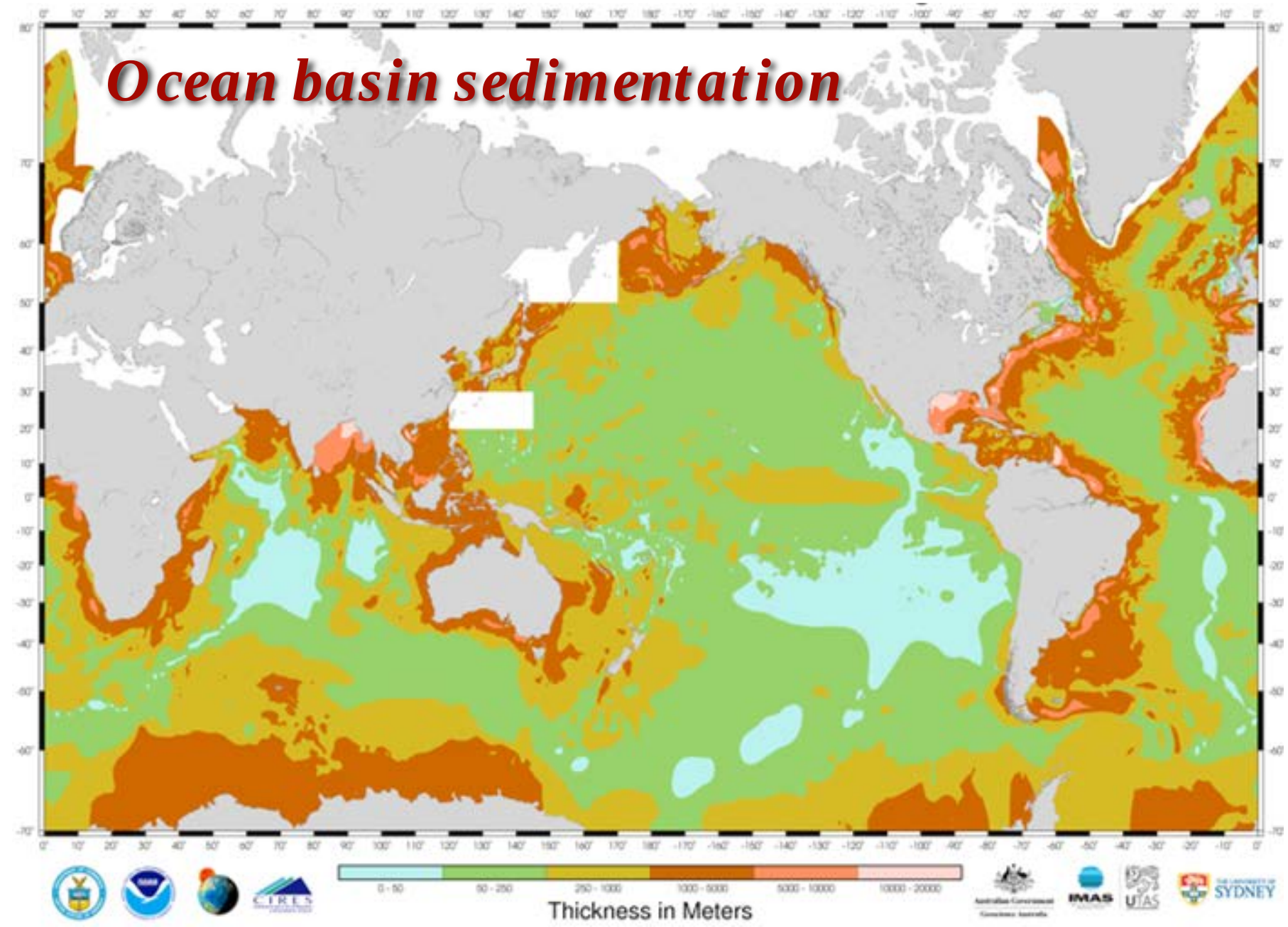
Outline

- Ocean basin sedimentation
- Anatomy of a forearc:
  - “Old paradigm”
  - Forearc basins and accretionary wedges
- Accretionary margins:
  - wedges, mélanges
    - Basics
    - Internal structure and models of growth
    - Exhuming high-pressure rocks
- Non-accretionary margins
- Modern subsurface views of accretionary prisms

