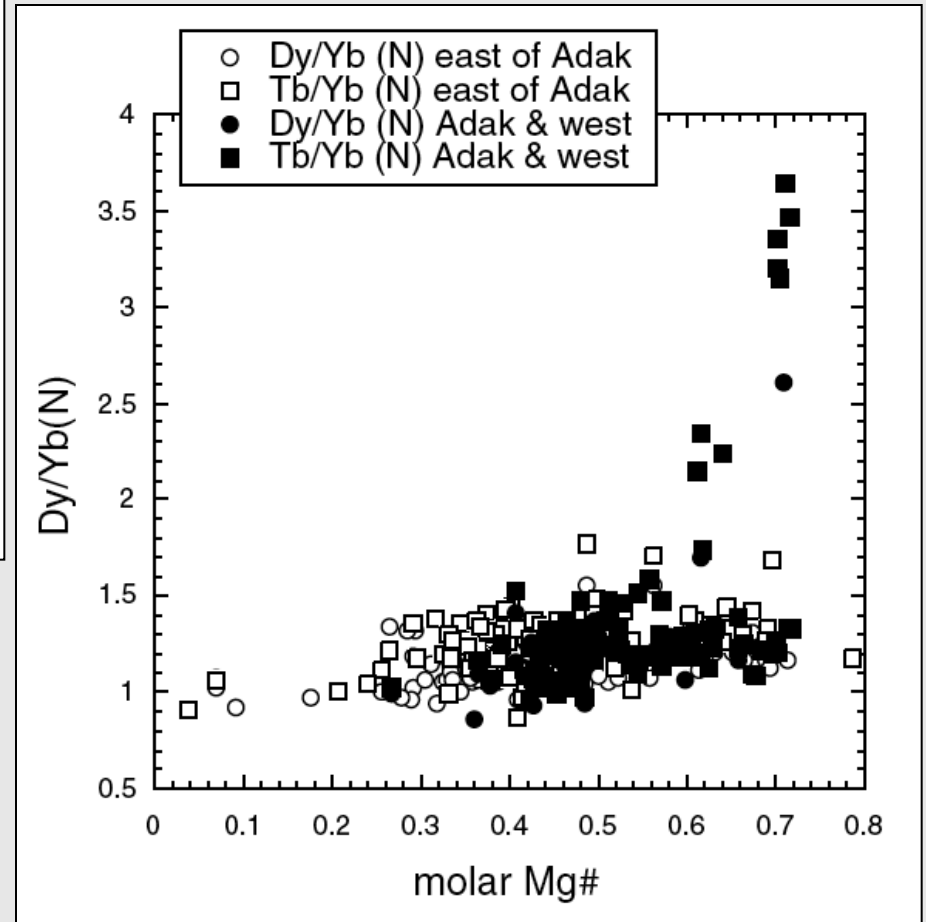
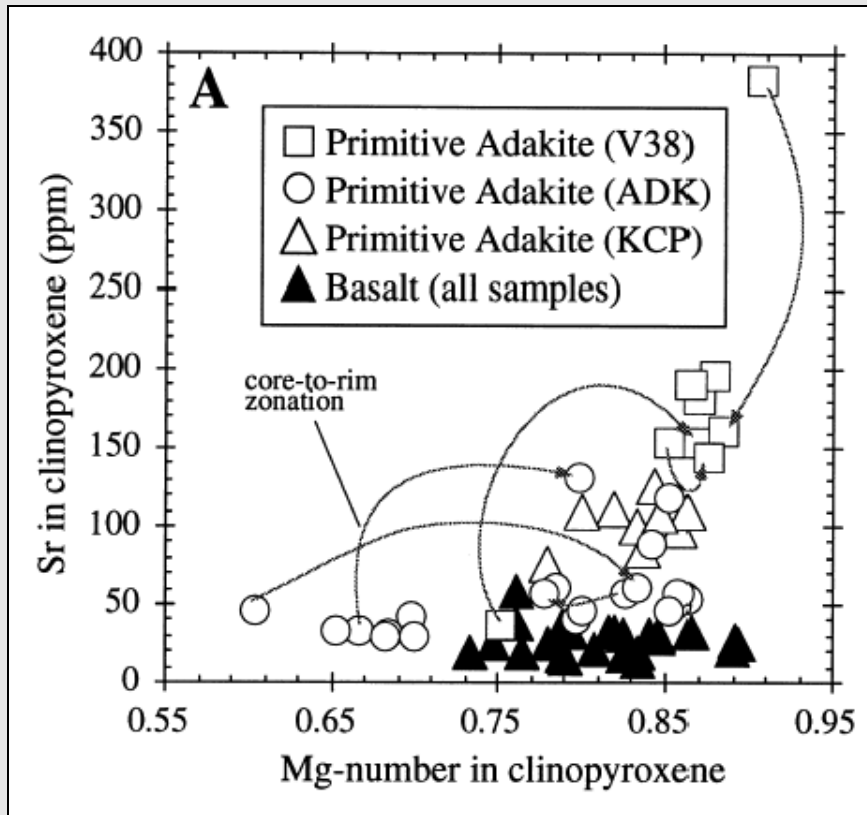
fractionation + reaction w mantle at base of crust

