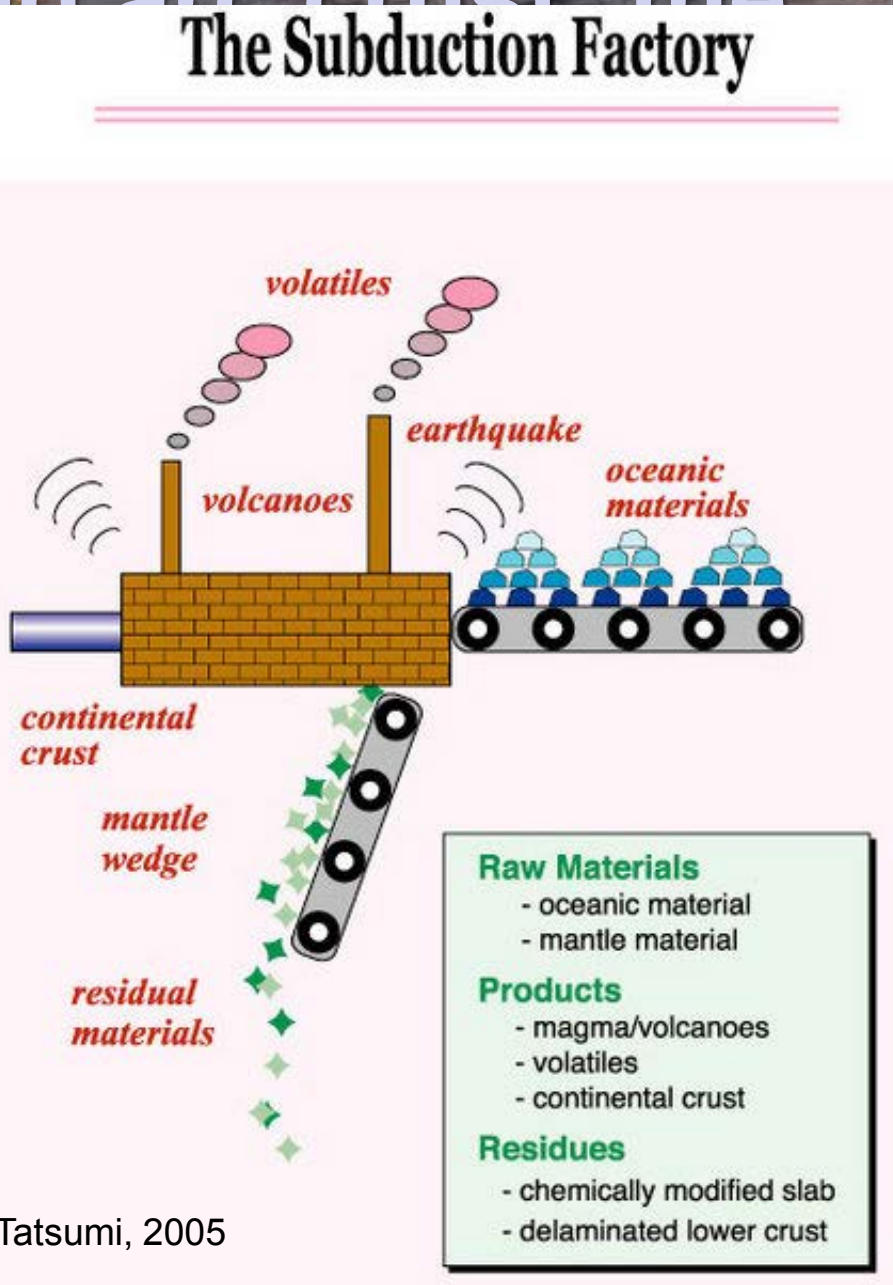
Constructing island arc crust: the volcanic to pluton the Rosario segm Cretaceous Alisit Mexico

Susan DeBari & Rebec
Washington University

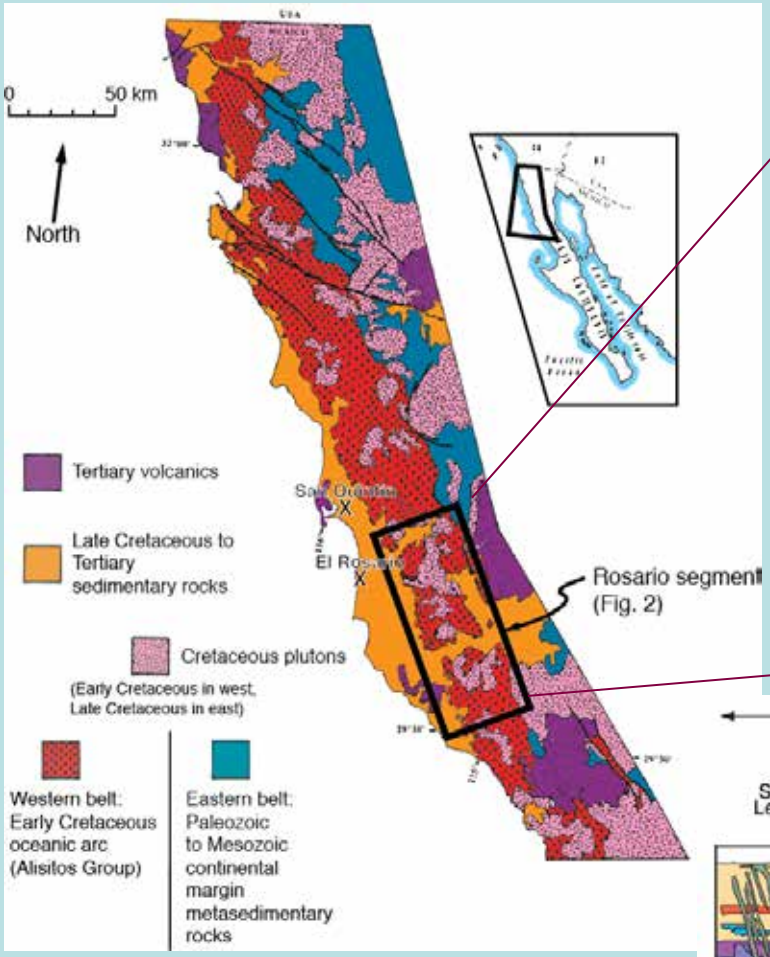
Cathy Busby and Sarah

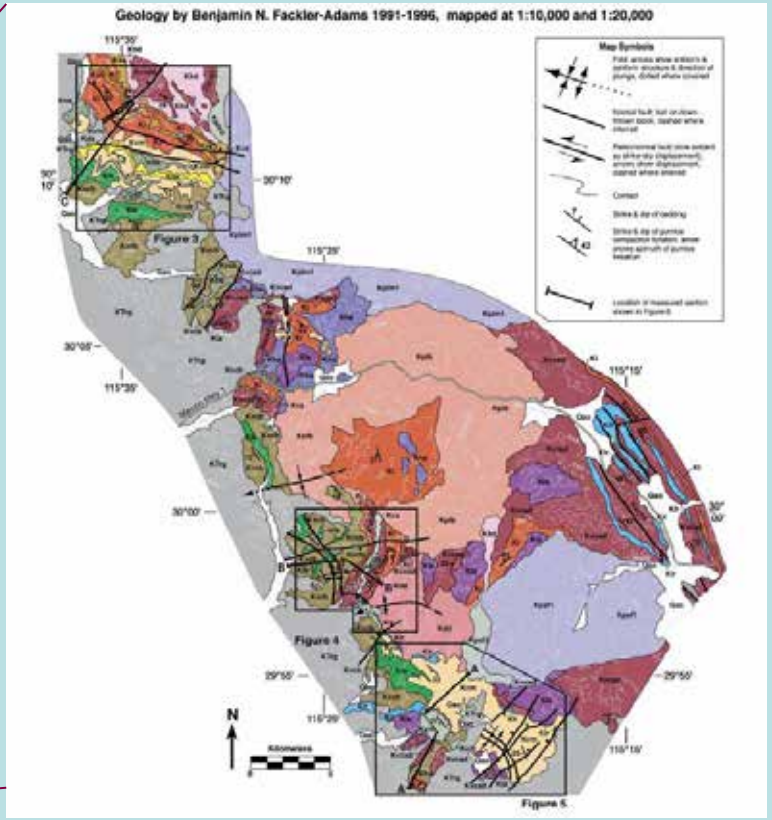


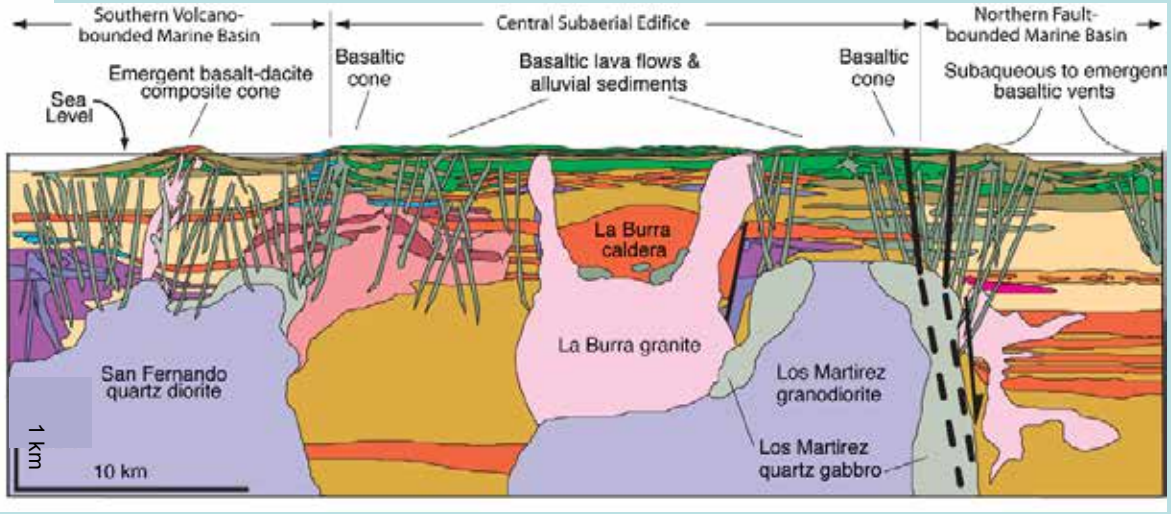
Tatsumi, 2005

Geo PRISMS

Rosario segment: Alisitos Arc







Right: Cross section through tilted but undeformed and unmetamorphosed upper- to middle crustal section mapped by Busby et al. (2006).