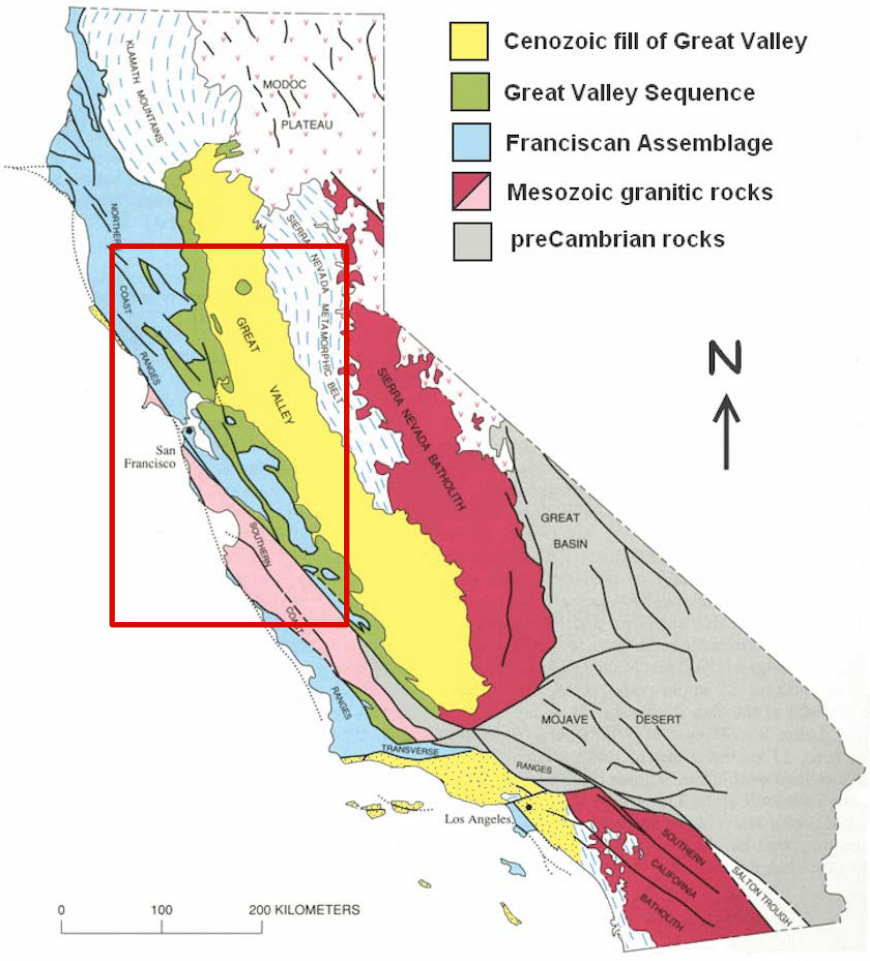
Ocean basin sedimentation

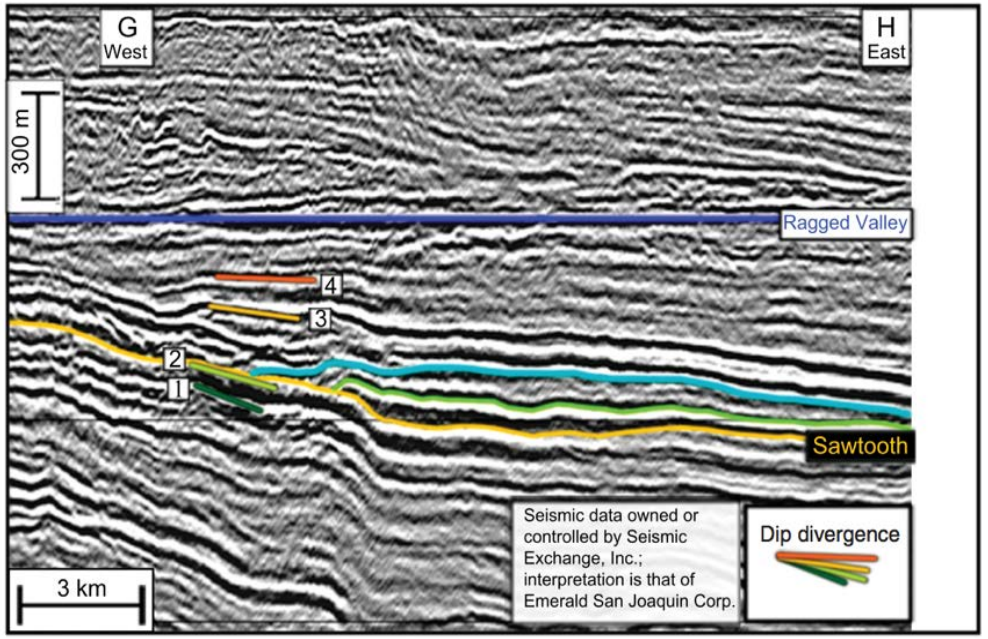


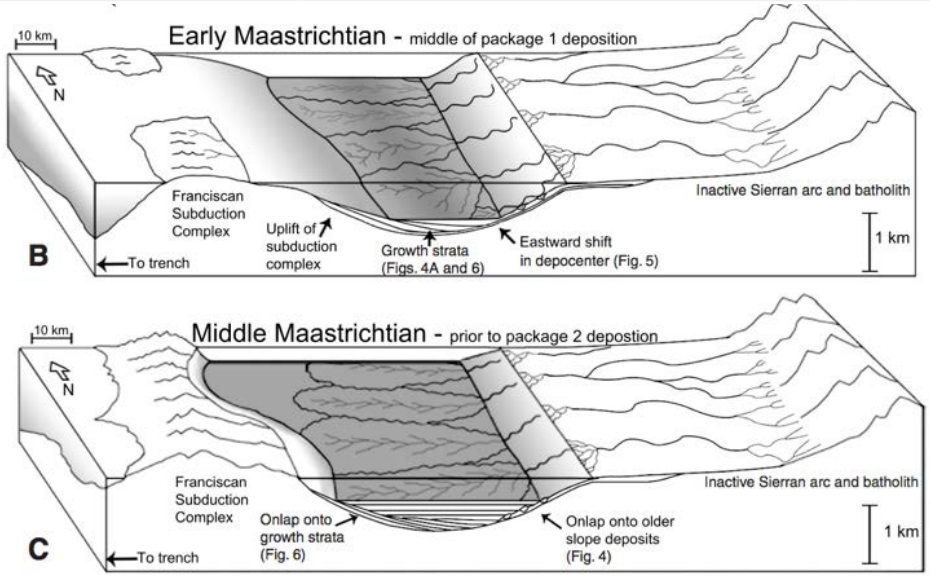
http://www.ngdc.noaa.gov/mgg/sedthick

Whittaker et al., 2013

Forearc subsidence linked to episodes of accretionary wedge growth in Mesozoic archetype of western California