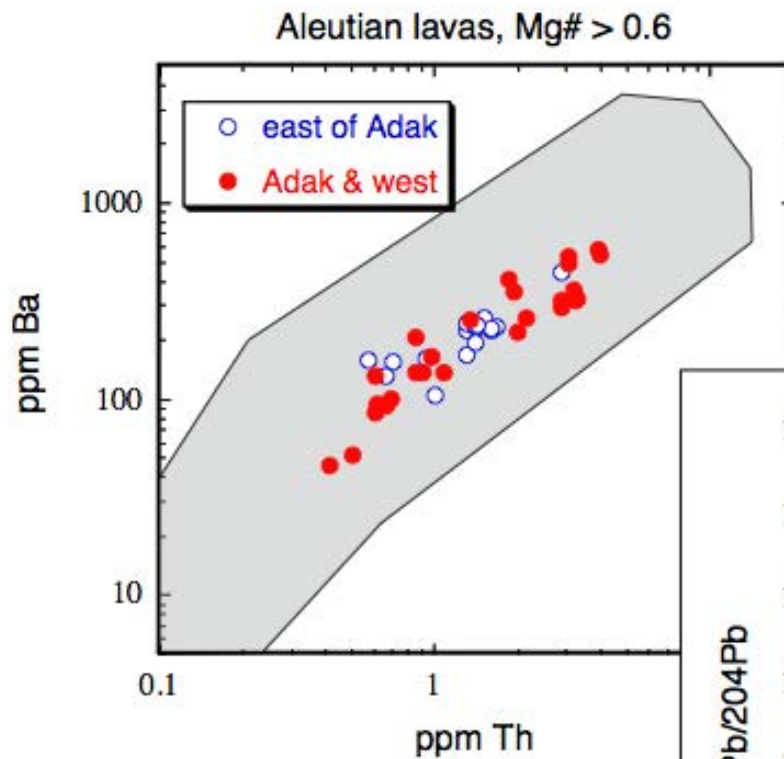


trace elements also distinguish continental and oceanic crust

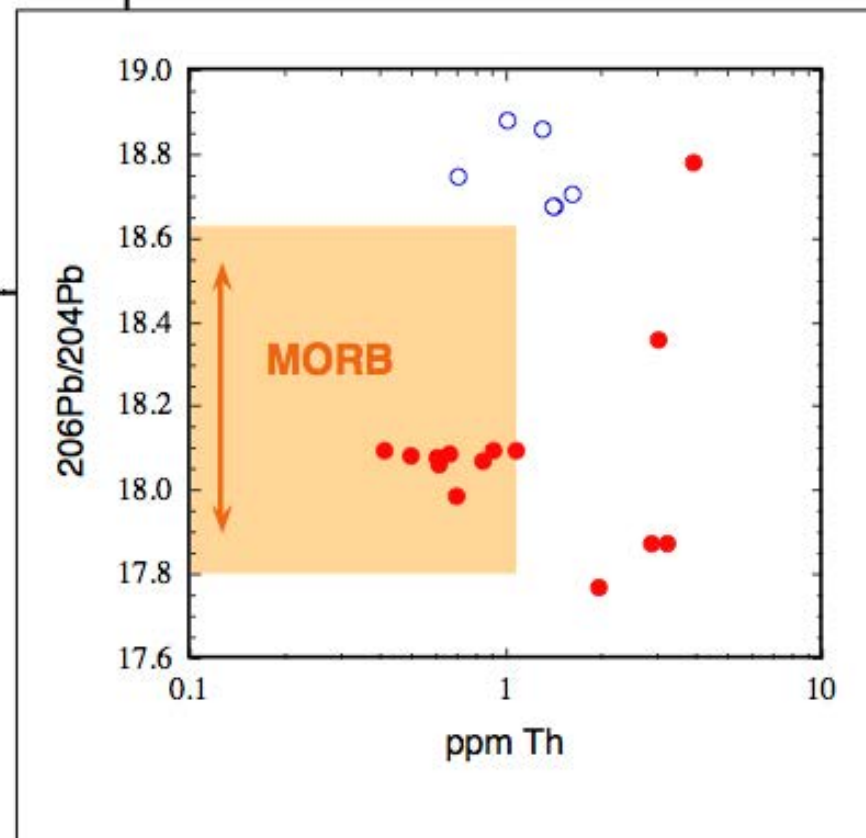


Aleutian lavas

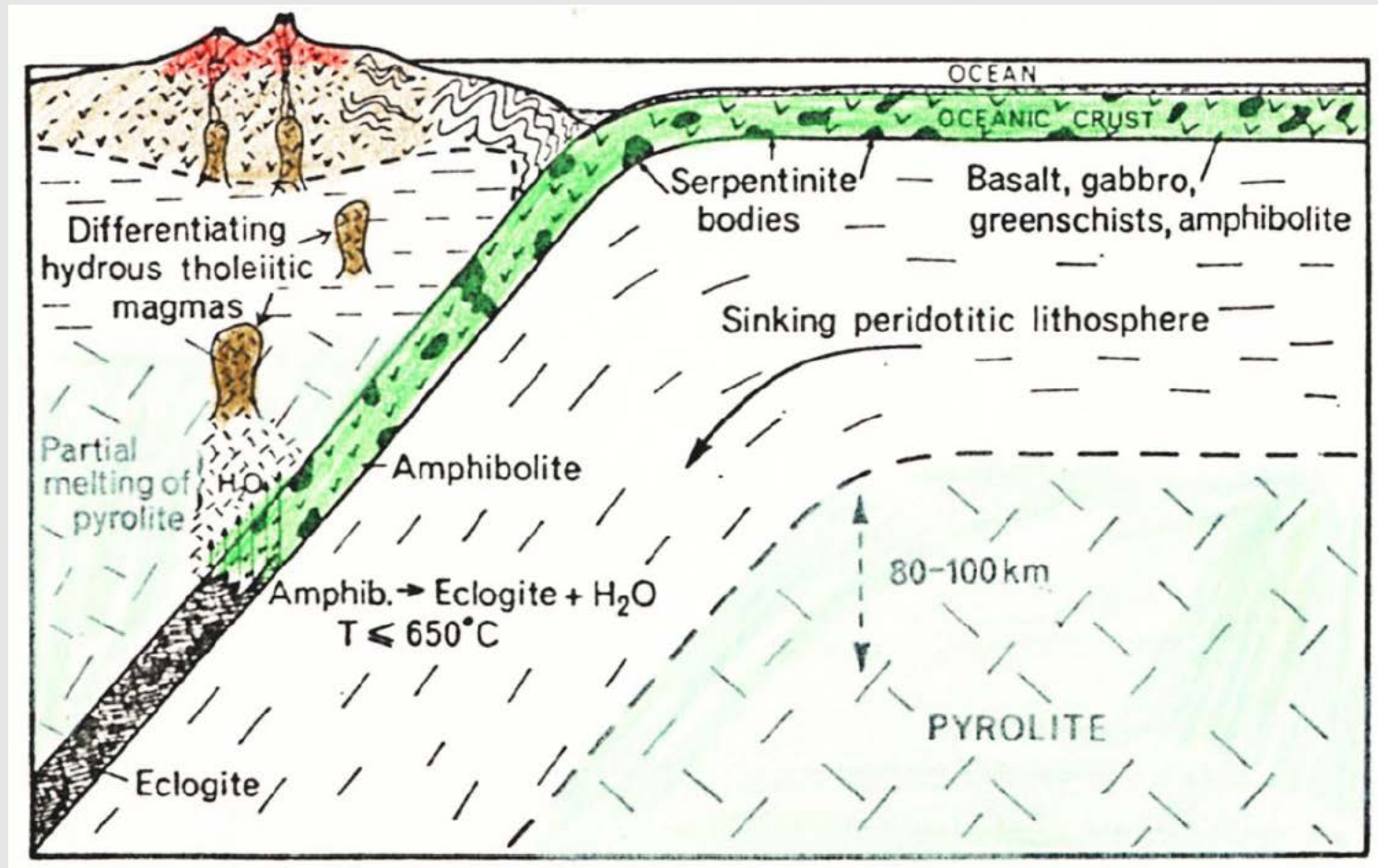




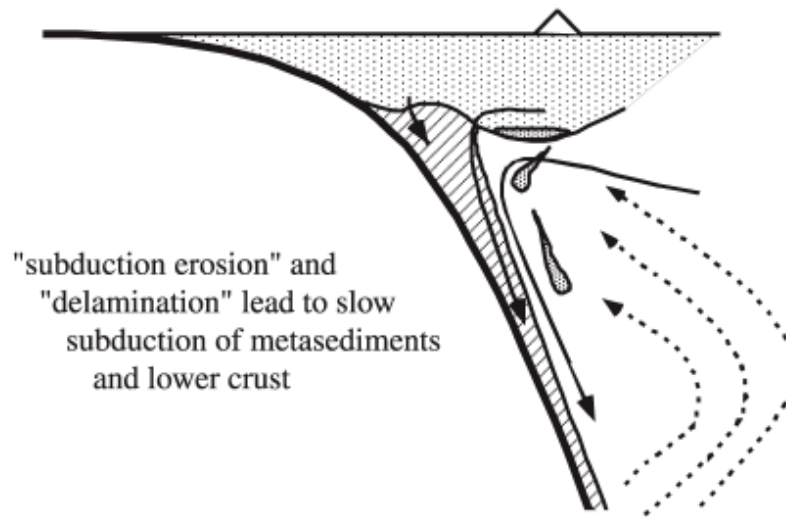
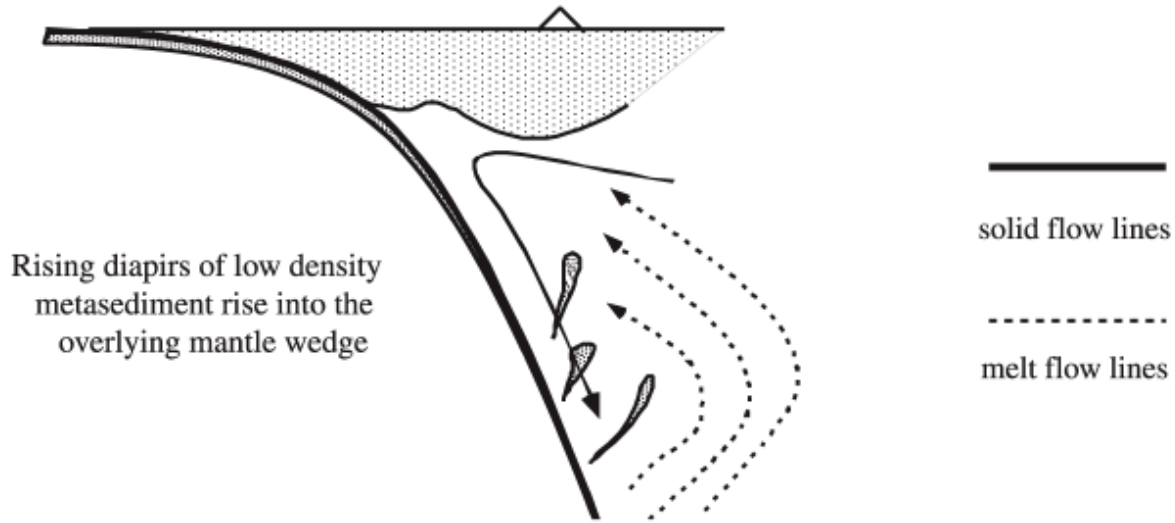
no recycled
continental sed
in western Aleutian
primitive andesites