Two motivations for this project

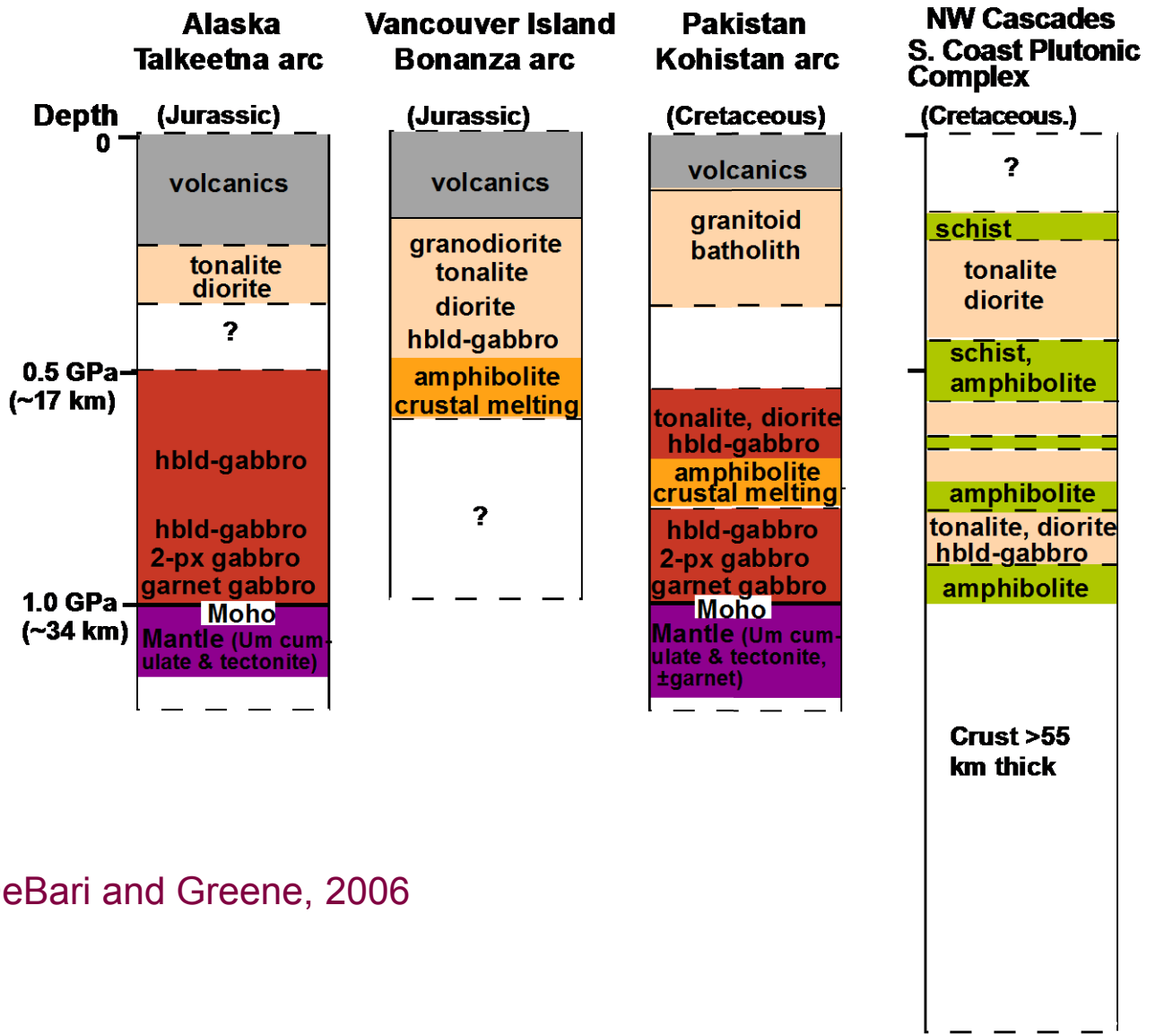
1. Address a GeoPrisms Science Plan key question:

What are the geochemical products of subduction zones, from mantle geochemical reservoirs to the architecture of arc lithosphere, and how do these influence the formation of new continental crust?

- *What are the rates and processes of arc crust growth and differentiation and how is arc crust transformed to continental crust?*

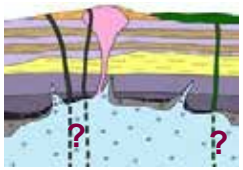
  "Estimates of the growth rates of plutonic arc crust …. must be approached either from ***field-based observations of sections of exhumed arc crust***, including geochemical characterization and geochronometry, or from a combination of geophysical, geochemical, and geochronologic studies of active arcs"

SCHEMATIC LITHOLOGIC SECTIONS



Alisitos Arc

(Early Cretaceous)



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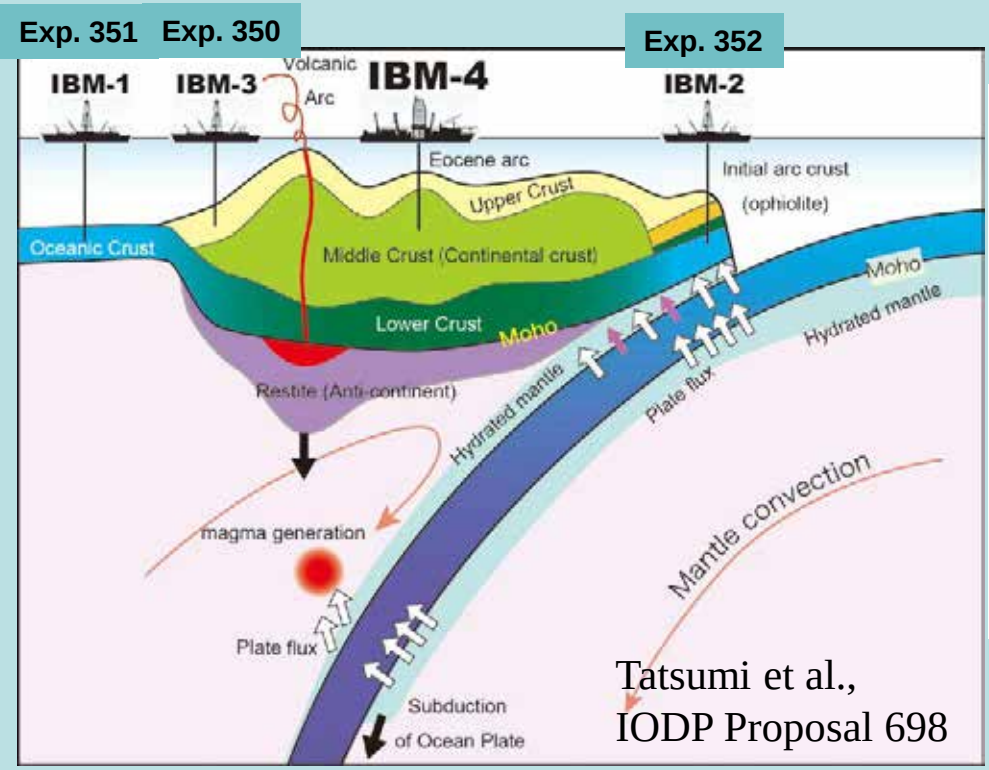
DeBari and Greene, 2006

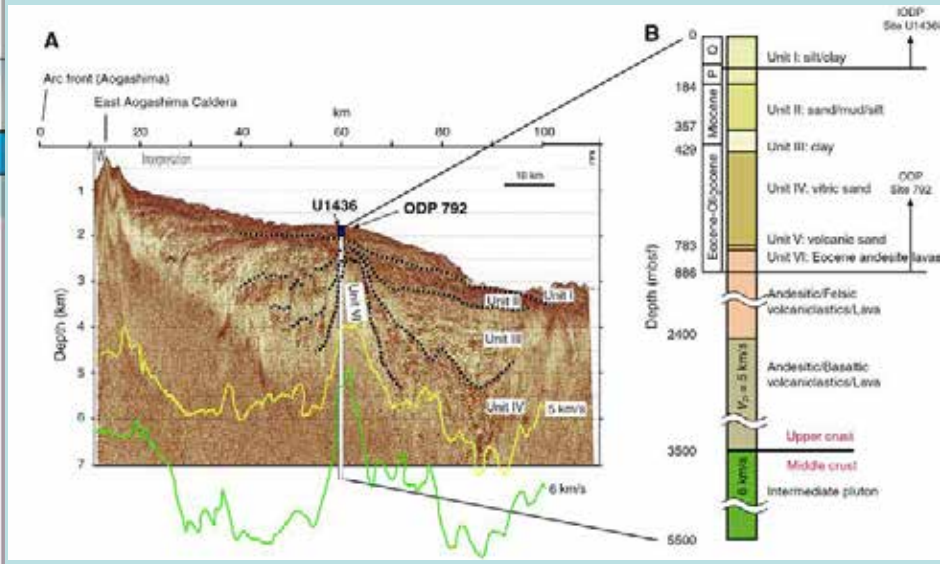
Two motivations for this project

2. Provide a 3-D field analog for proposed “deep-drilling” in the Izu Bonin arc:



Tatsumi et al.,
IODP Proposal 698

At IBM-4, Chikyu will drill through the **upper crust to middle crust transition** in the Izu oceanic arc.