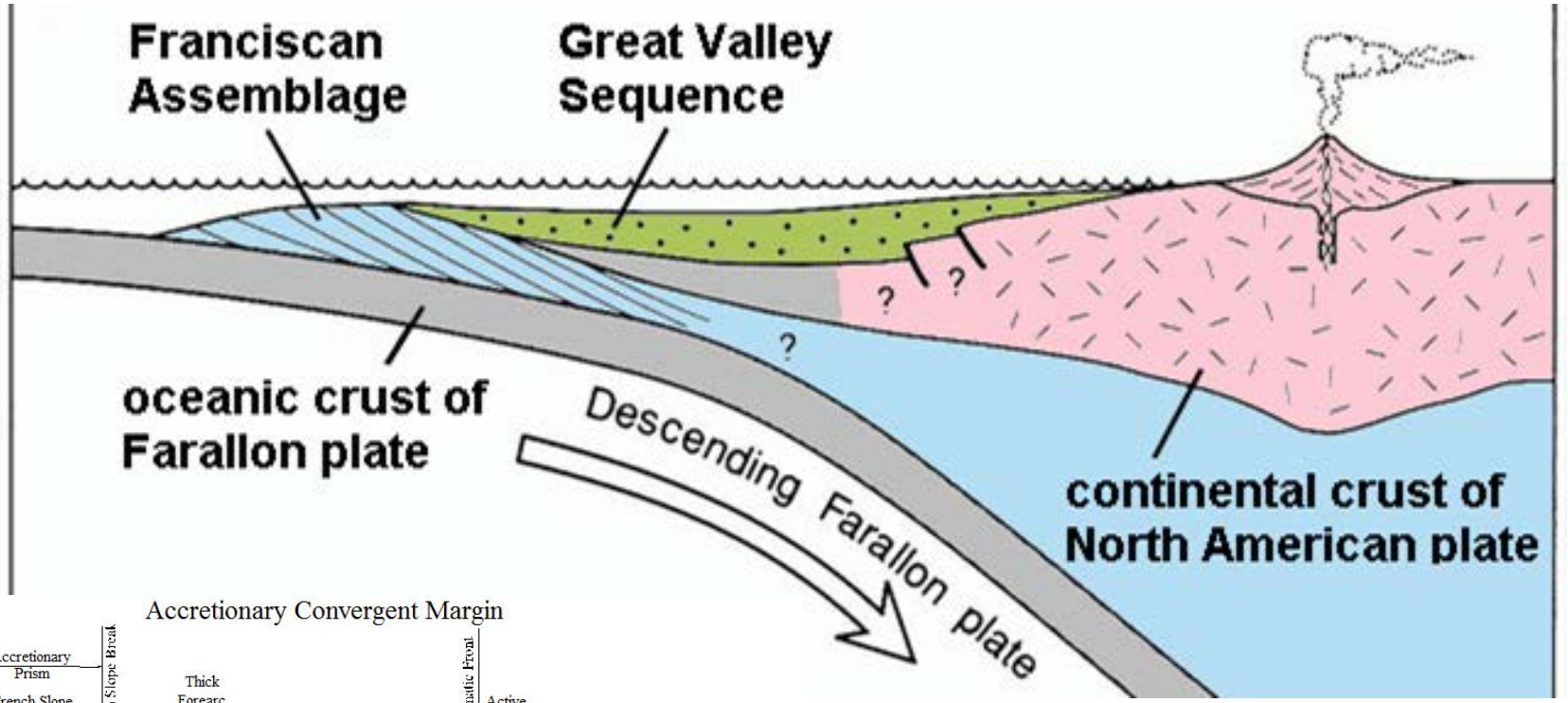


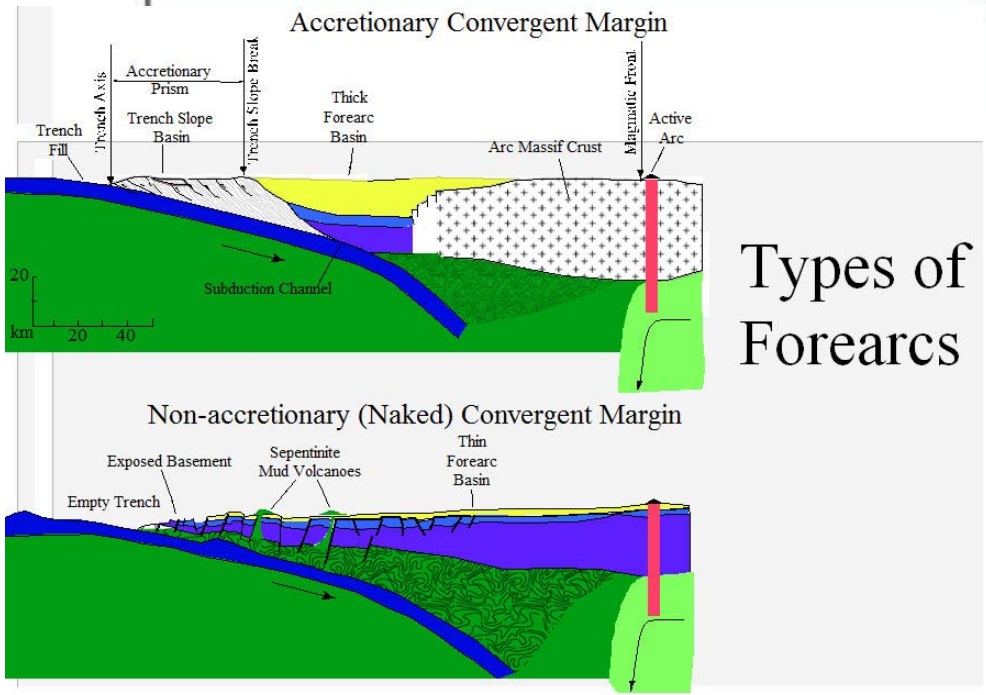




Mitchell et al., 2010

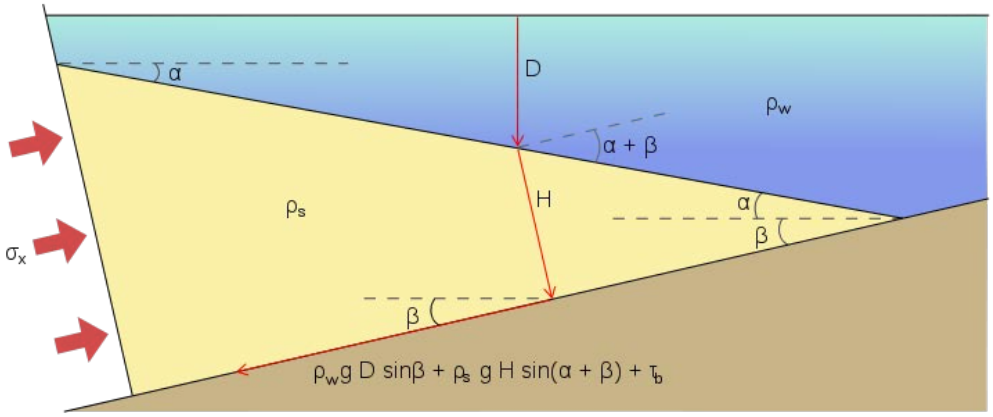
Great Valley Sequence map by Mikesclark, CC BY-SA 3.0