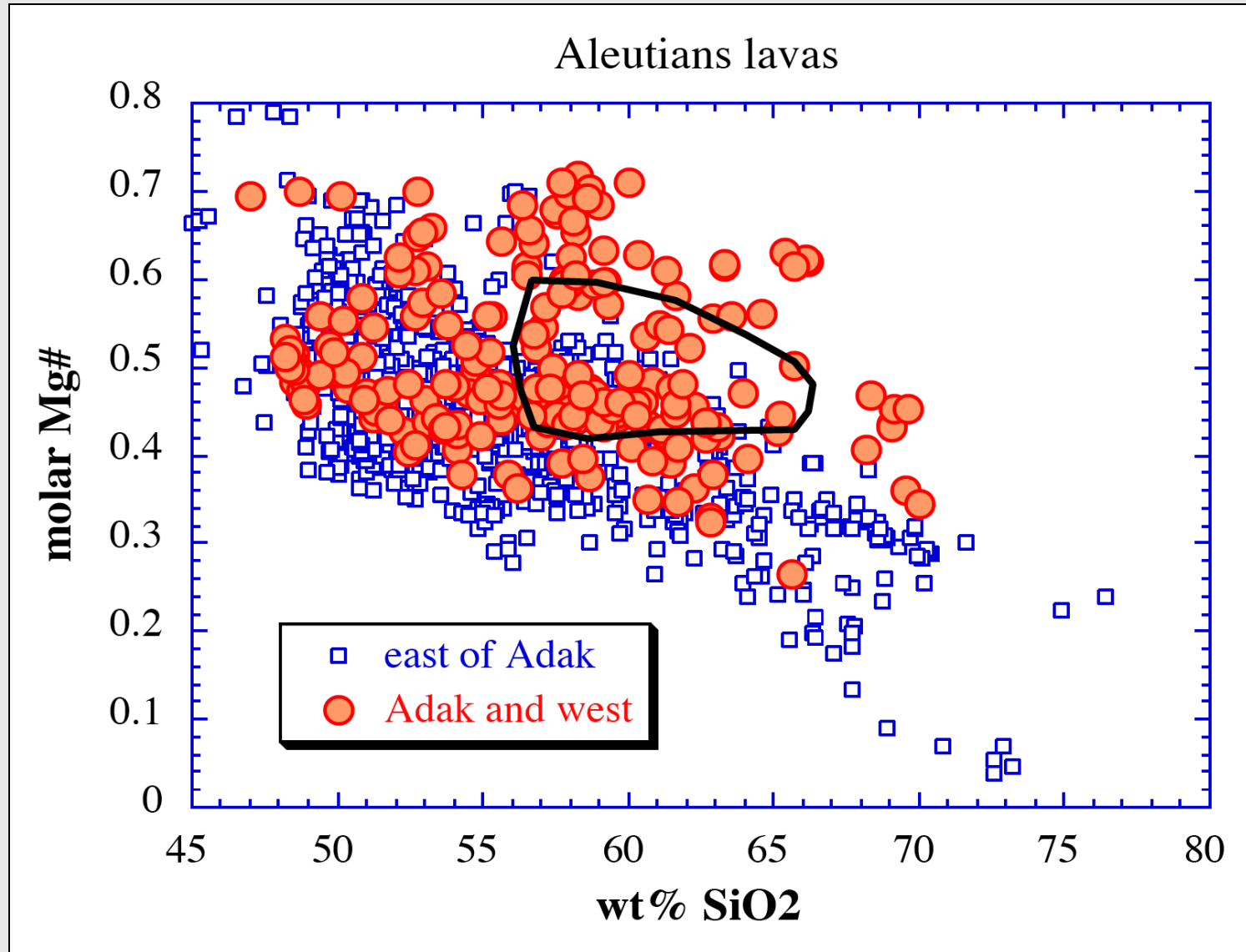
also Ringwood, 1974



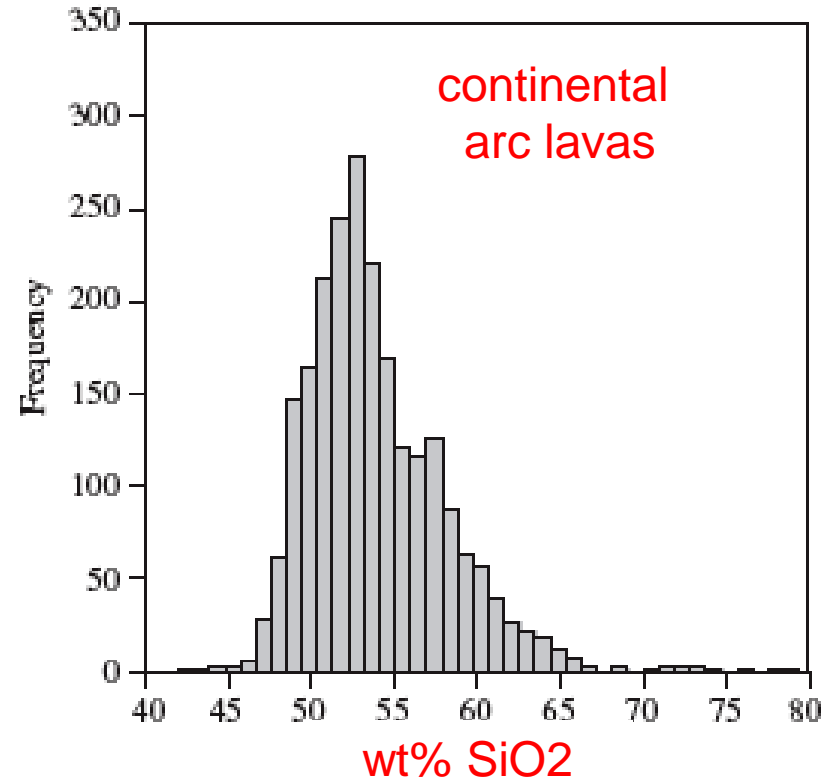
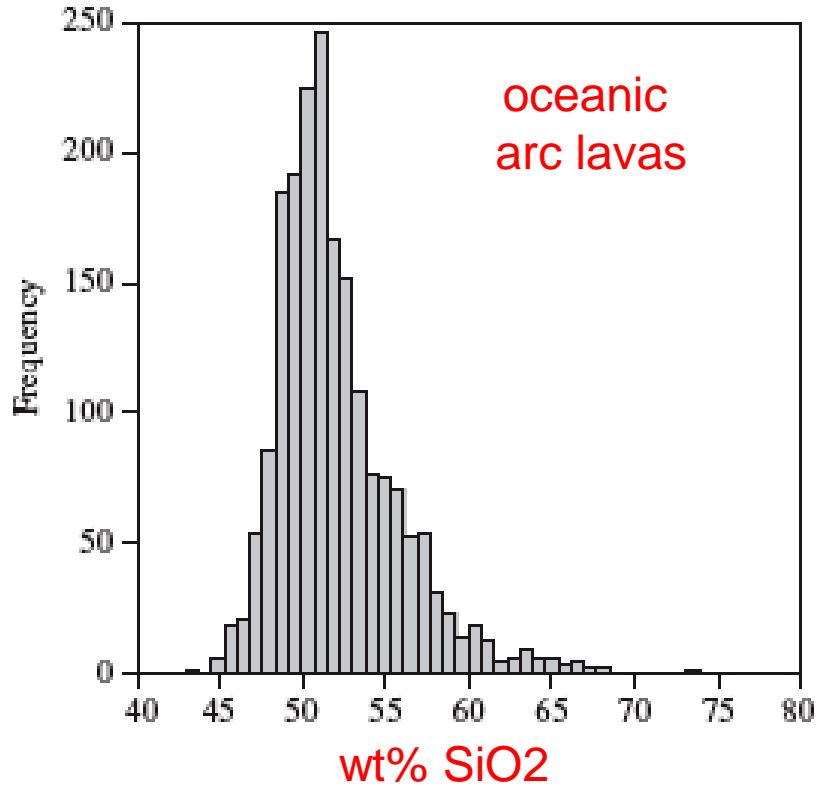
Geochemistry of Subduction-related Magmatic Arcs



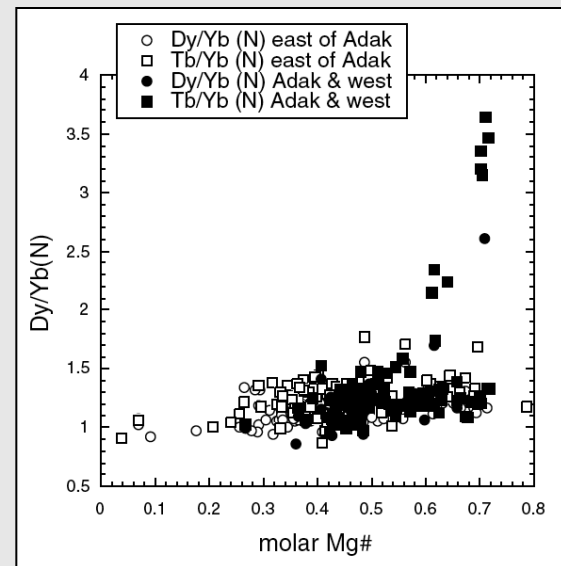
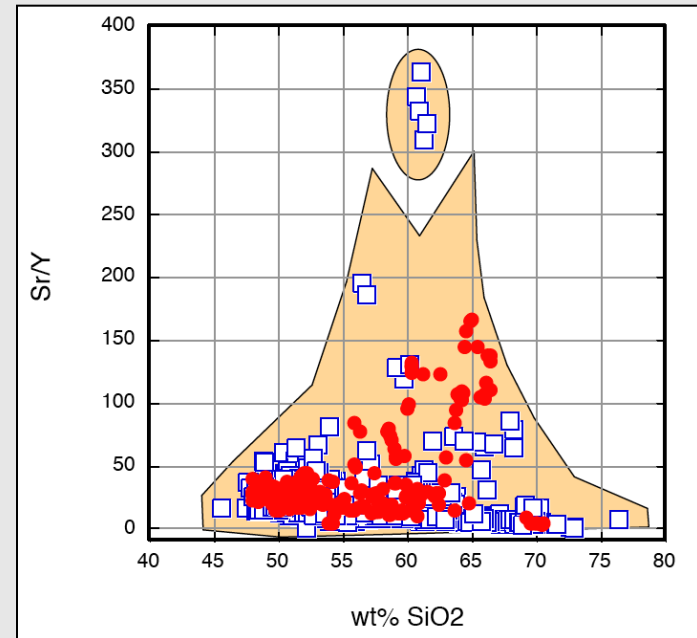
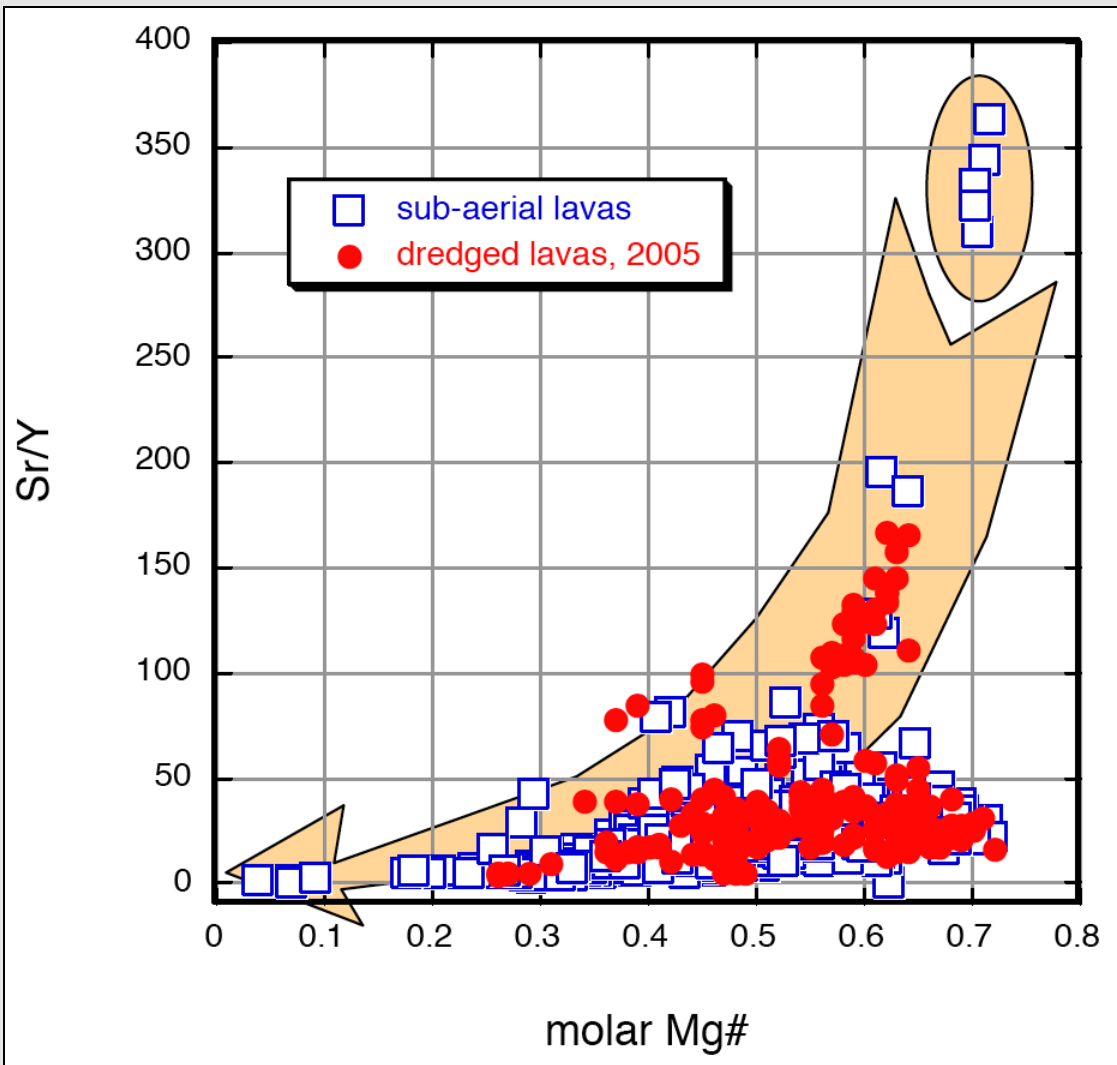
some island arcs have lavas ~ continental crust