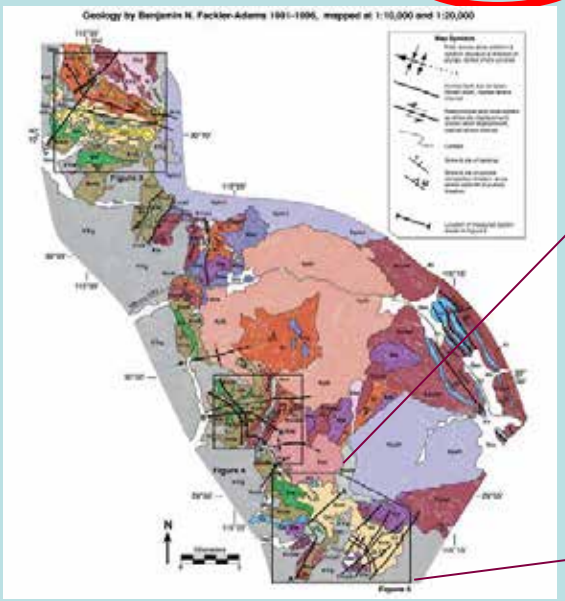


This transition is *very well-exposed* in the Alisitos arc.

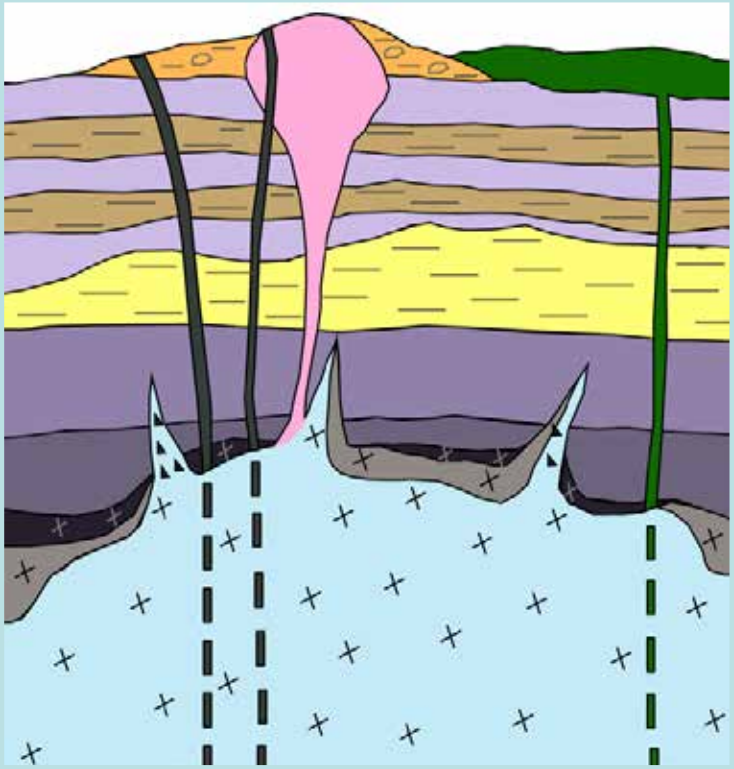
Rosario segment, Alisitos arc

- Monoclinal section, west dipping
- Outstanding exposure, 3-D picture of uppermost 5-6 km of the arc
- Scale of volcanic features similar to active arcs
- Extensional, subsiding arc provides constant exposure of stratigraphy

Plan: to determine in detail the relationships between plutonic, hypabyssal, and volcanic rocks, using field, geochemical, and geochronological data.



Plutonic rocks – mafic, intermediate, felsic bodies



Plutonic rocks – mafic, intermediate, felsic bodies

Plutonic rocks – intrusive into overlying volcanic sequence

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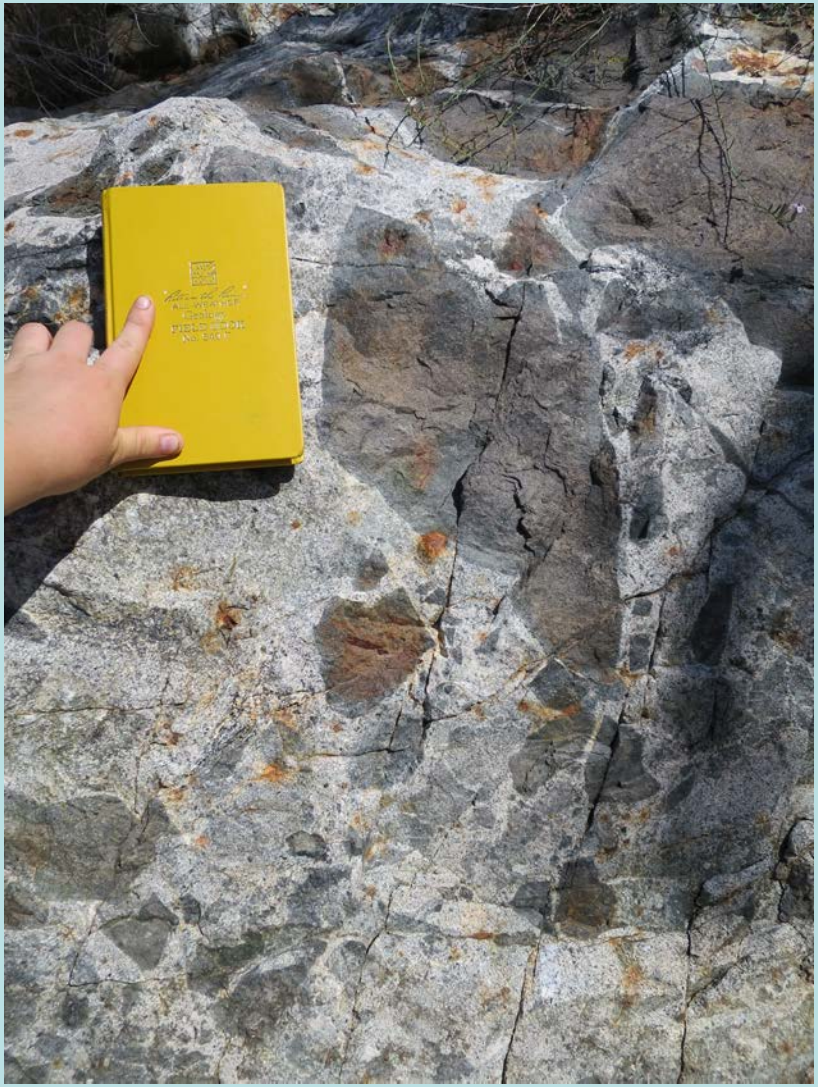
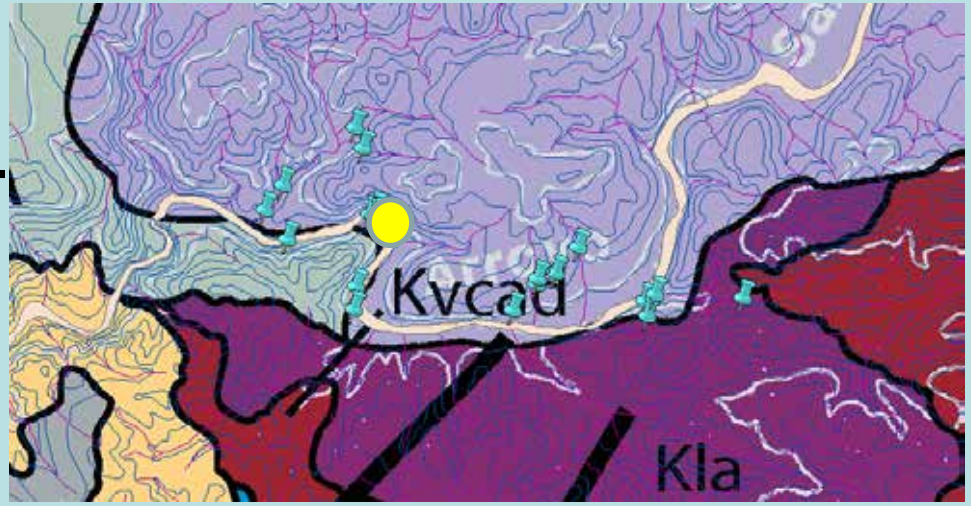
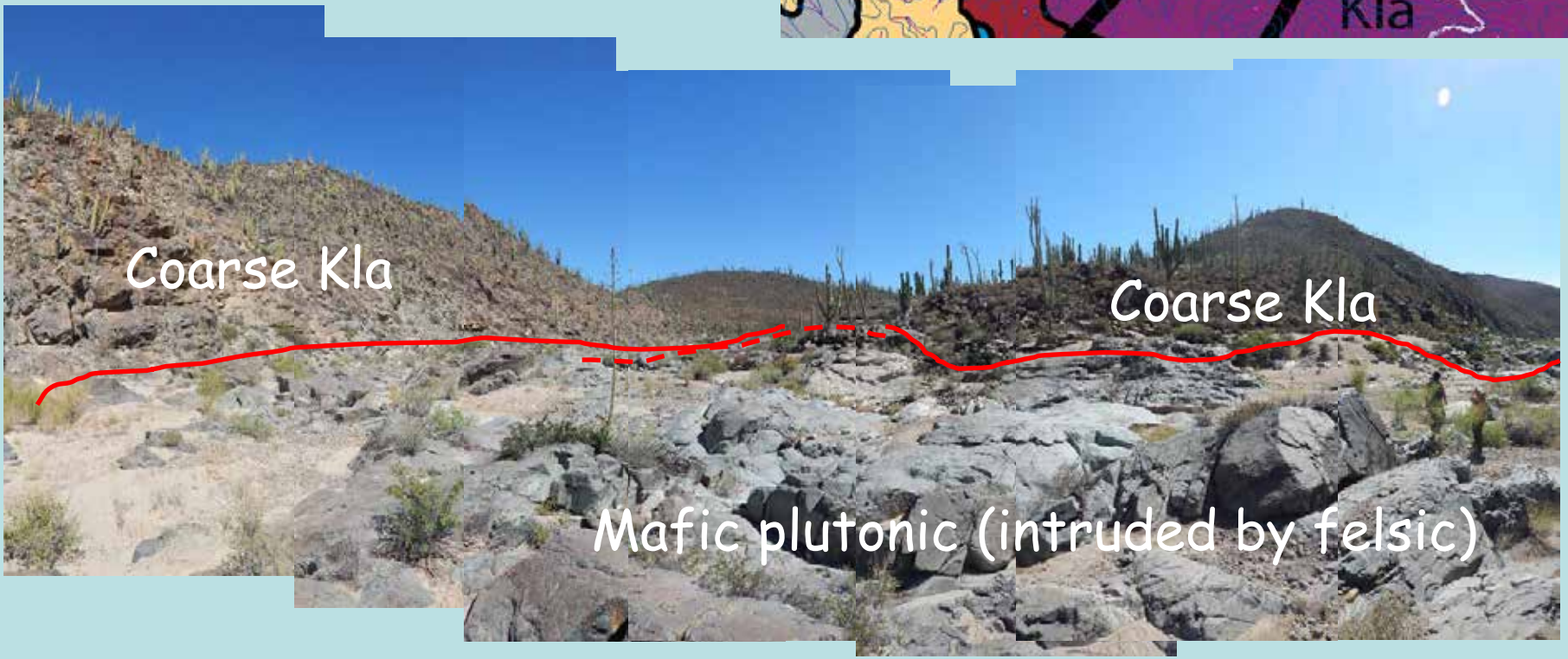