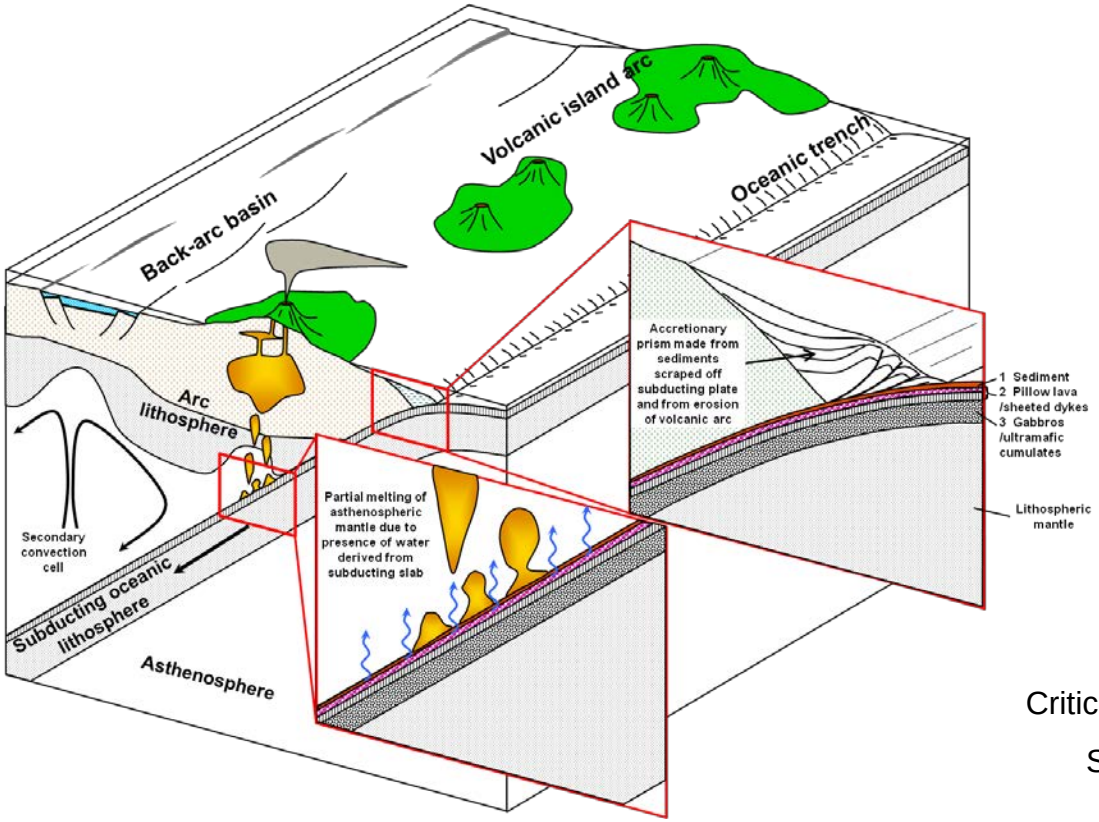




Types of Forearcs

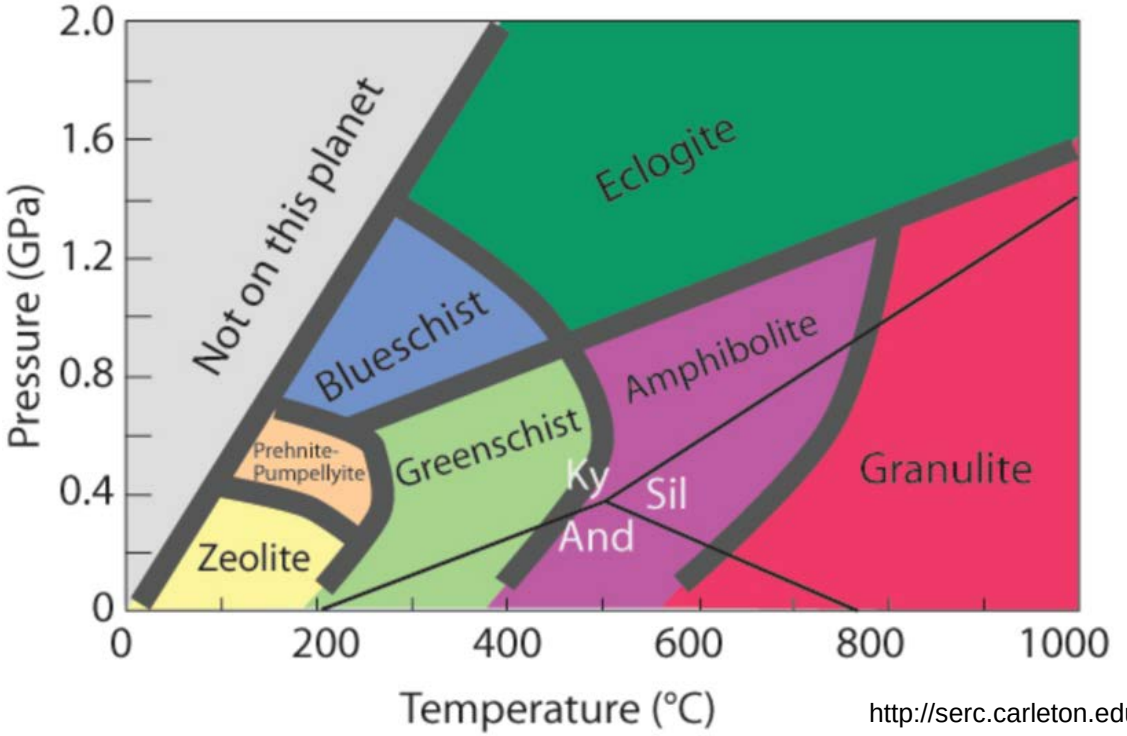
Forearc basin and near-trench sedimentation dominated by continentally-derived hemipelagic and debris flow deposits





Just like retroarc fold-thrust belts, accretionary prisms ("forearc fold-thrust belts") are wedge-shaped with a topographic slope (alpha) and a basal dip (beta)

-The internal structure of ancient accretionary prisms (more specifically, mélanges) is more “jumbled” than retroarc fold-thrust belts

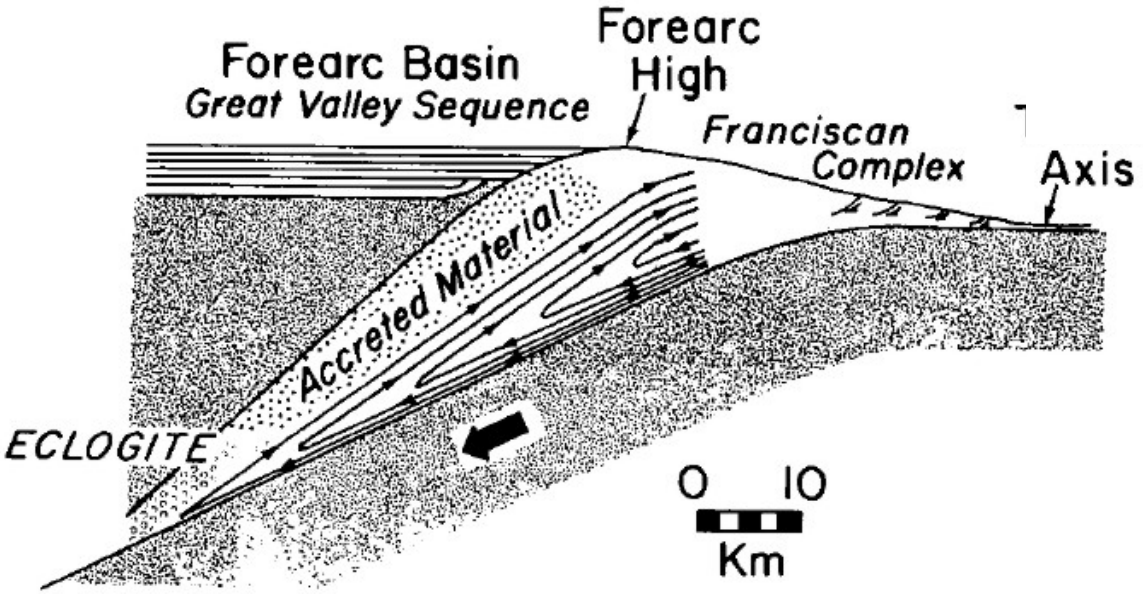


-Often discrete blocks of HP and UHP rocks in a “matrix” of lower grade material

http://serc.carleton.edu/research_education/equilibria/classicalthermobarometry.html

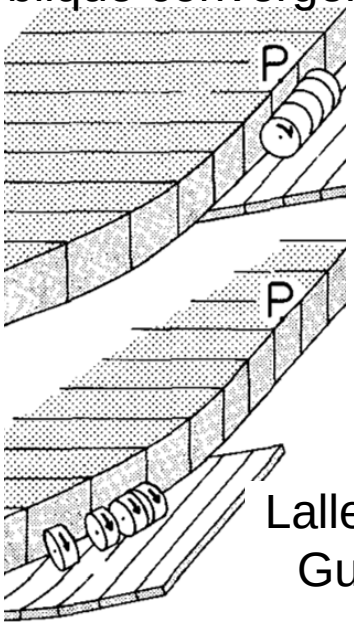
Several ideas for exhuming high pressure rocks in mélanges:

Subduction channel



Cloos 1982

Oblique convergence

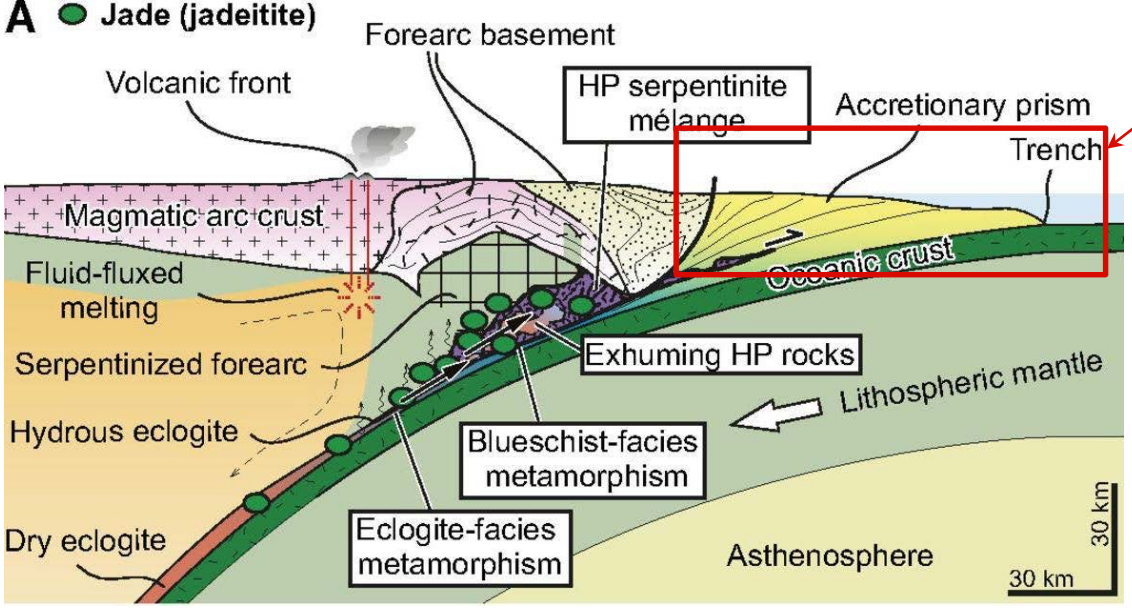


Lallemant and Guth, 1990

Also:

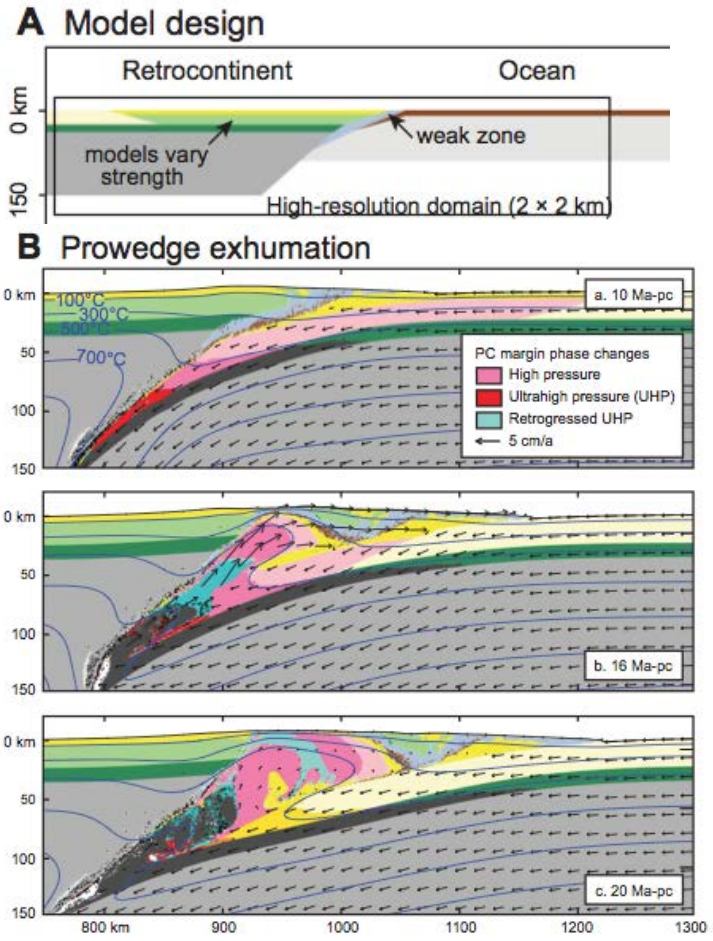
-Buoyant ascent and normal faulting (Platt, 1987)

- Mass wasting and normal faulting (von Huene et al., 2003)

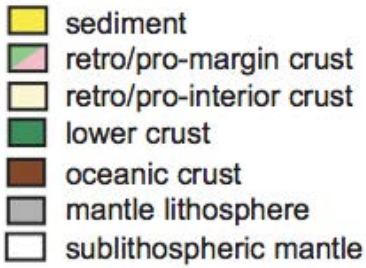


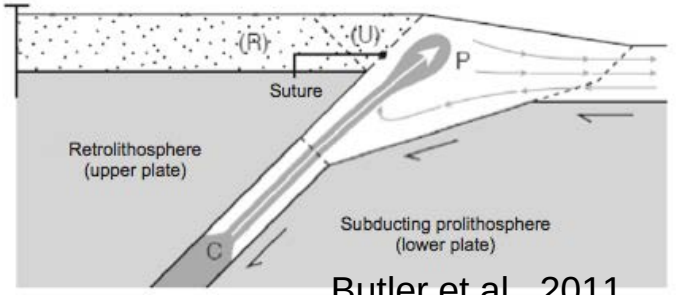
Stern et al 2013

We have great data for this area



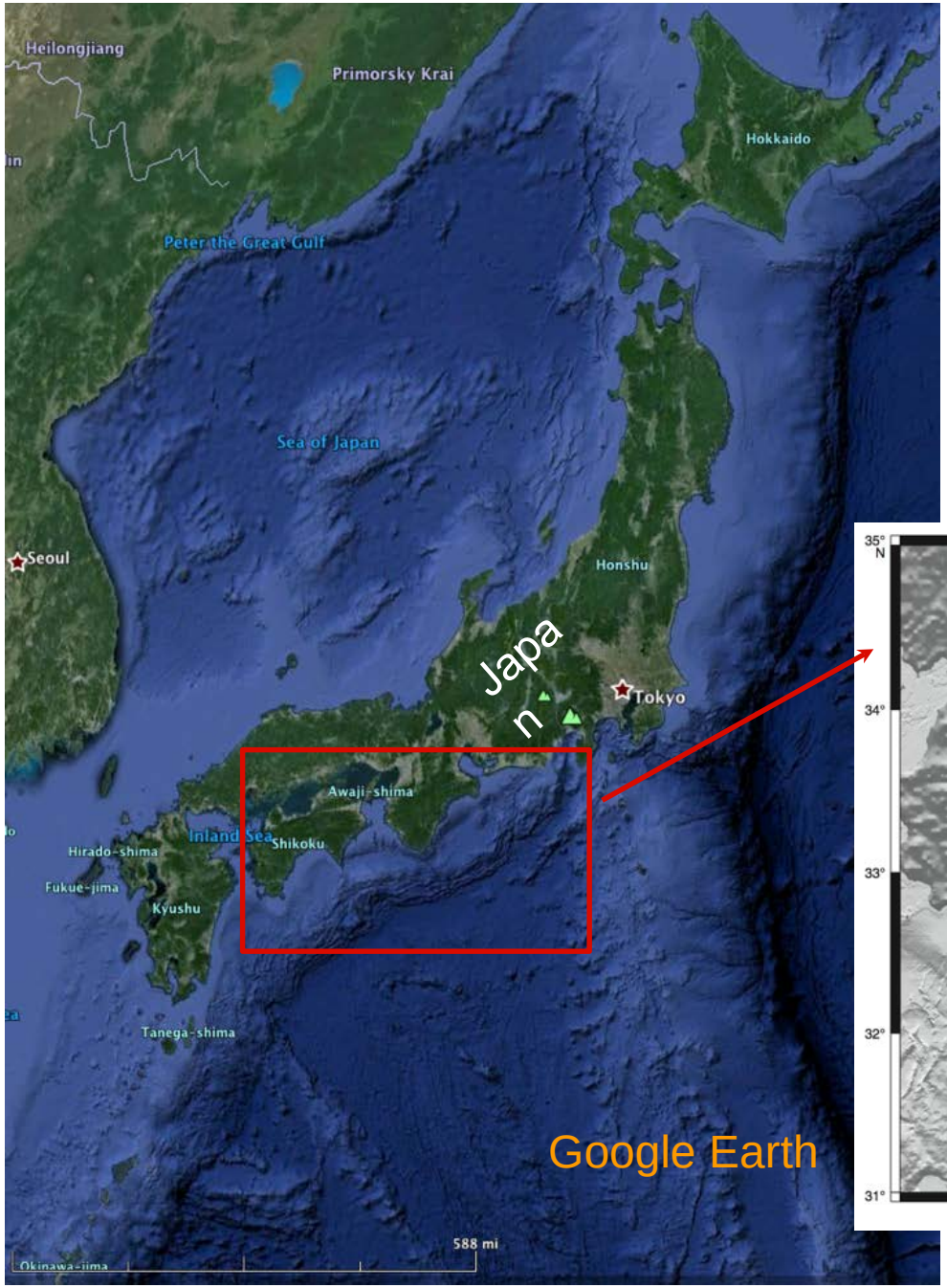
Buoyant, “diapir”-like rise currently popular model to explain high pressure rocks exhumed at subduction zones; still need better geophysical data to explore deep processes