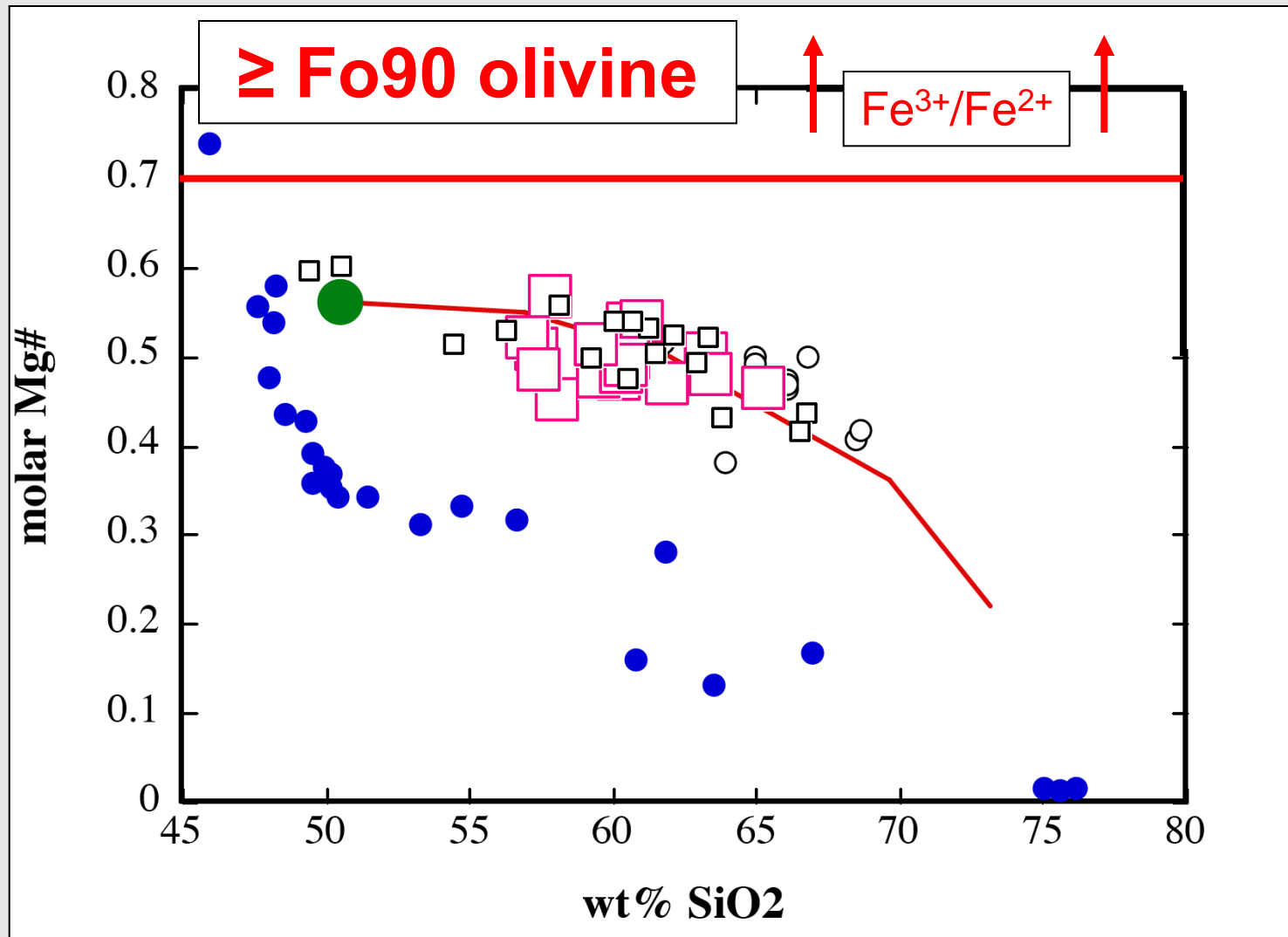
all samples, $0.5 < \text{Mg\#} < 0.7$



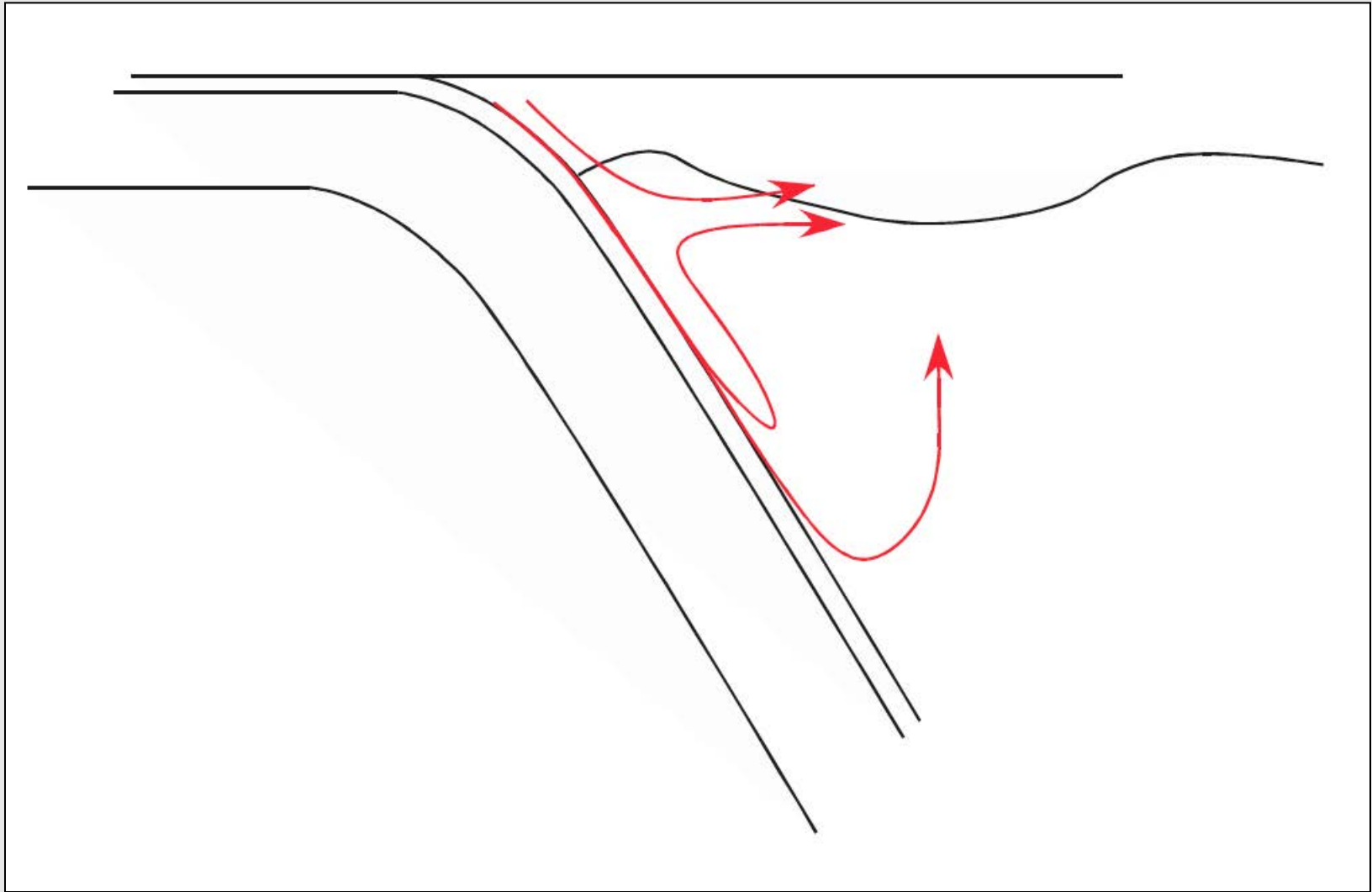
Aleutian lavas



major elements in continental crust like “calc-alkaline”
arc andesite & dacite

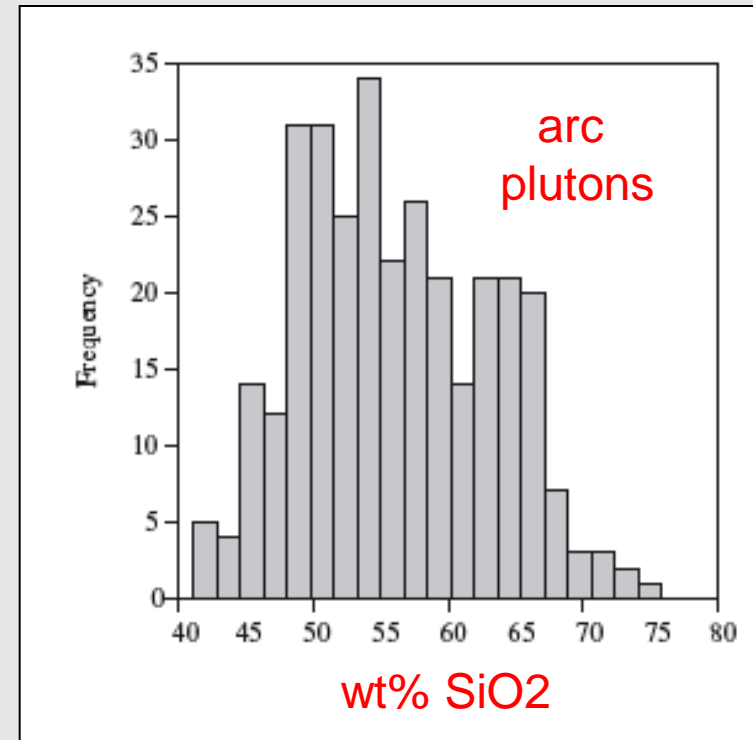
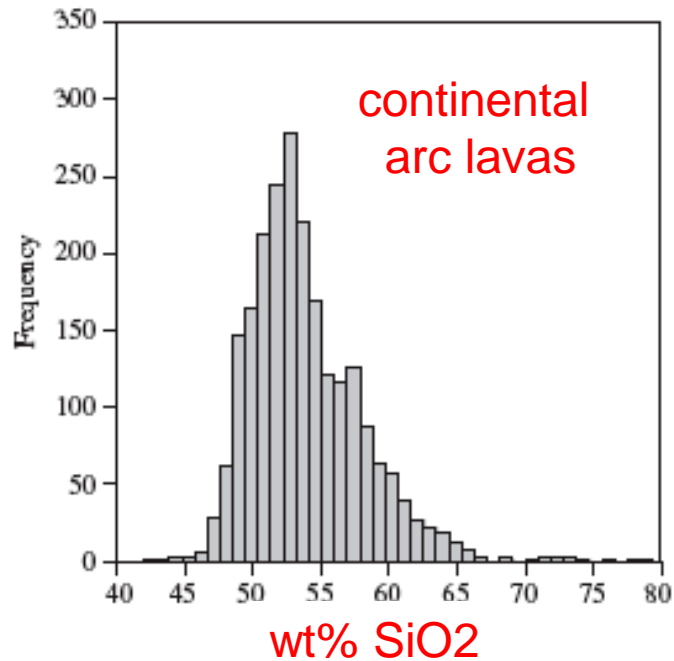
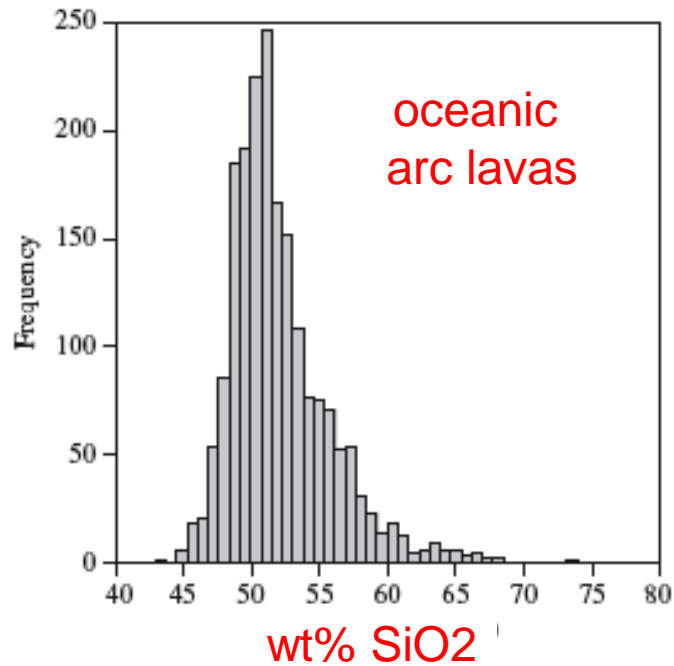