Plutonic rocks –

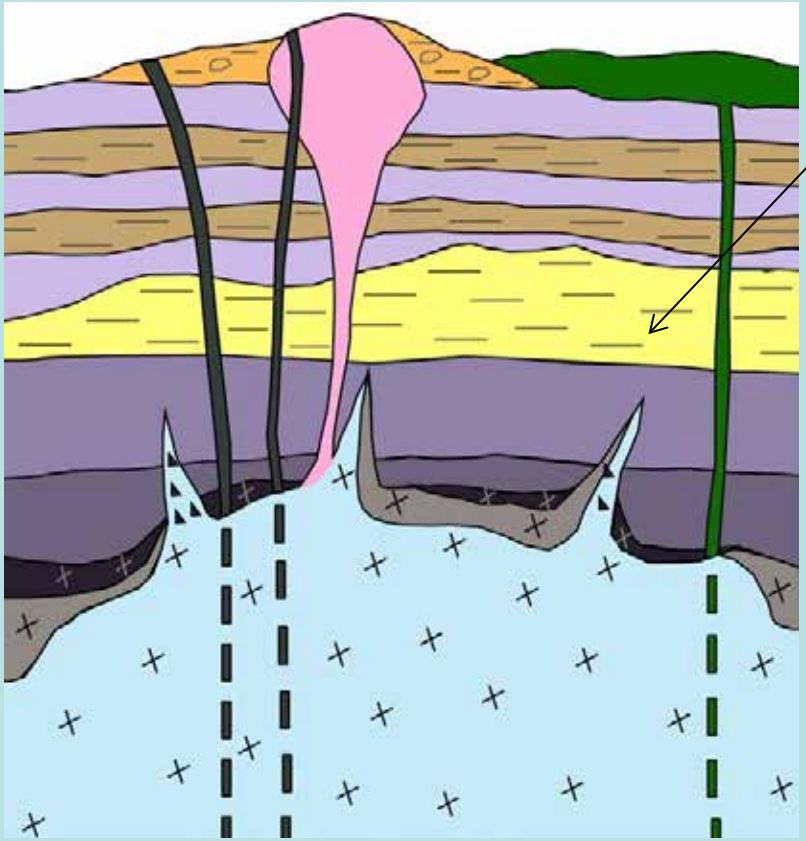




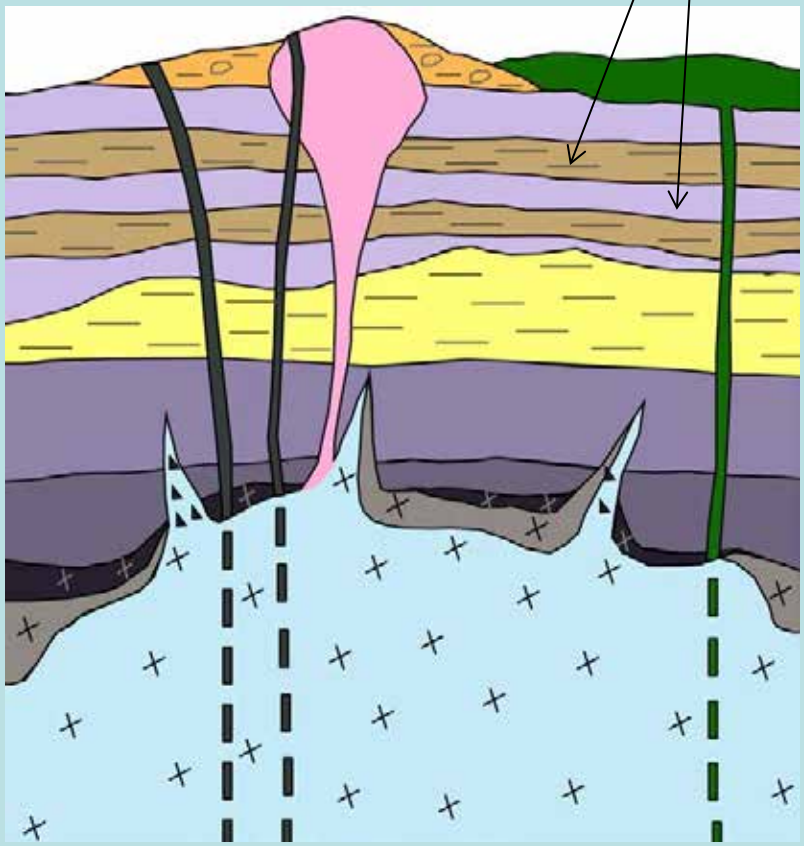
Volcanic units from central subaerial edifice

Marine volcaniclastic rocks

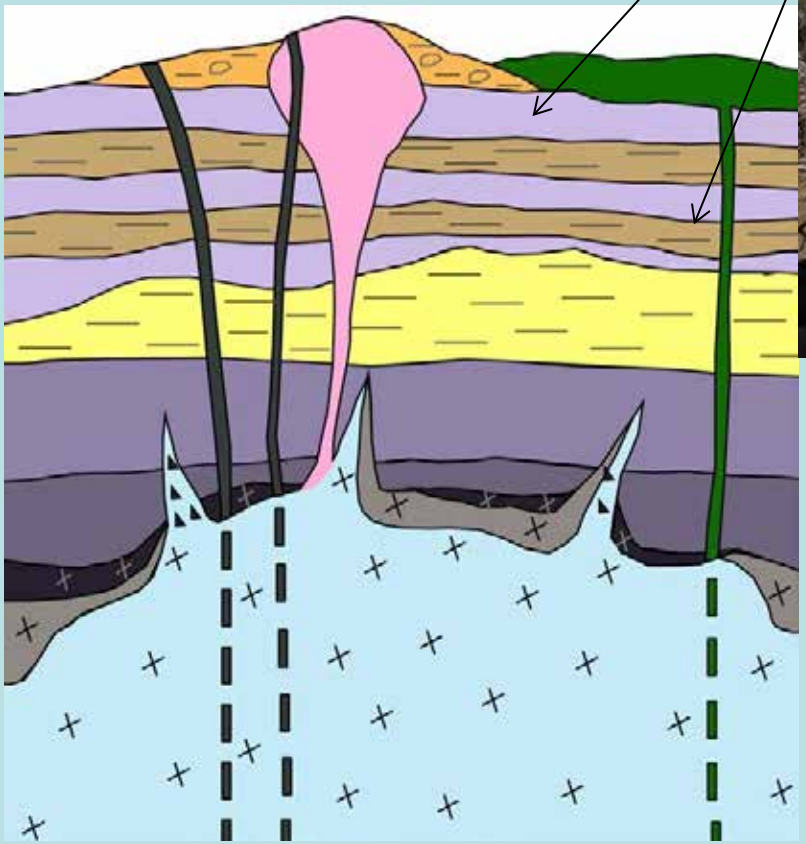
- Fine grained, thin bedded tuffs (Kvm)
- Pumiceous subaqueous pyroclastic flow deposits (Kpf)

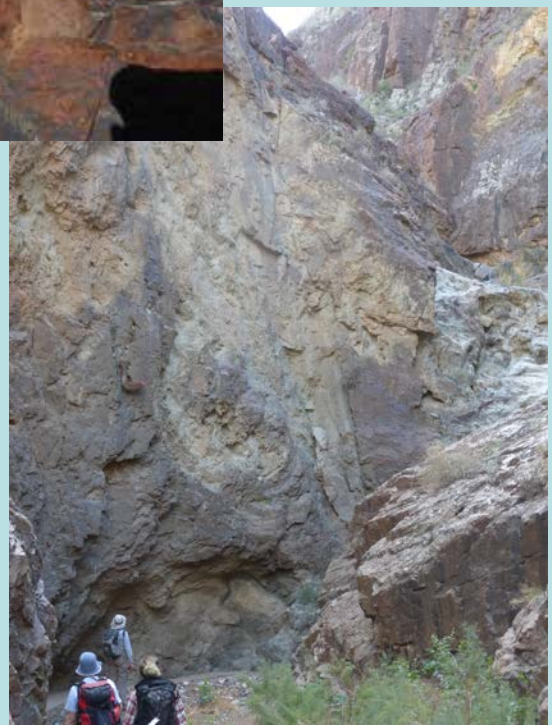


Volcanic units – intermediate to mafic breccias interbedded with andesitic lavas/sills