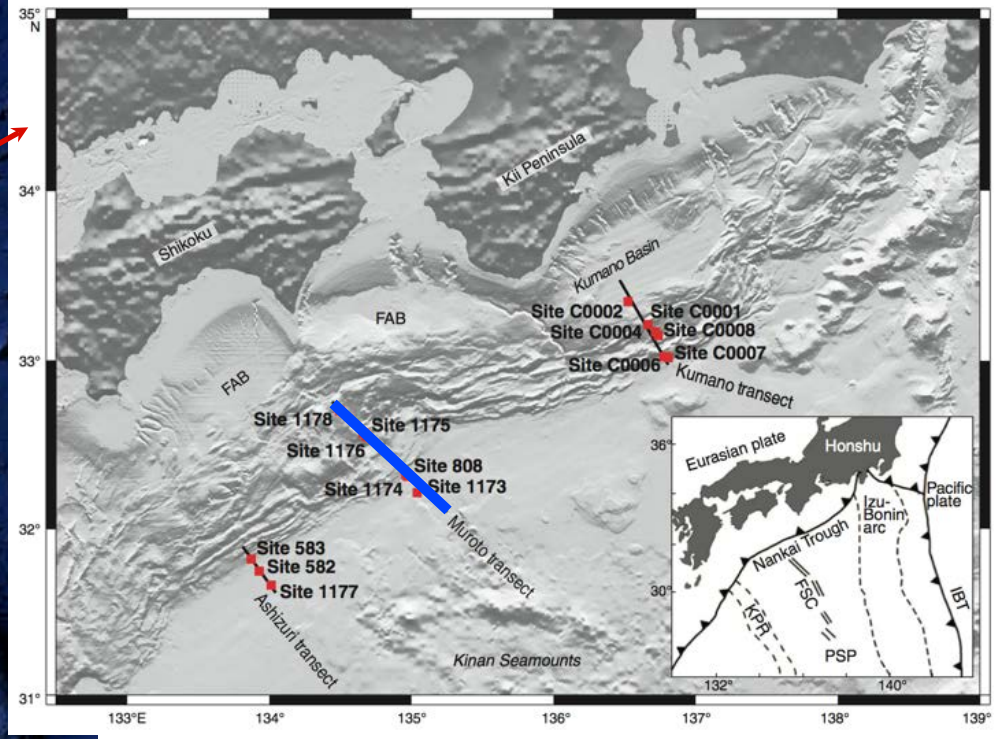




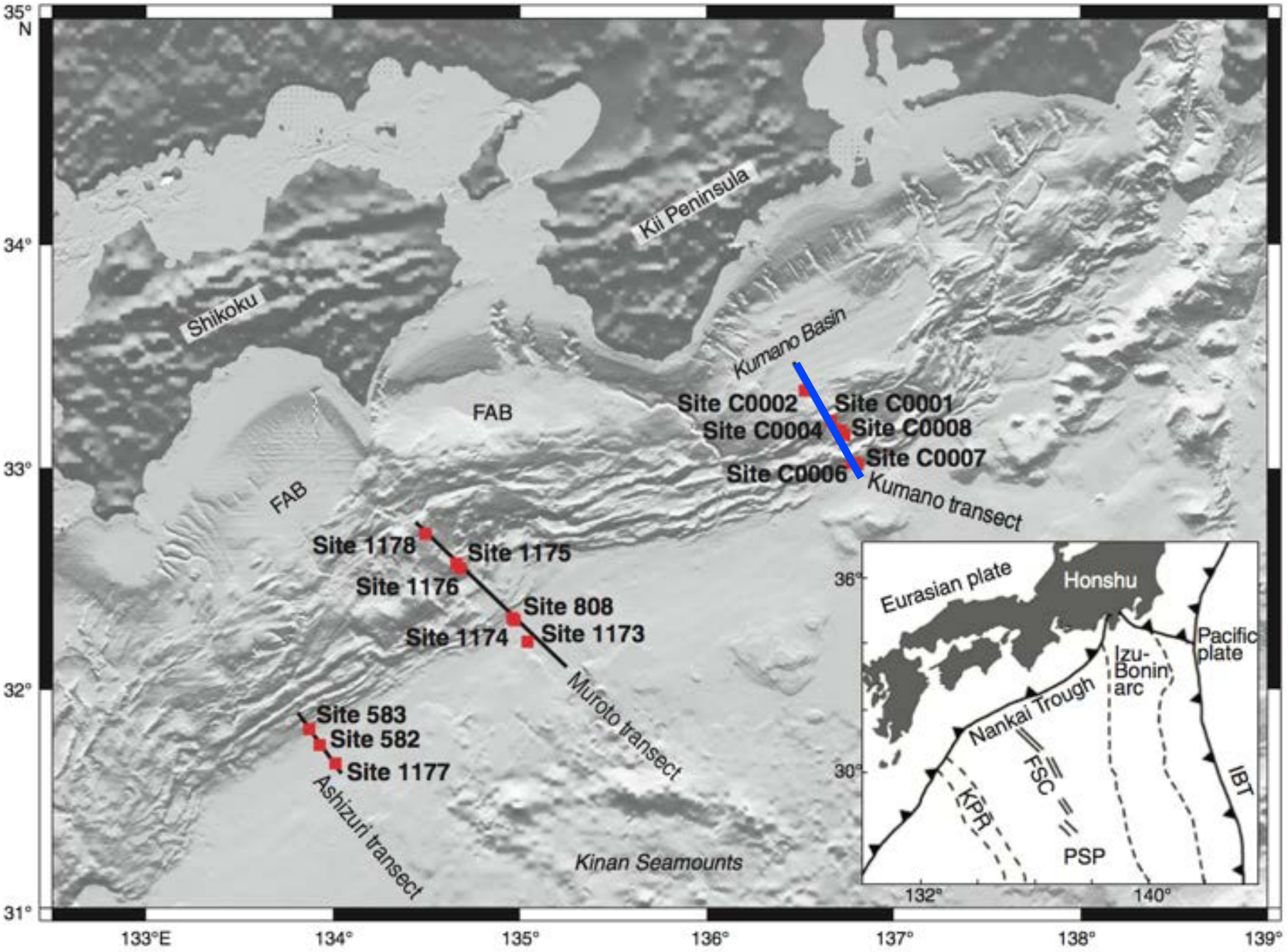
Butler et al., 2011

High resolution bathymetry coupled with 3D seismic reflection data and boreholes provide detailed views of structures at plate boundary: some structures similar to retroarc fold-thrust belts!