“relamination” of buoyant material

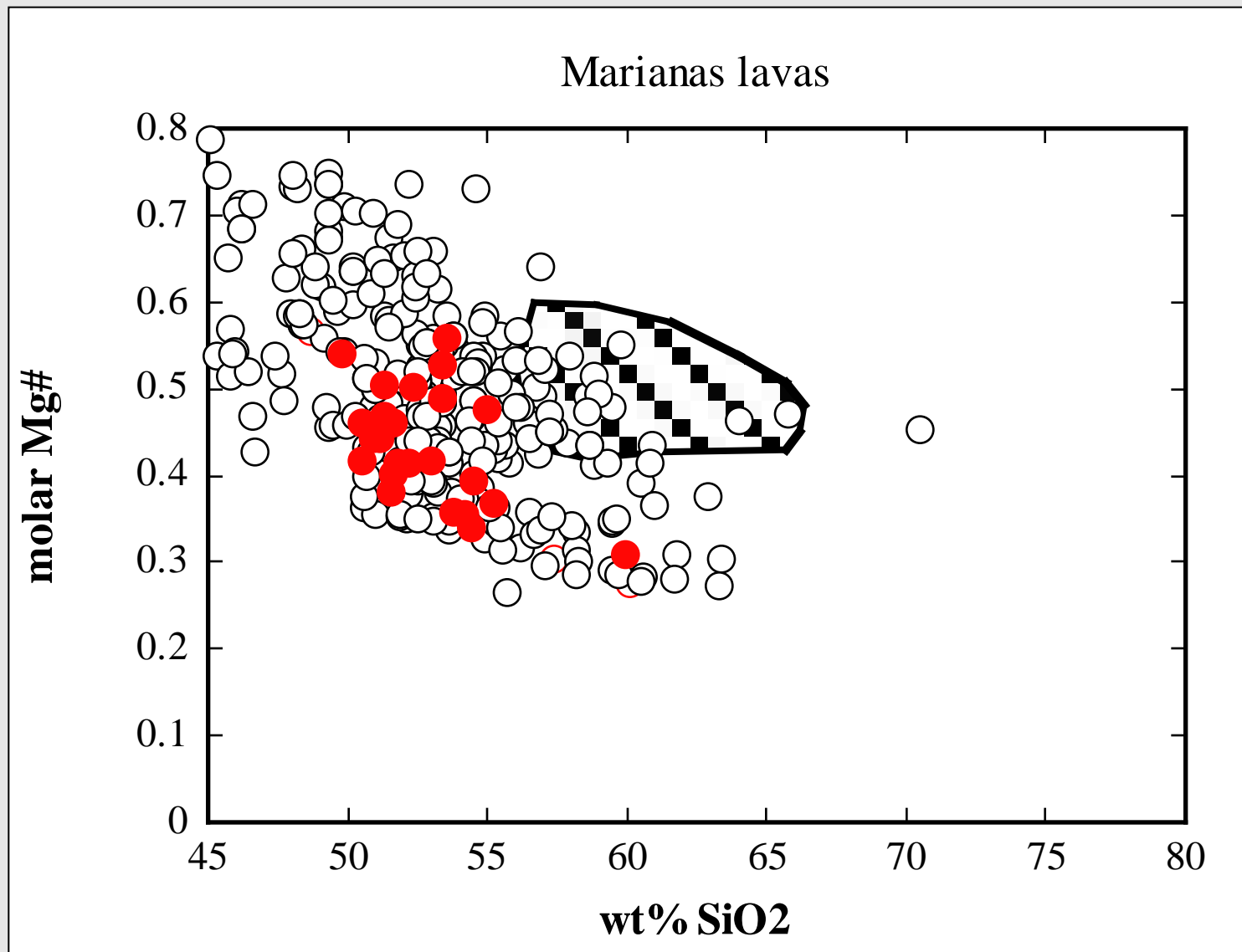


Kelemen et al., 2003 Treatise on Geochem

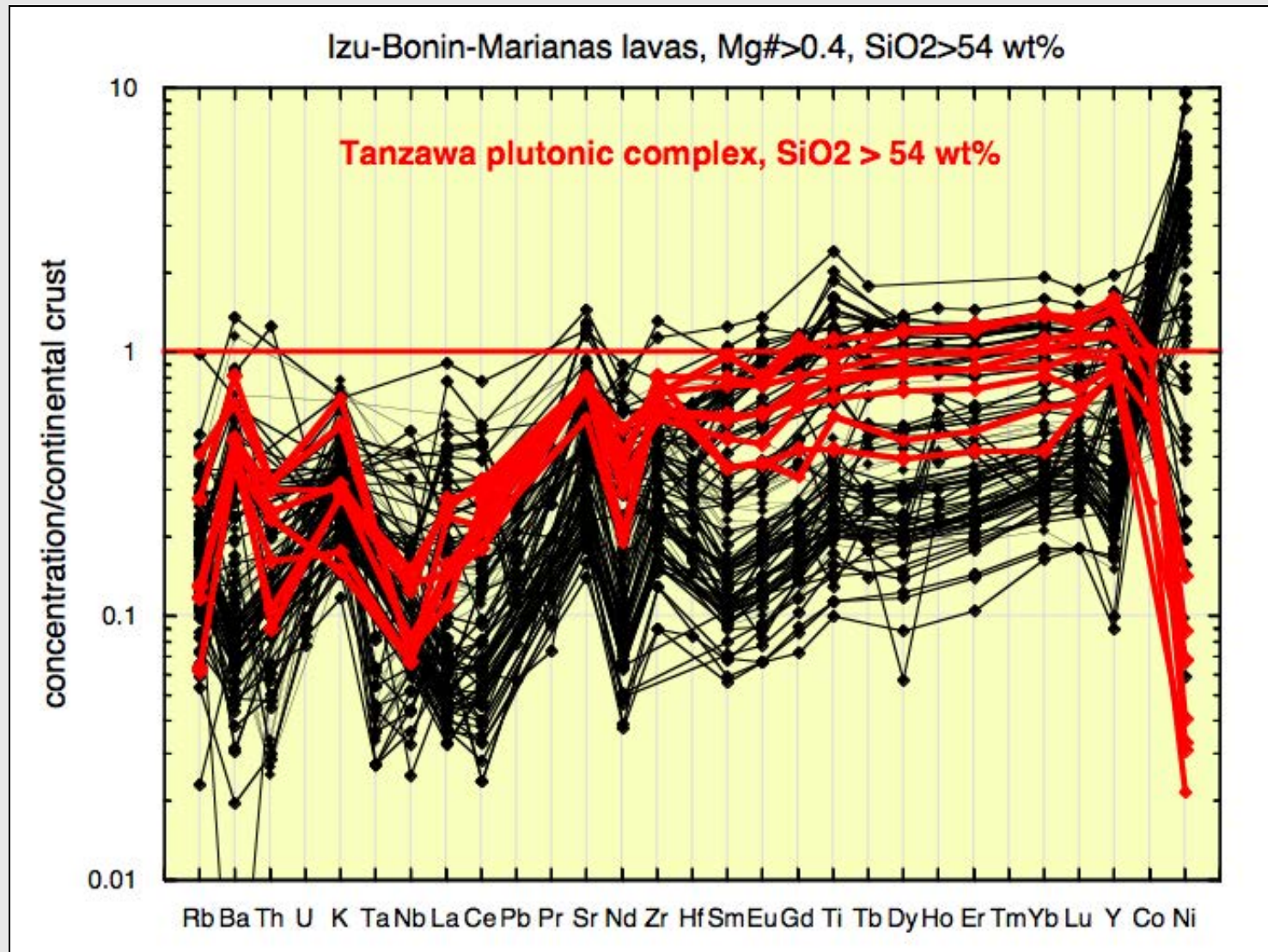
all samples, $0.5 < \text{Mg\#} < 0.7$