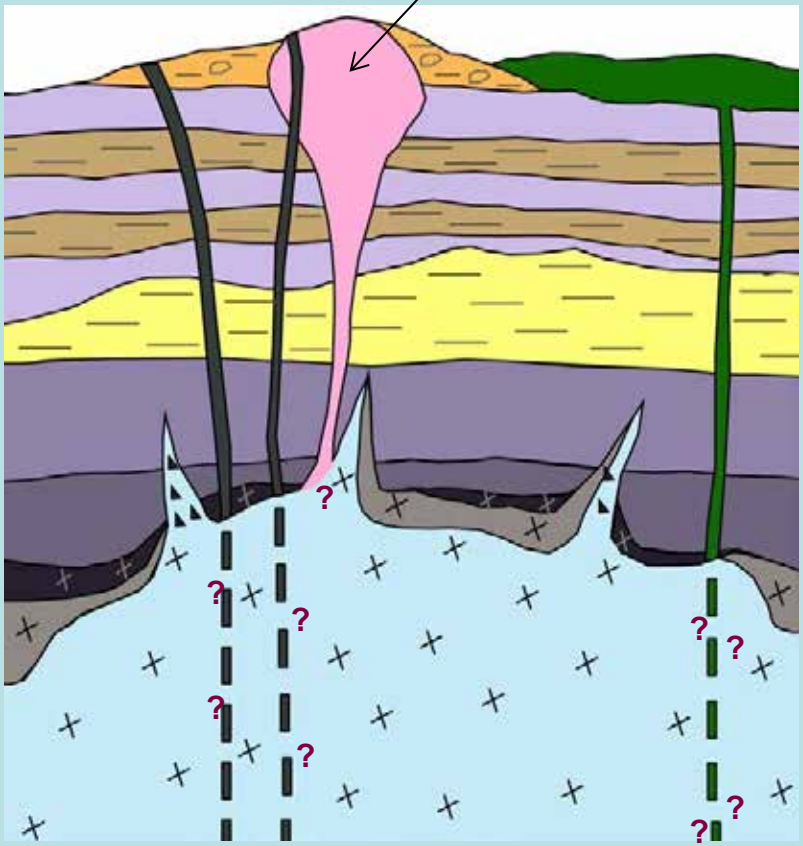


Volcanic units – “andesitic” lavas

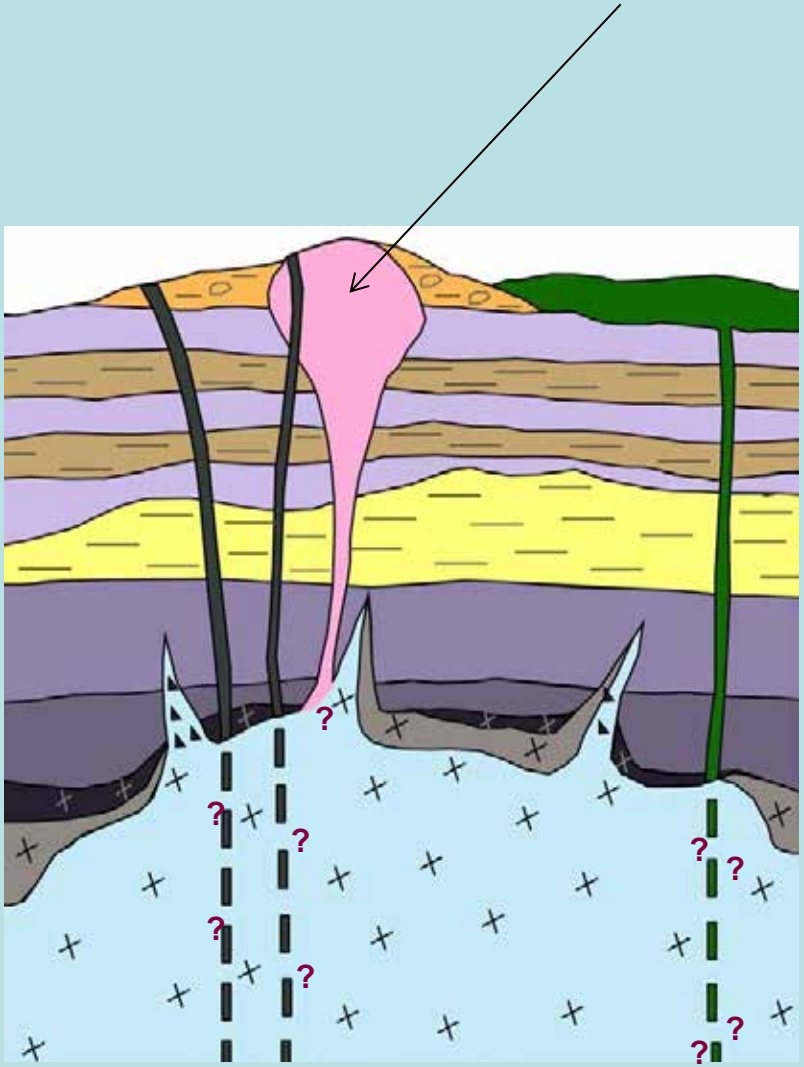




Volcanic units – dacite dome and associate pyroclastic flow deposits

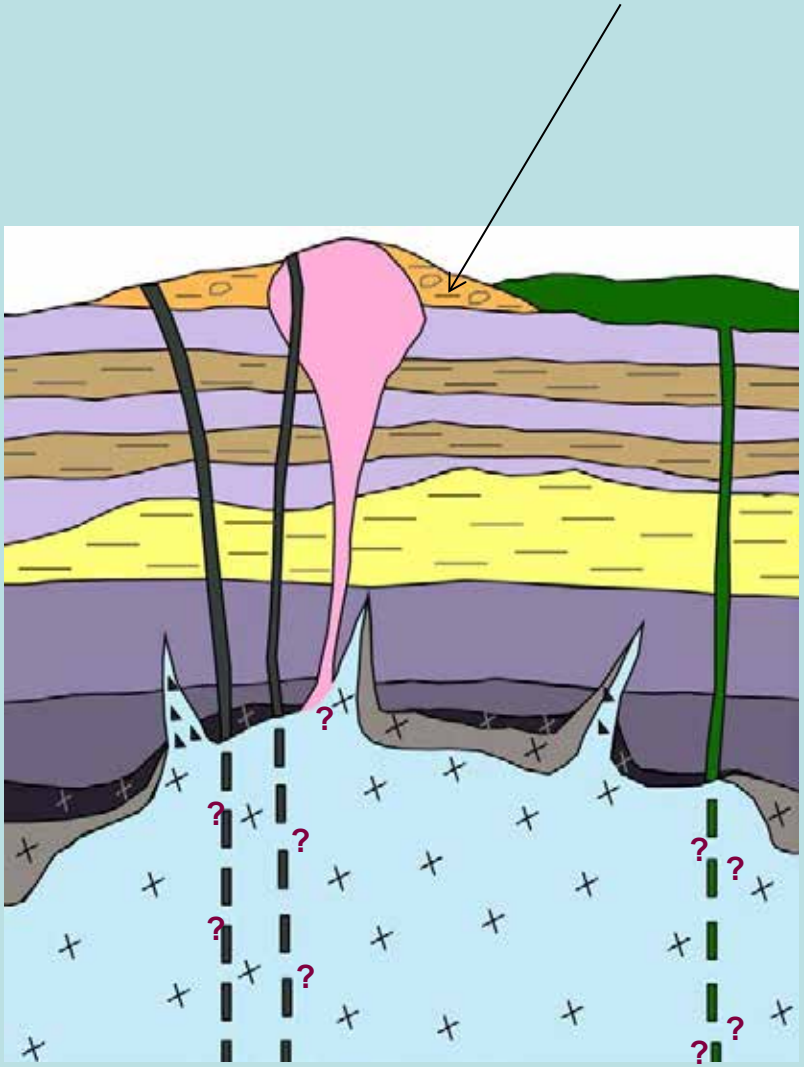


Volcanic units – dacite dome and associate pyroclastic flow depostis

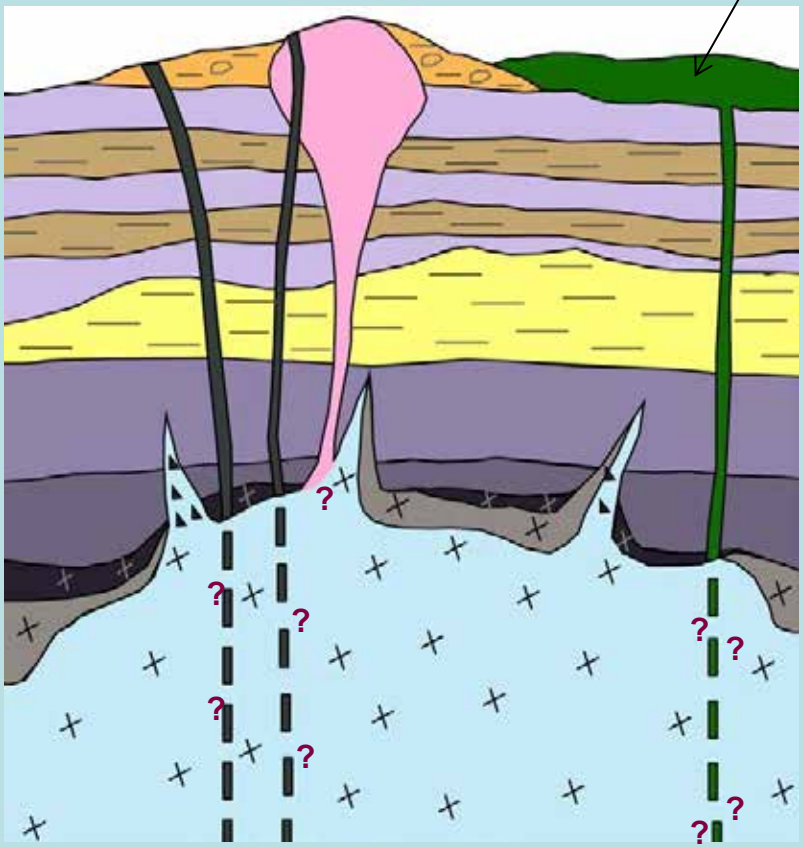


Dacite contains xenoliths of underlying andesite