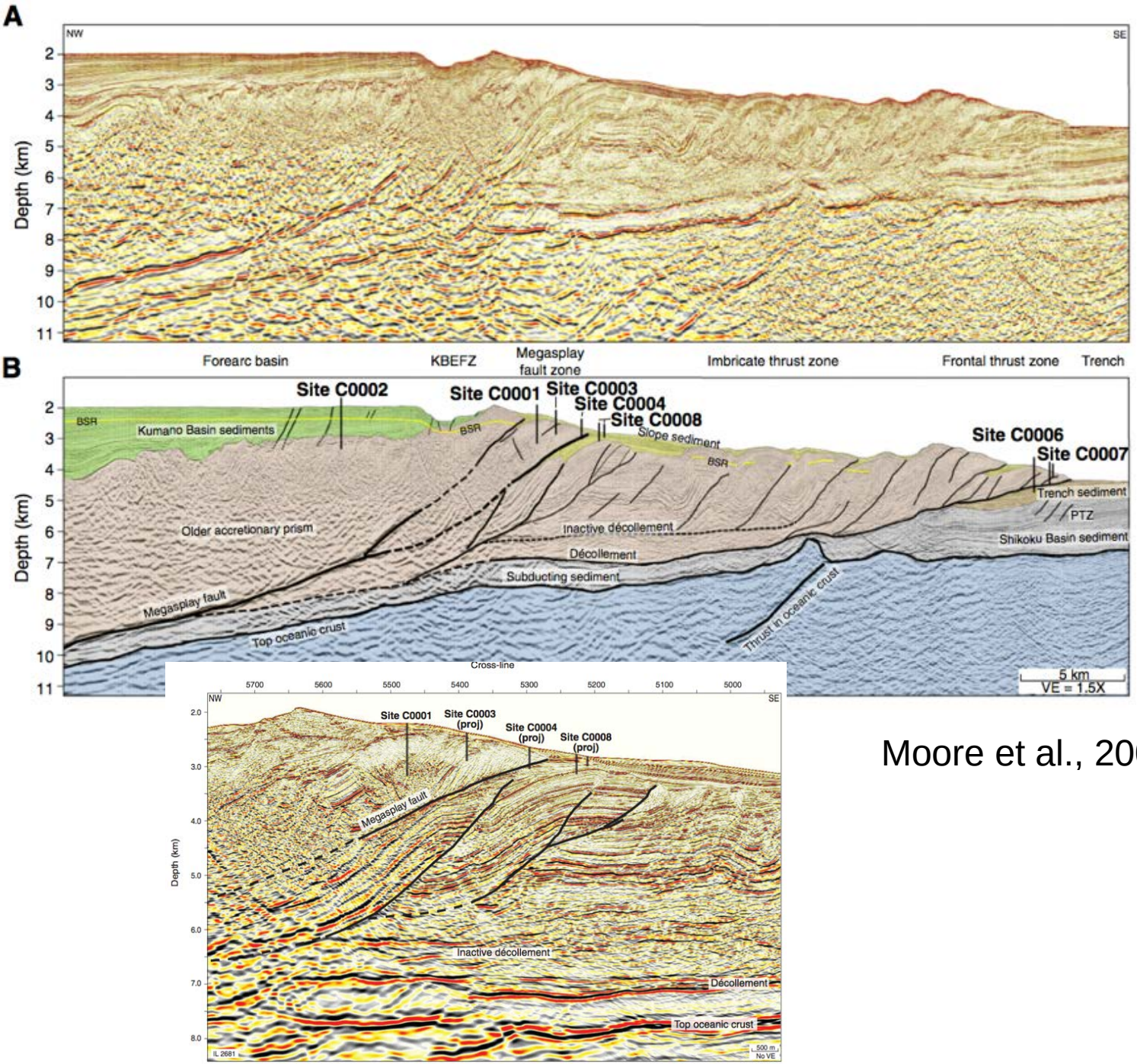




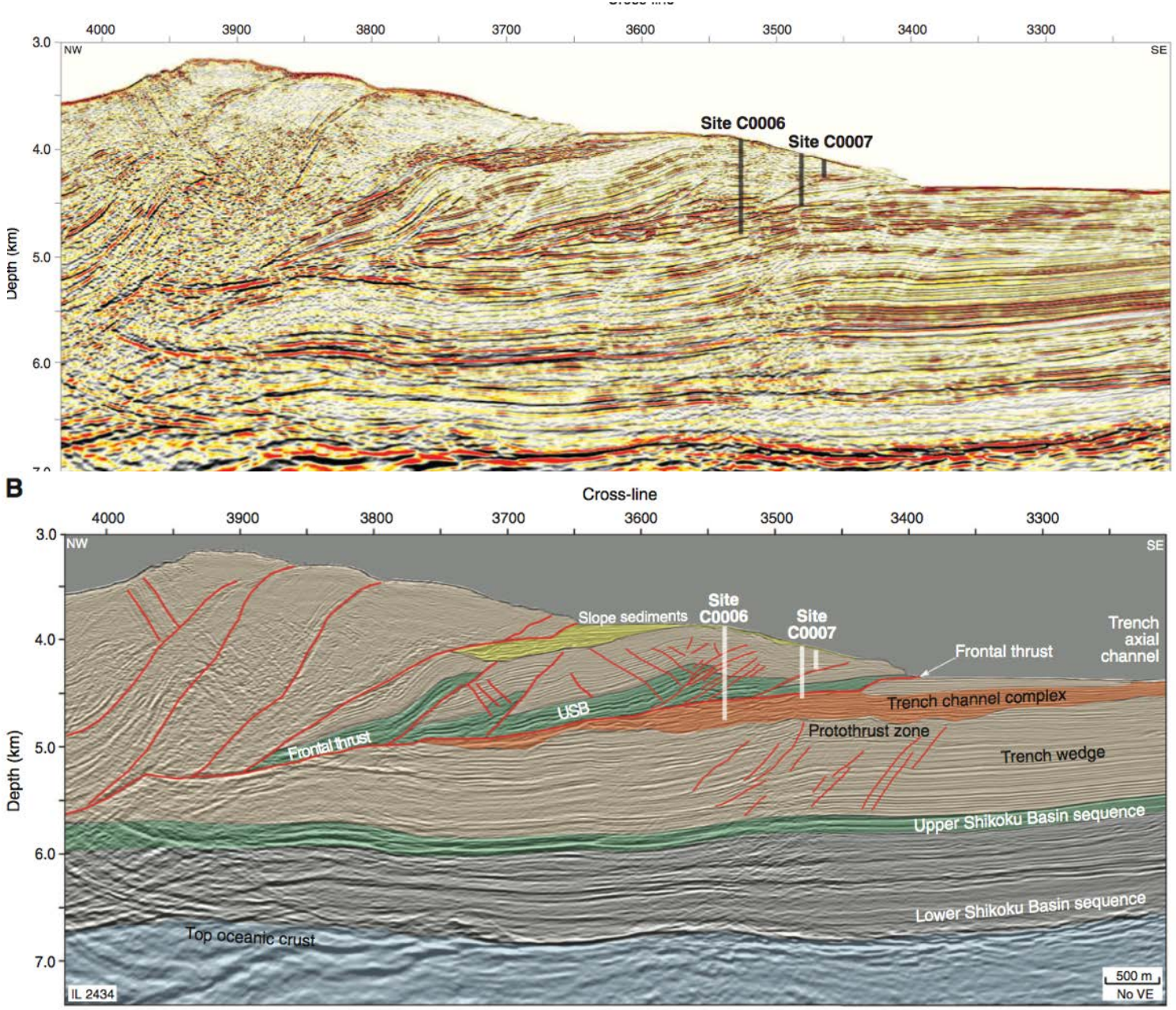
Moore et al., 2009



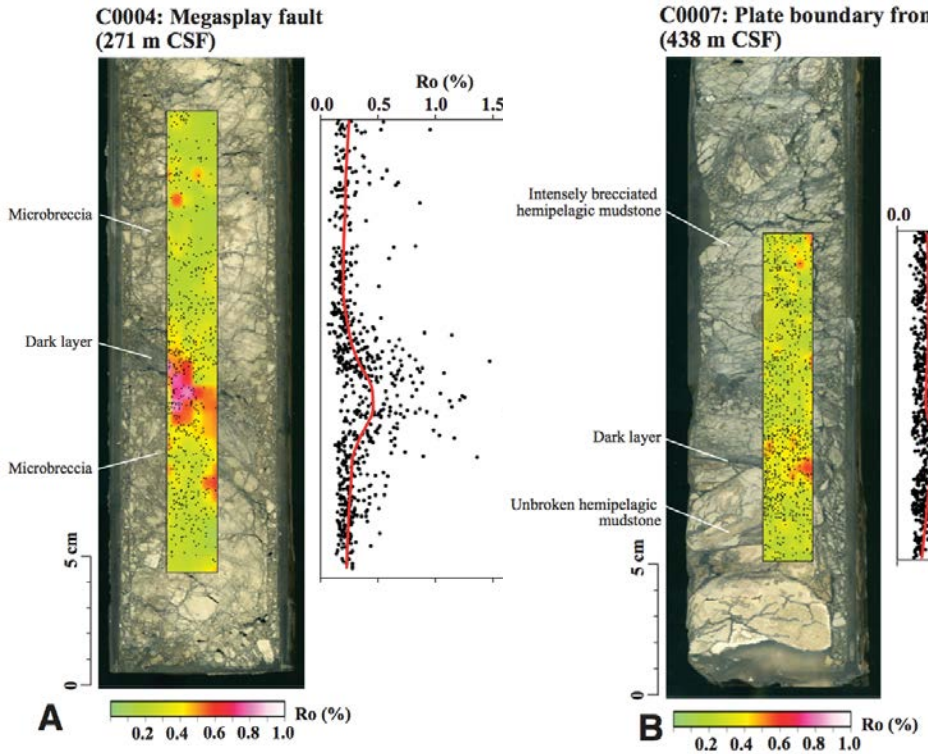
Moore et al., 2009

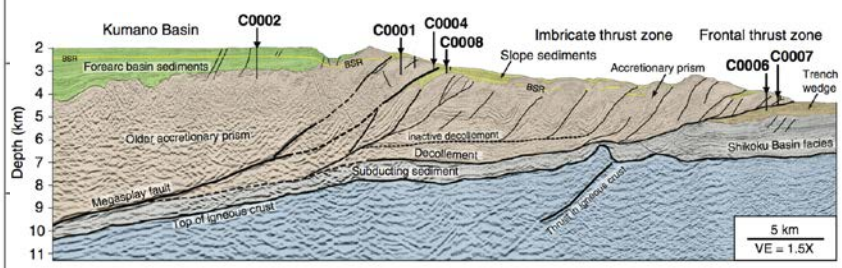


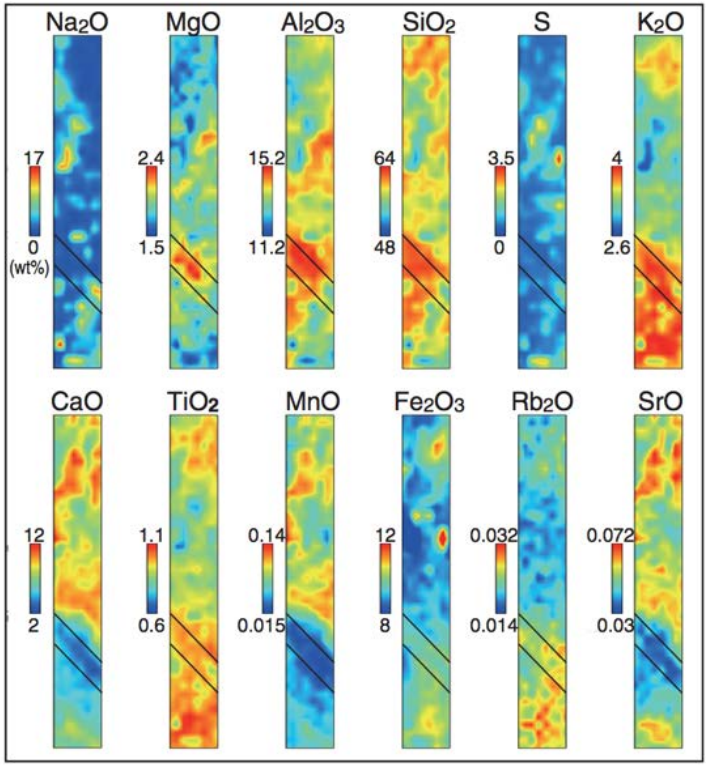
Moore et al., 2009



Moore et al., 2009







Core from out-of-sequence “splay” fault indicates frictional heating along fault zone

Yamaguchi et al., 2011;
Sakaguchi et al., 2011

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