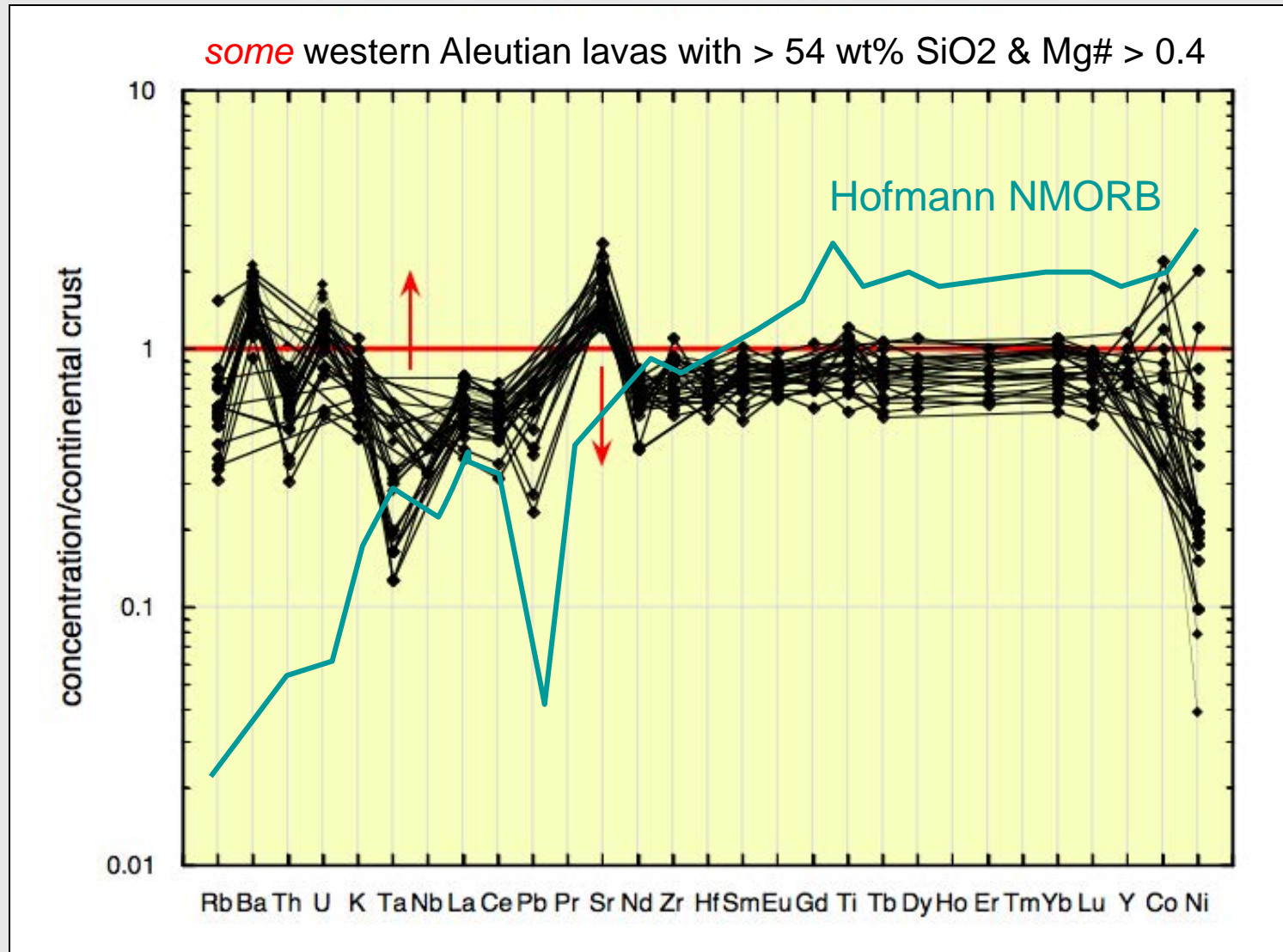
not all arcs produce primitive andesites



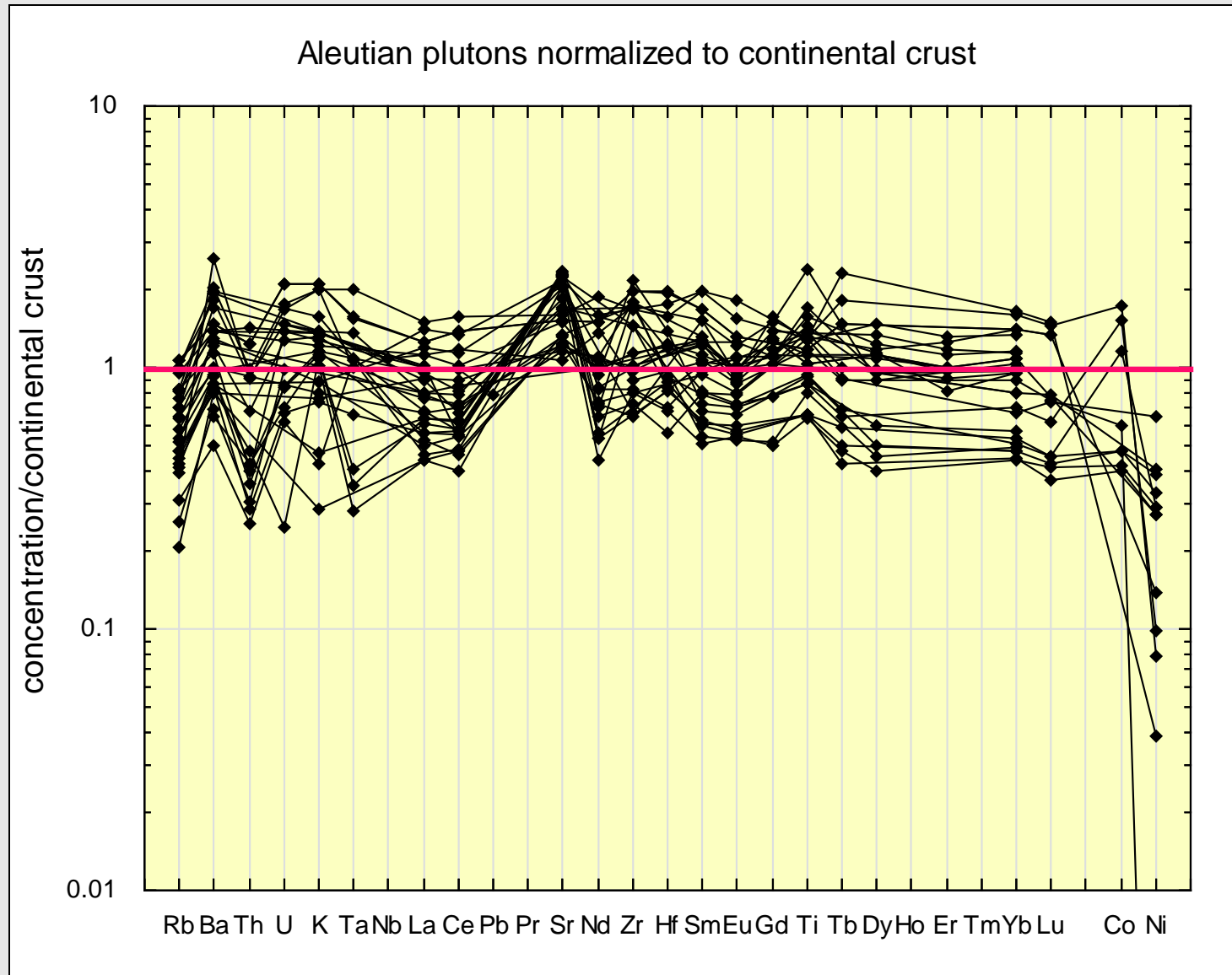
basaltic arcs don't have trace elements ~ continental crust