Volcanic units – dacite dome and associate pyroclastic flow depostis

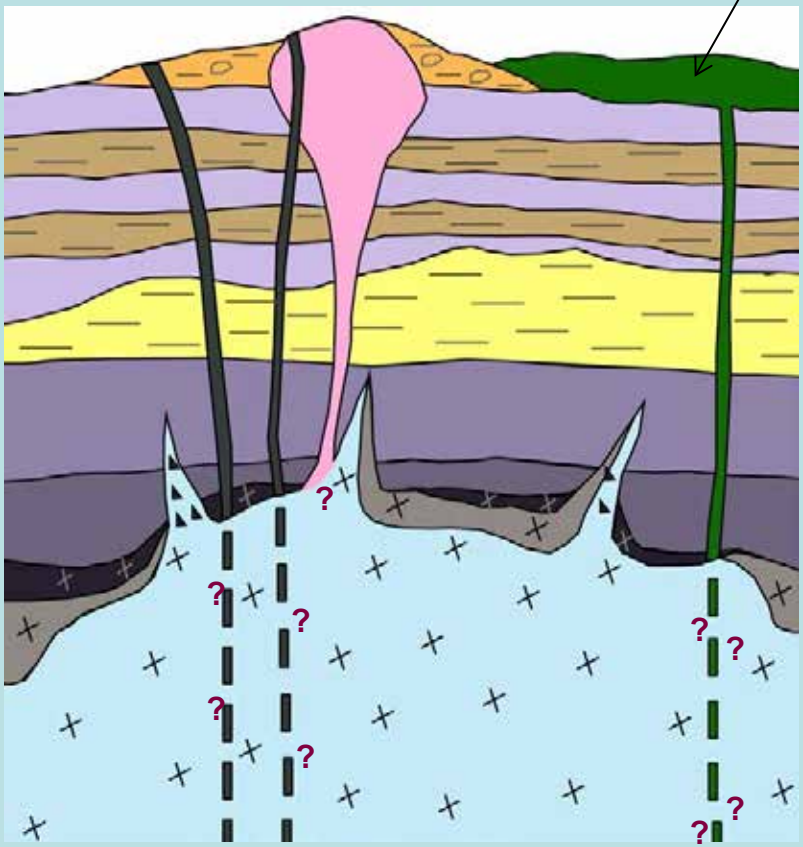


Volcanic units – “basaltic” flows, hyaloclastite breccias, sills, and dikes



Basalt flows with limestone interlayers

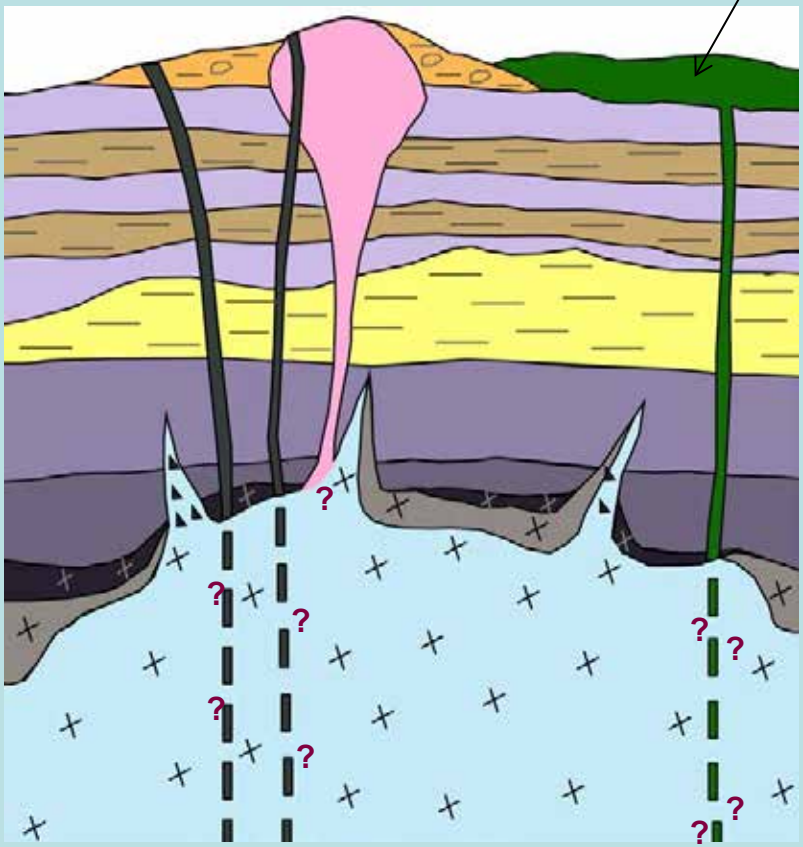
Volcanic units – “basaltic” flows, hyaloclastite breccias, sills, and dikes



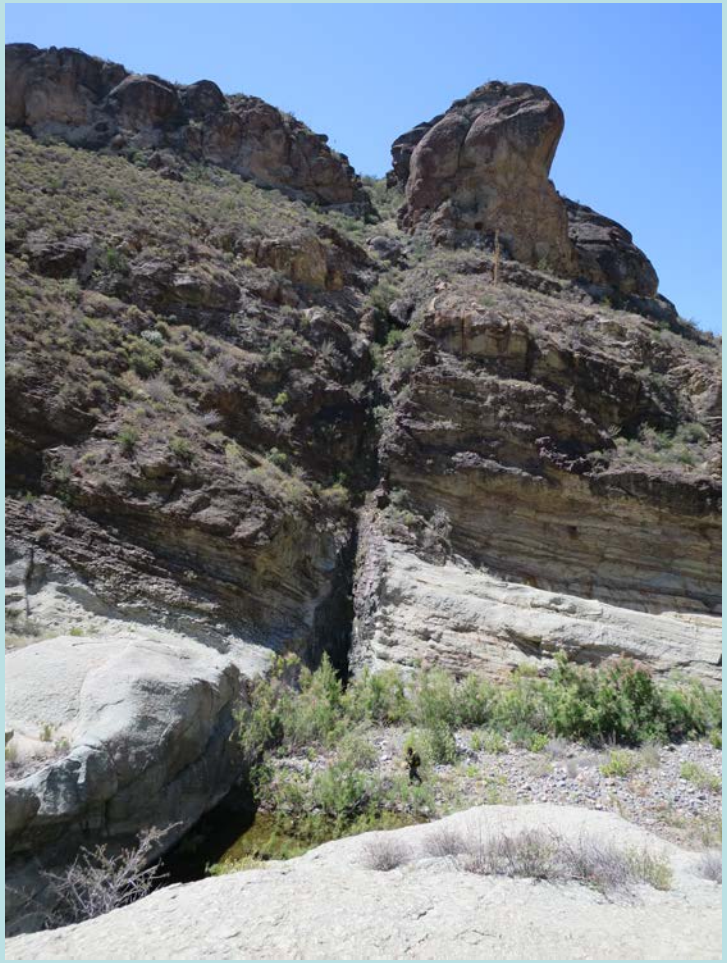
Irregular mafic intrusions into wet piles of mafic hyaloclastite

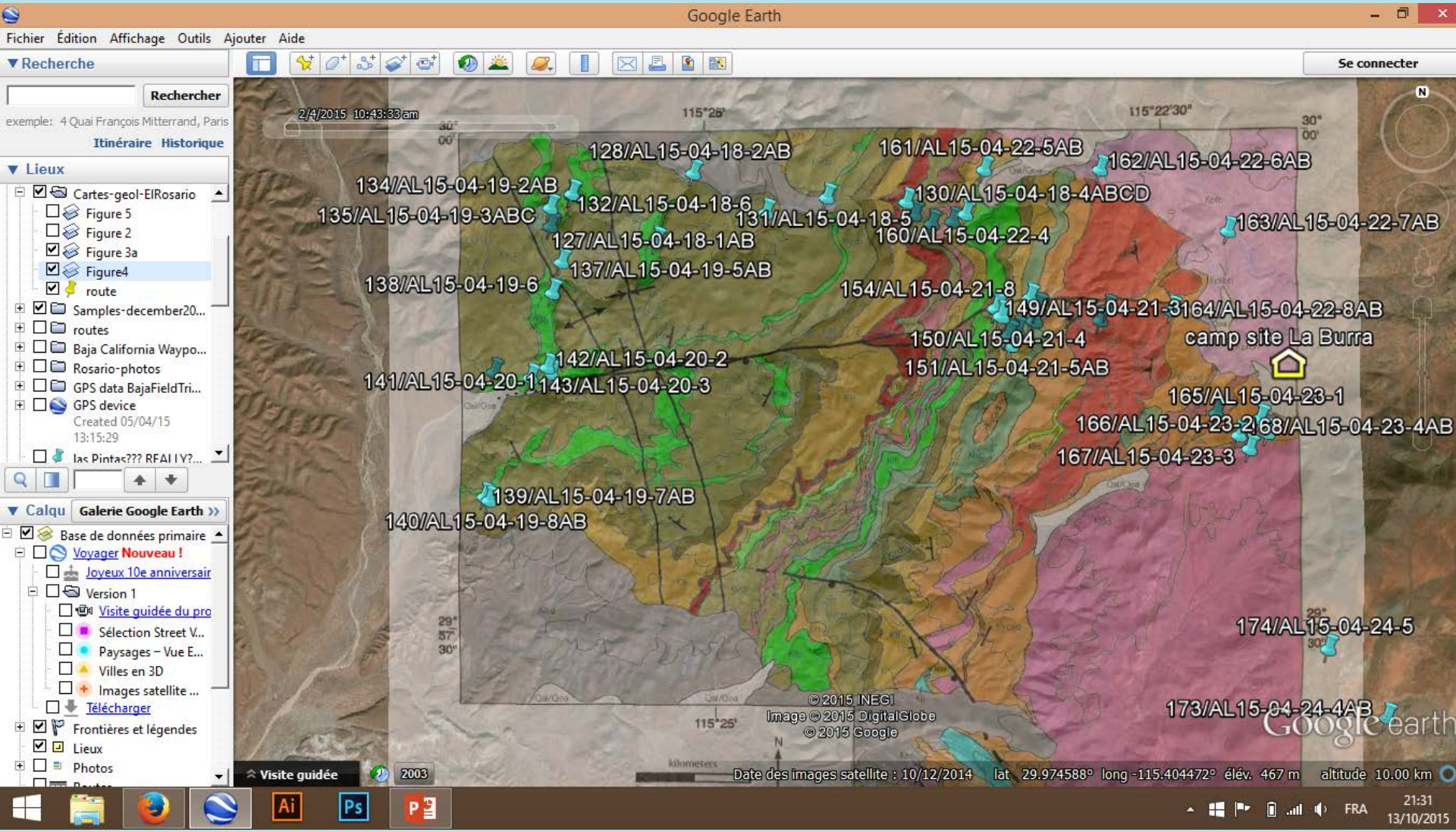
Volcanic units – “basaltic” flows, hyaloclastite breccias, sills, and dikes

Irregular mafic intrusions



Volcanic units – “basaltic” flows, hyaloclastite breccias, sills, and dikes

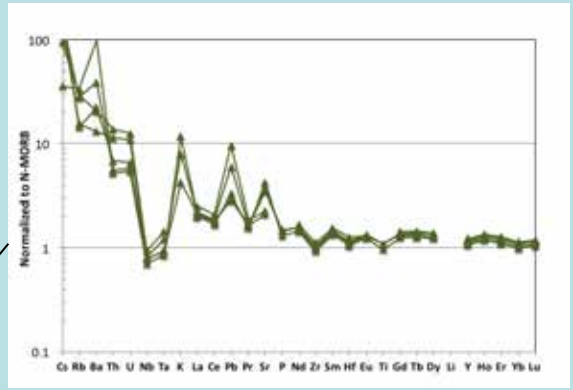




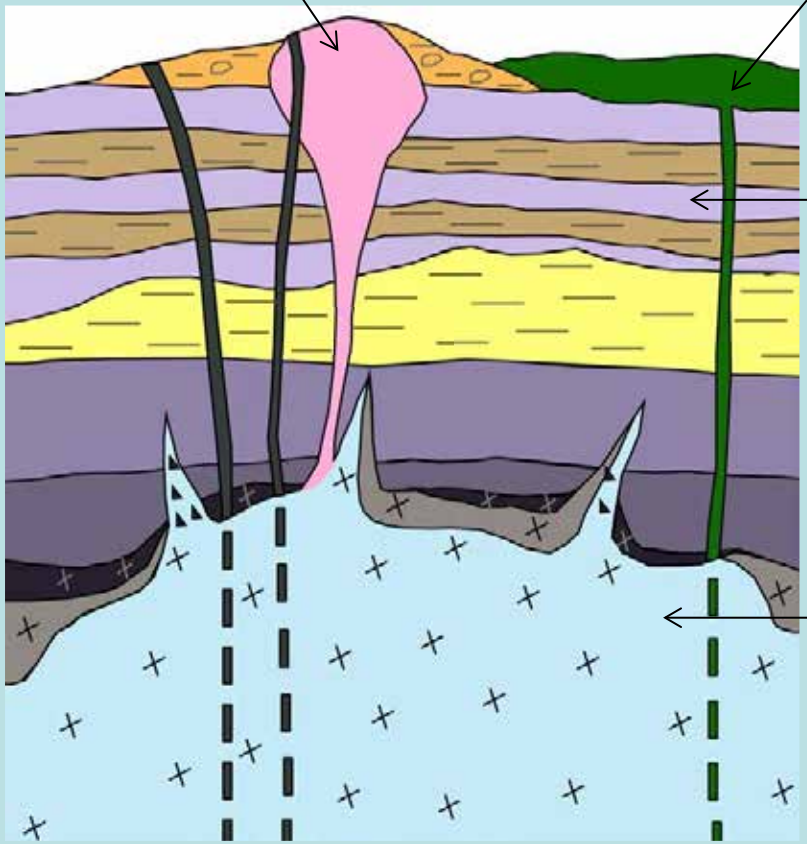
Developing the "3D-model" for the broader community

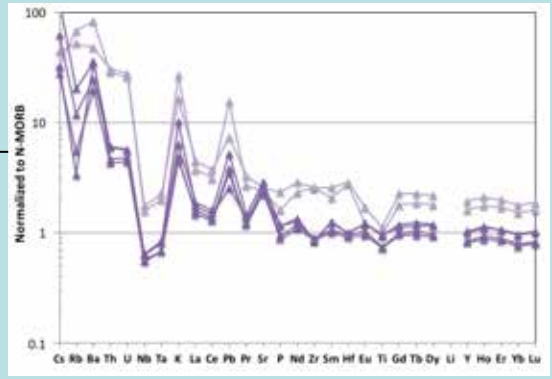
INITIAL GEOCHEMICAL DATA: southern volcano bounded basin:

Dacite

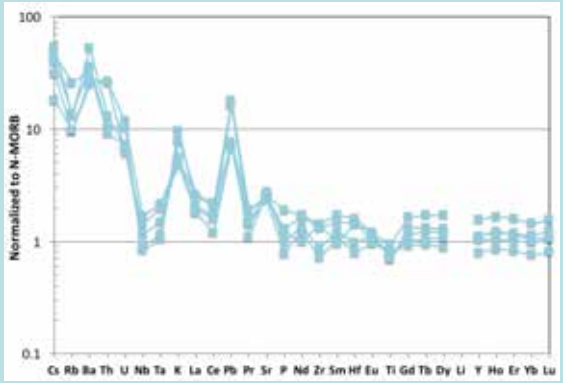


"Basalt"



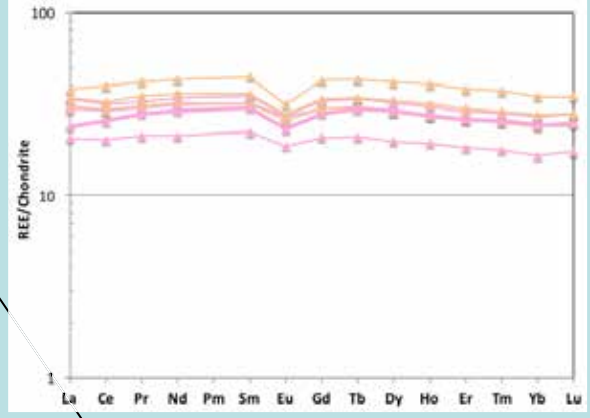


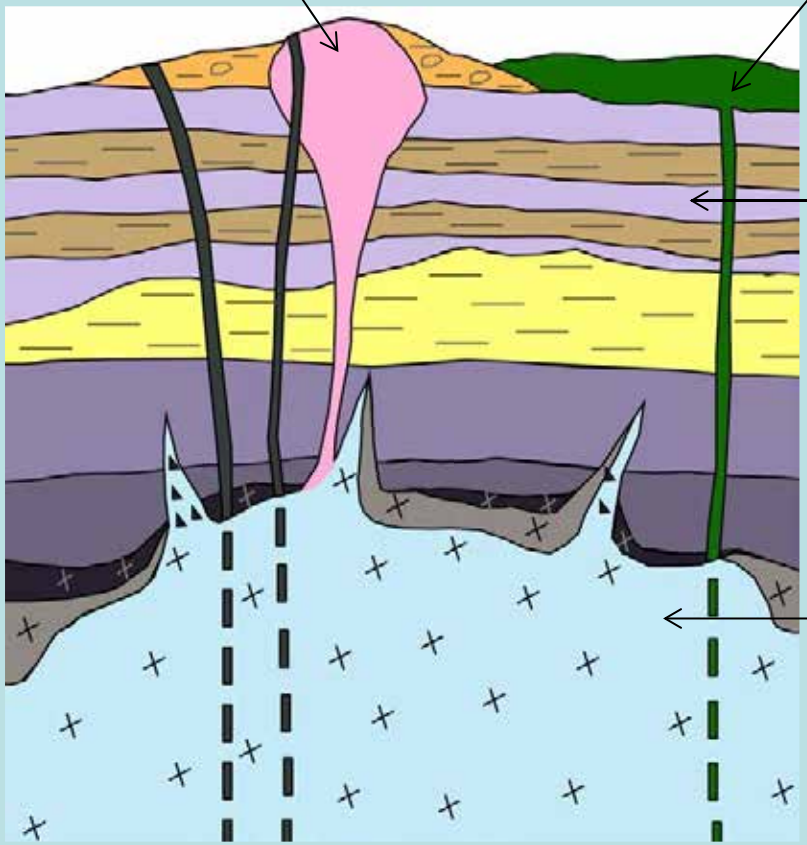
"Andesite"