trace elements in primitive and high Mg# andesites ~ continental crust

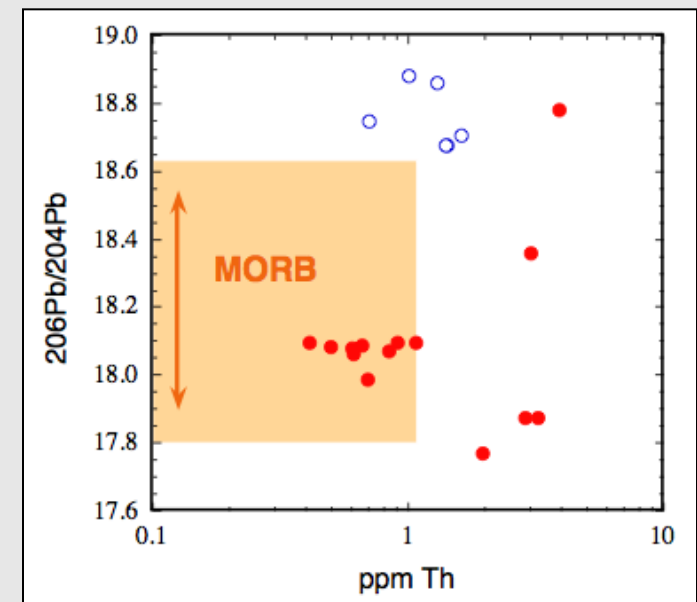
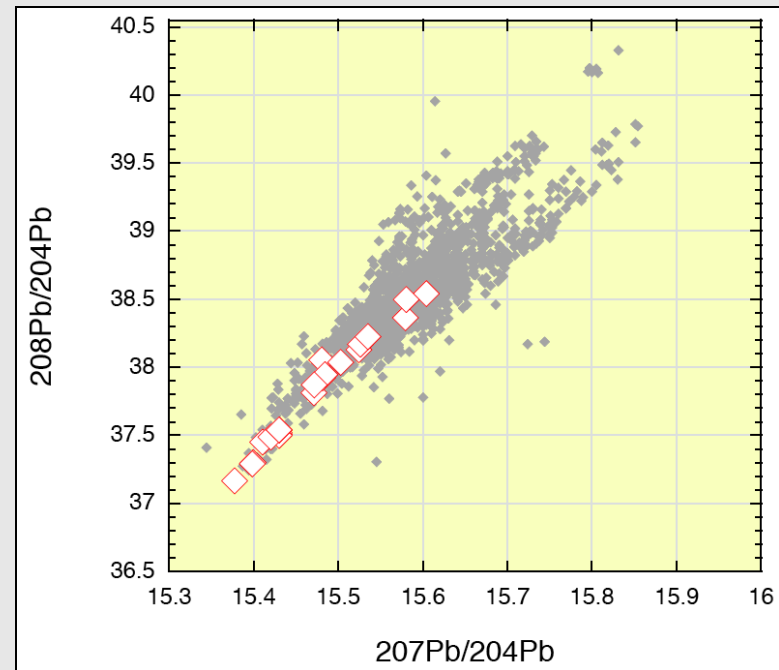
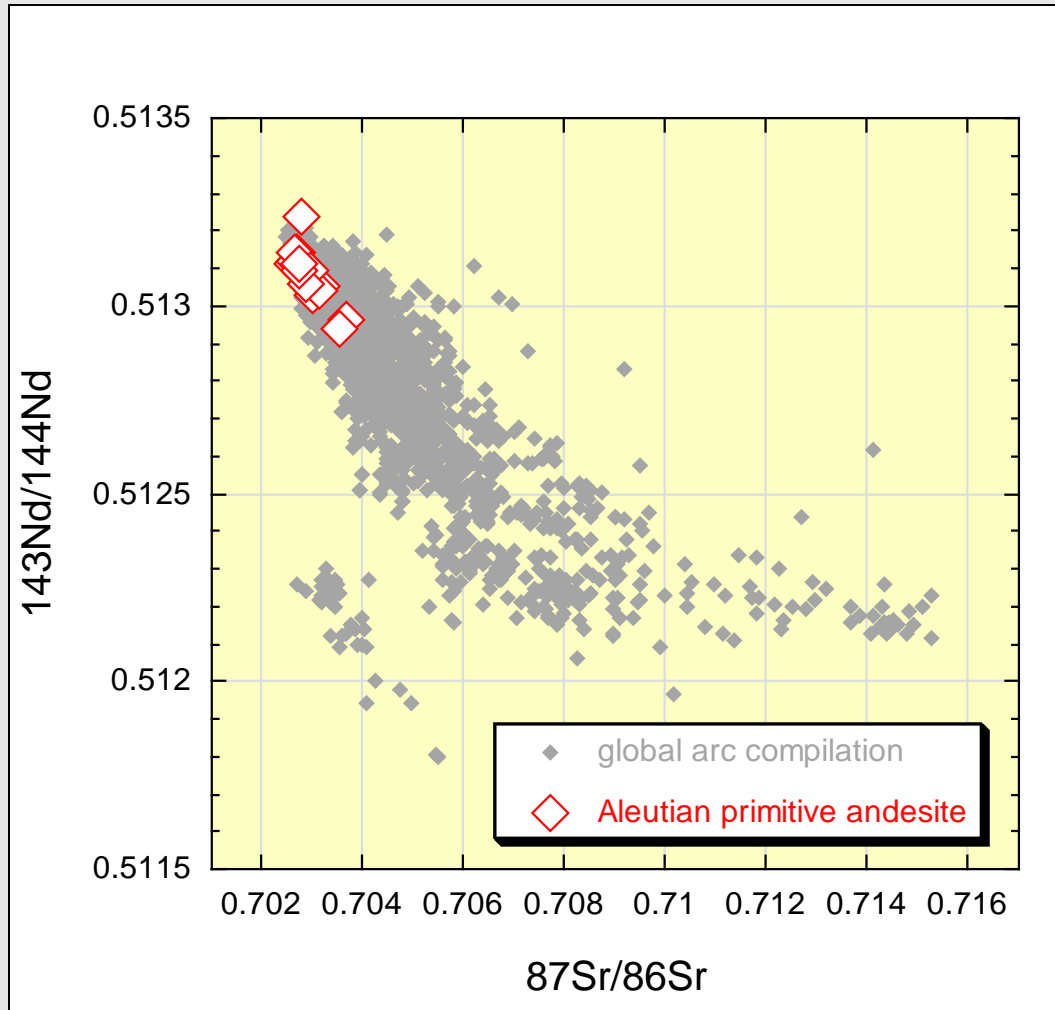