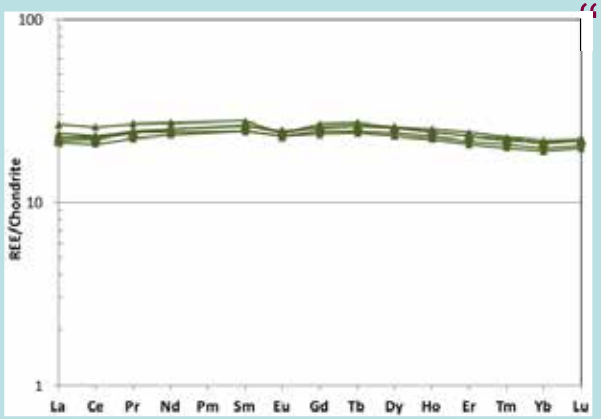
Plutonic

Dacite

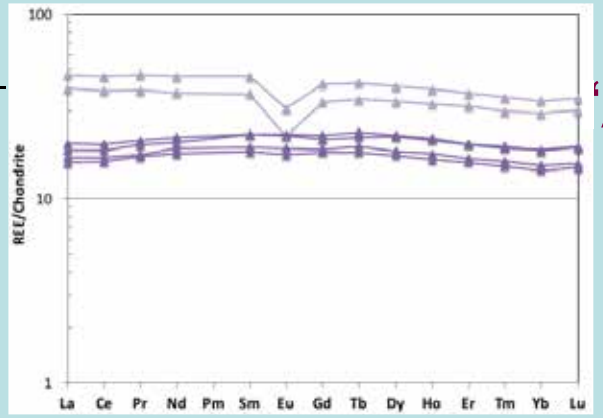




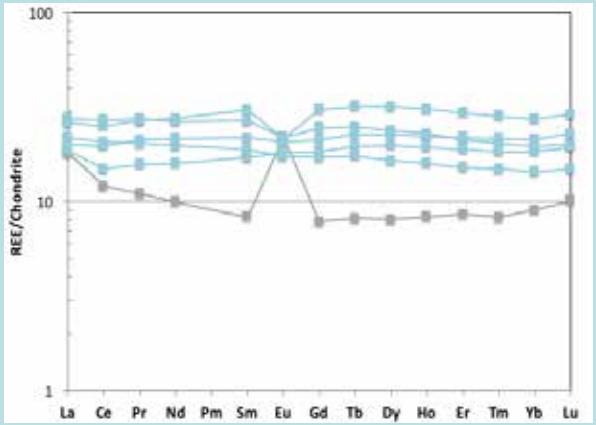
"Basalt"



"Andesite"

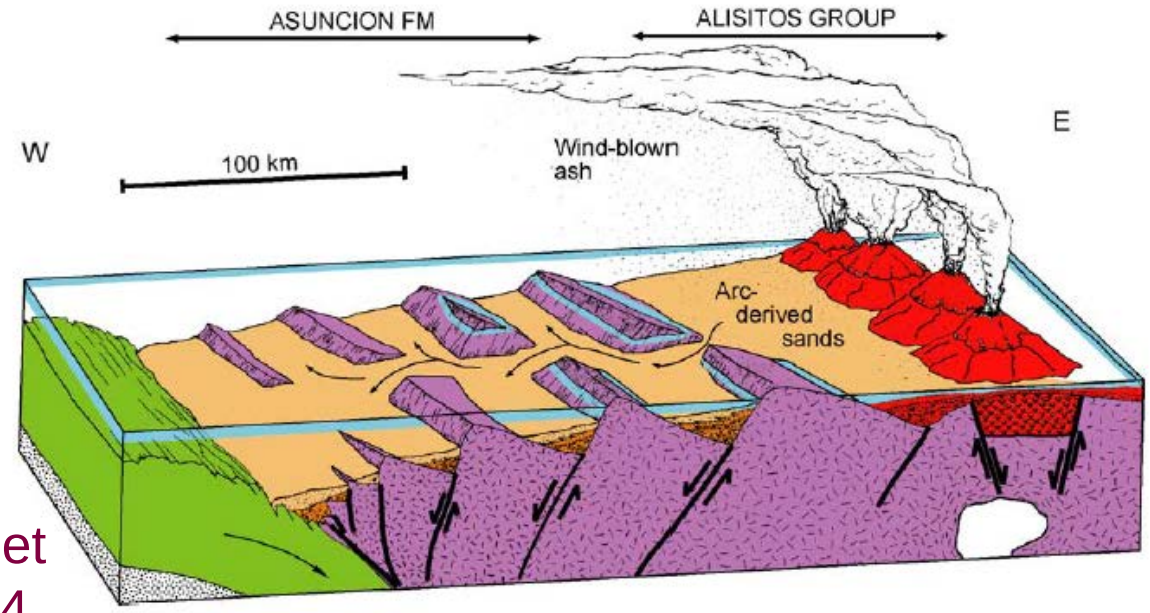


Plutonic



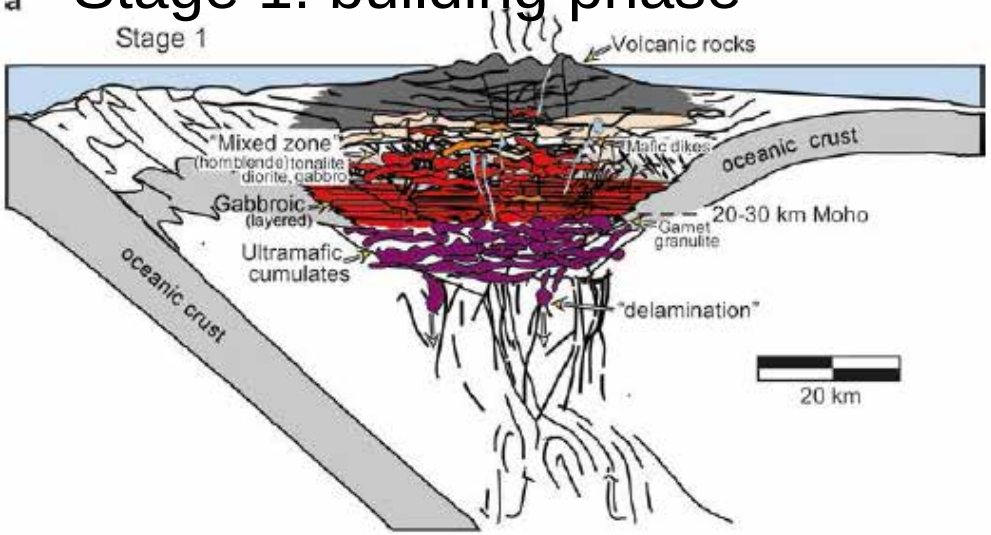
FIRST ORDER INTERPRETATIONS (still a work in progress):

- Likely an extensional/arc-rifting sequence (not calc-alkaline)
- No major geochemical changes in source through the stratigraphic section, units likely related by simple differentiation.
- Although it made continental crust, it is not “continent-like” in its geochemical signature. Why not?

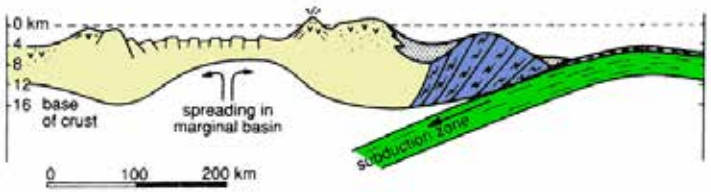


Busby et al. 2004

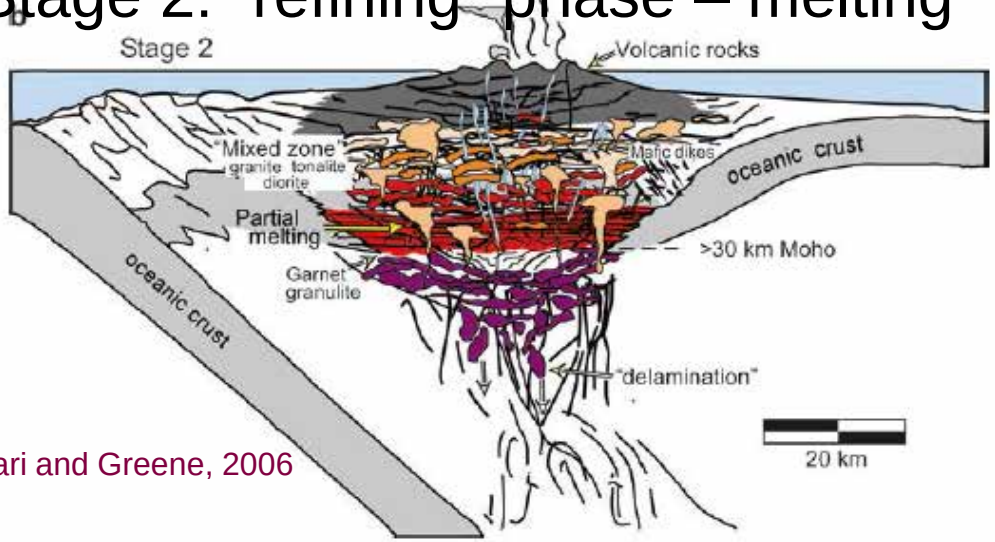
a Stage 1: building phase



Extending arcs don't get thick enough to enter that "refining" phase?



Stage 2: "refining" phase – melting



DeBari and Greene, 2006

Do we need non-extensional arcs create a more calc-alkaline, continent-like signature?

Questions?