most Aleutian plutonic rocks have compositions ~ continental crust

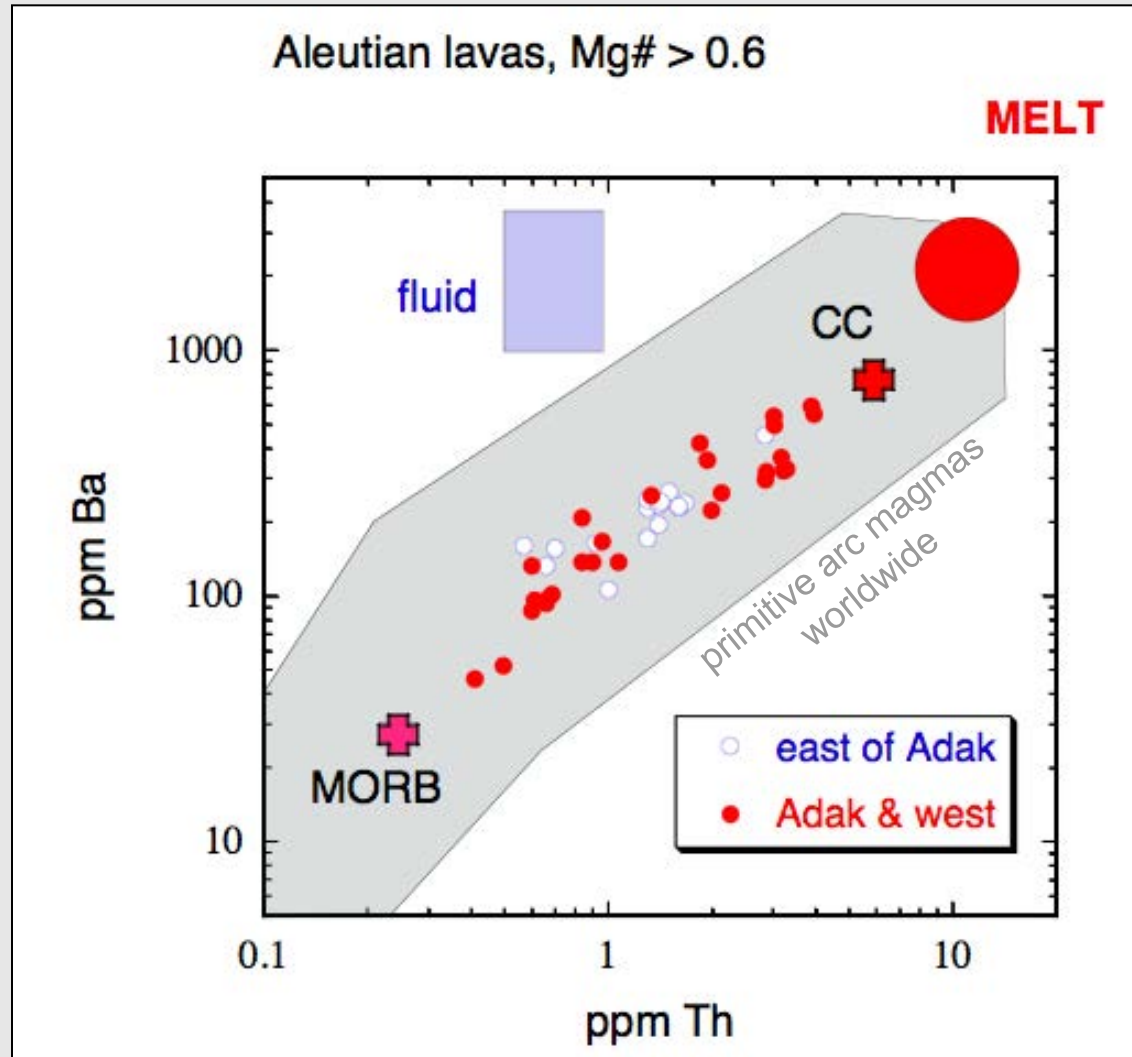


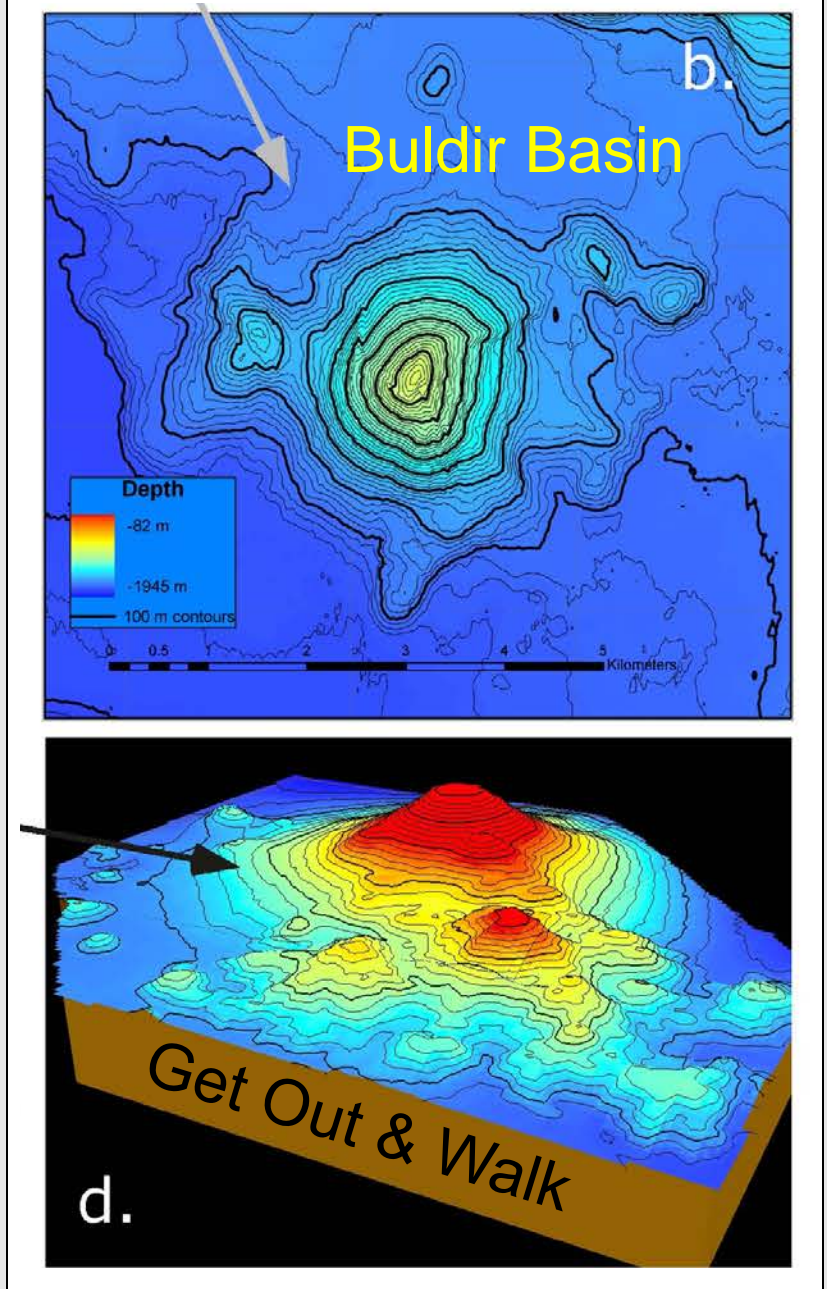
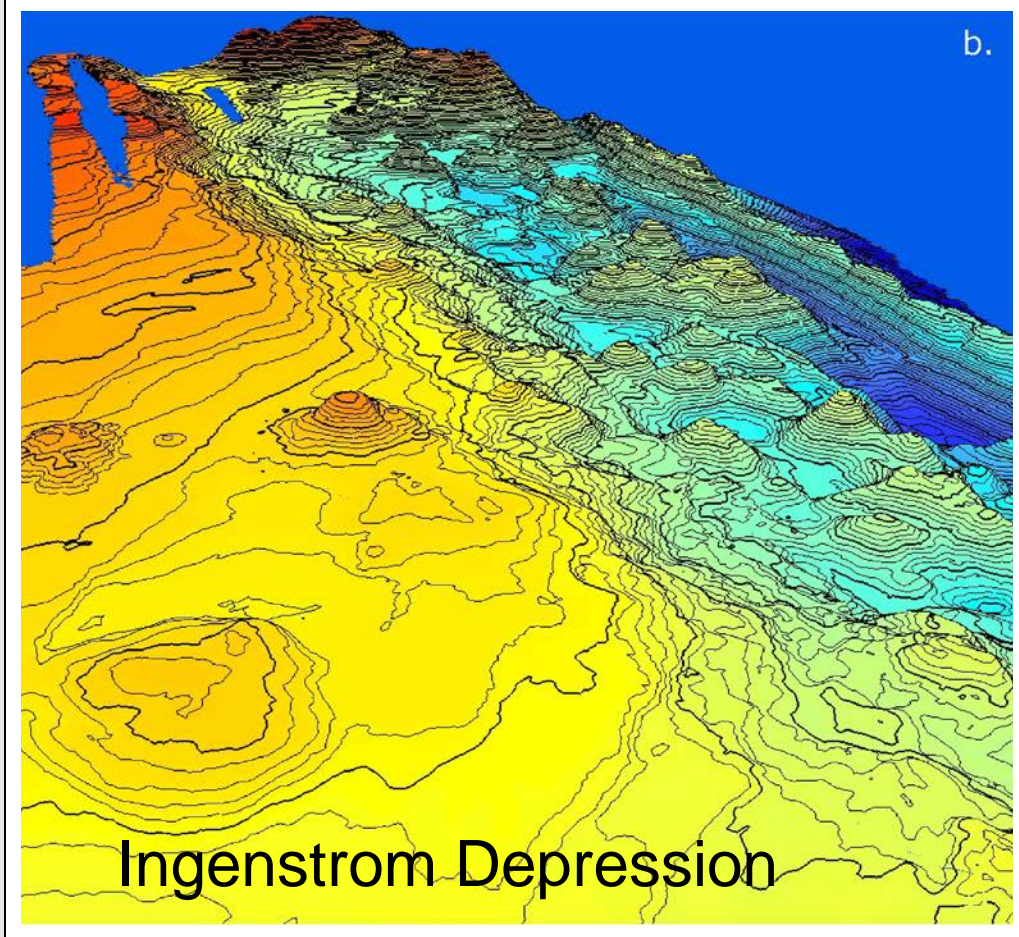
QuickTime™ and a
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no recycled continental sediments in W Aleutian primitive andesites

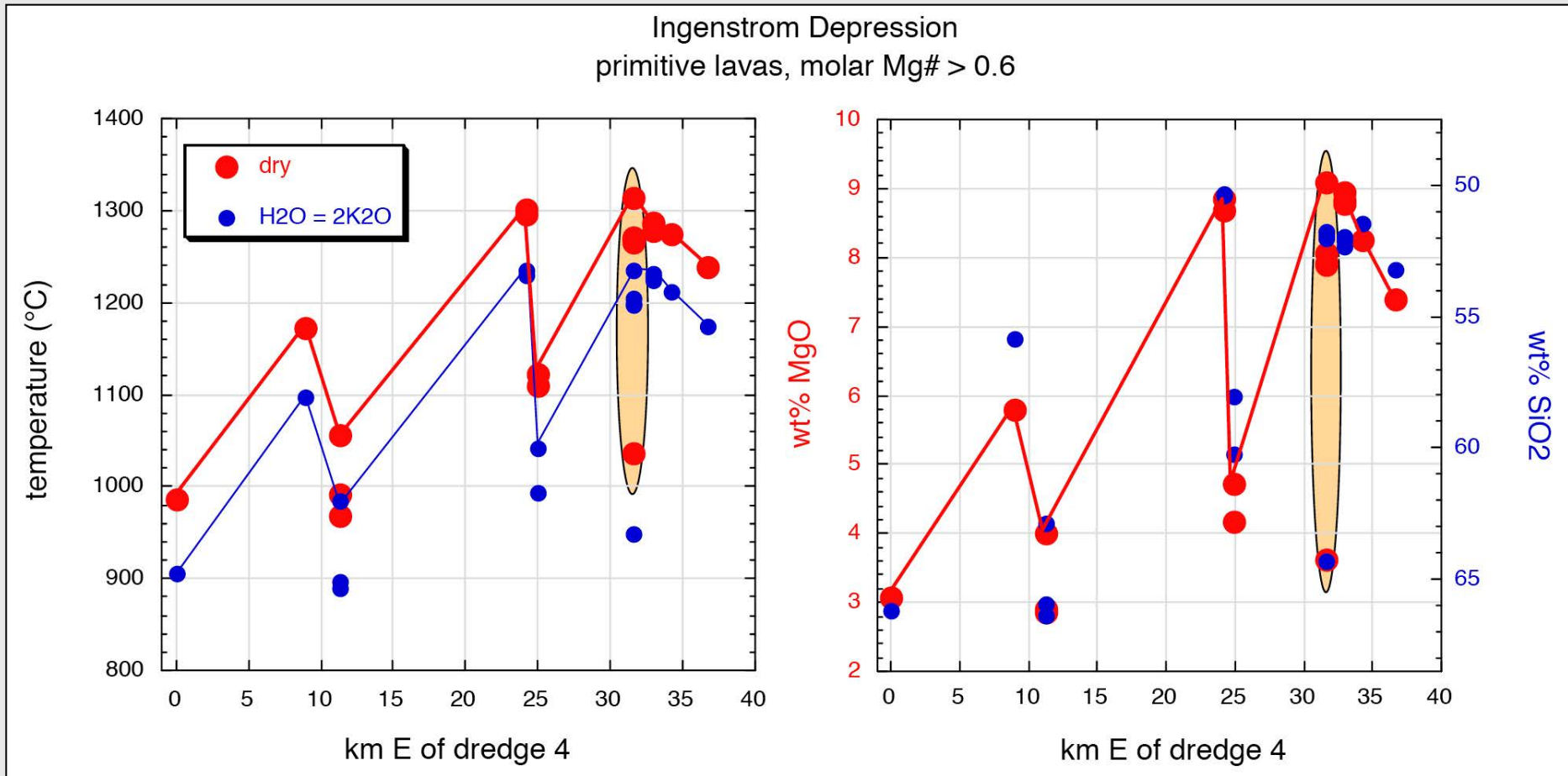


global subduction component = melt
(recycled continental sediments? not always ...)





high temperature basalts near low temperature primitive andesites



mixing primitive basalt & enriched “granite”?

