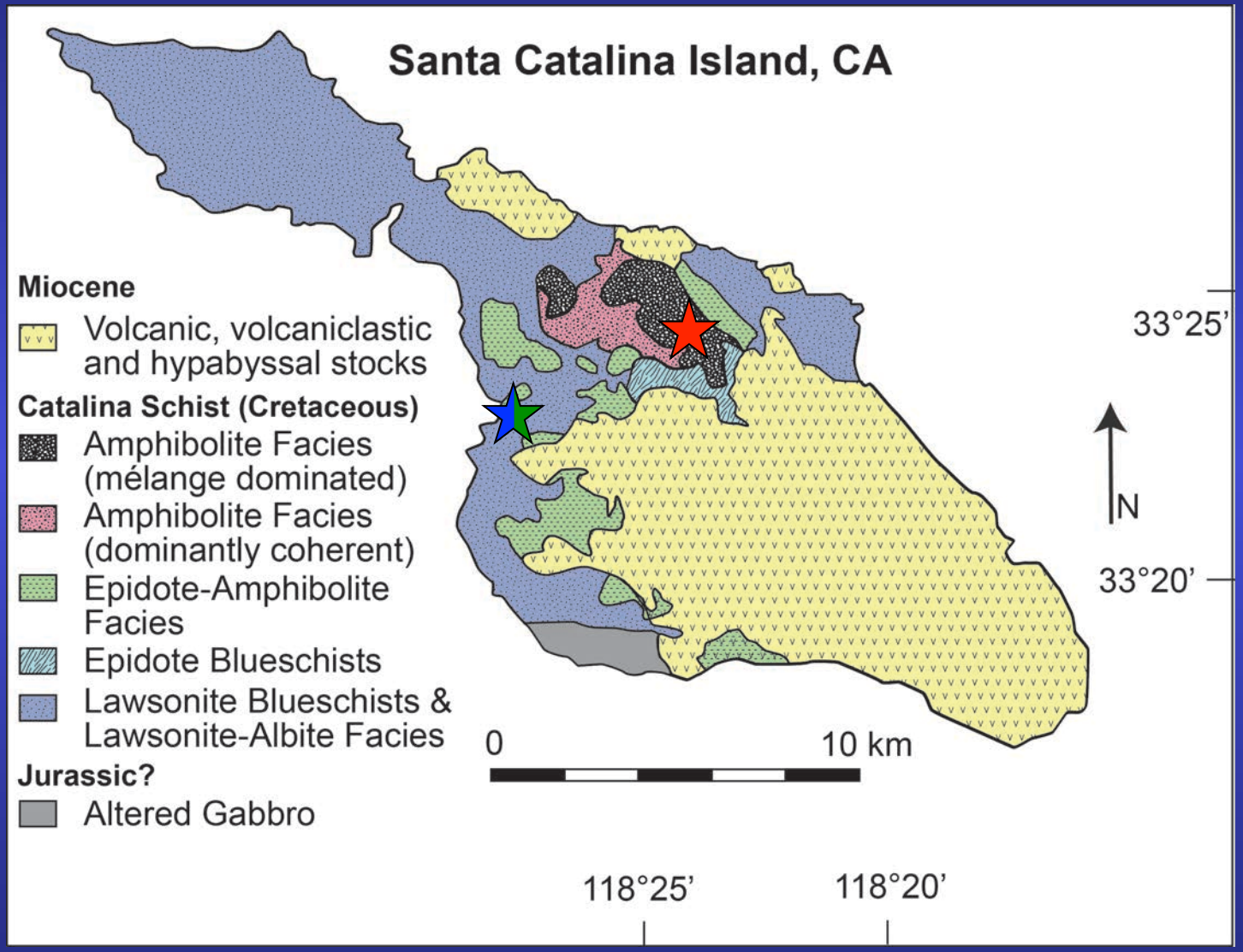
# Catalina Schist Field Trip
# 10/15/15

***Sarah Penniston-Dorland***, *Univ of Maryland*

# Sunrise Ferry

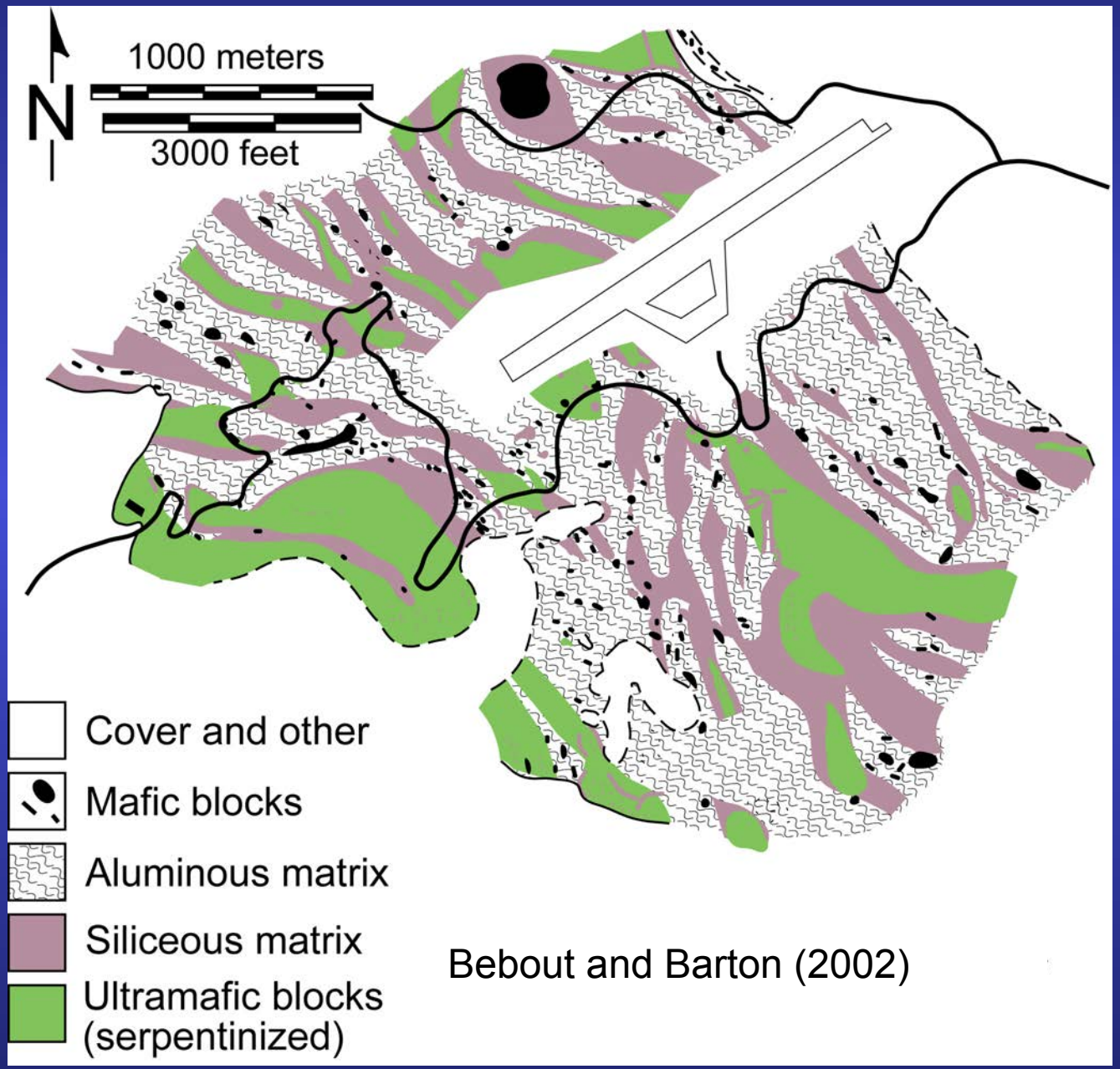
# Respect the lifeforms on the island

# Catalina Schist Geologic Map




Grove and Bebout, 1995; Bebout, 2007

# Km-scale melange




Bebout and Barton (2002)

# Rocks and Minerals
# Amphibolite Facies

## Mafic blocks –
Hornblende, plagioclase, garnet, epidote, rutile, titanite

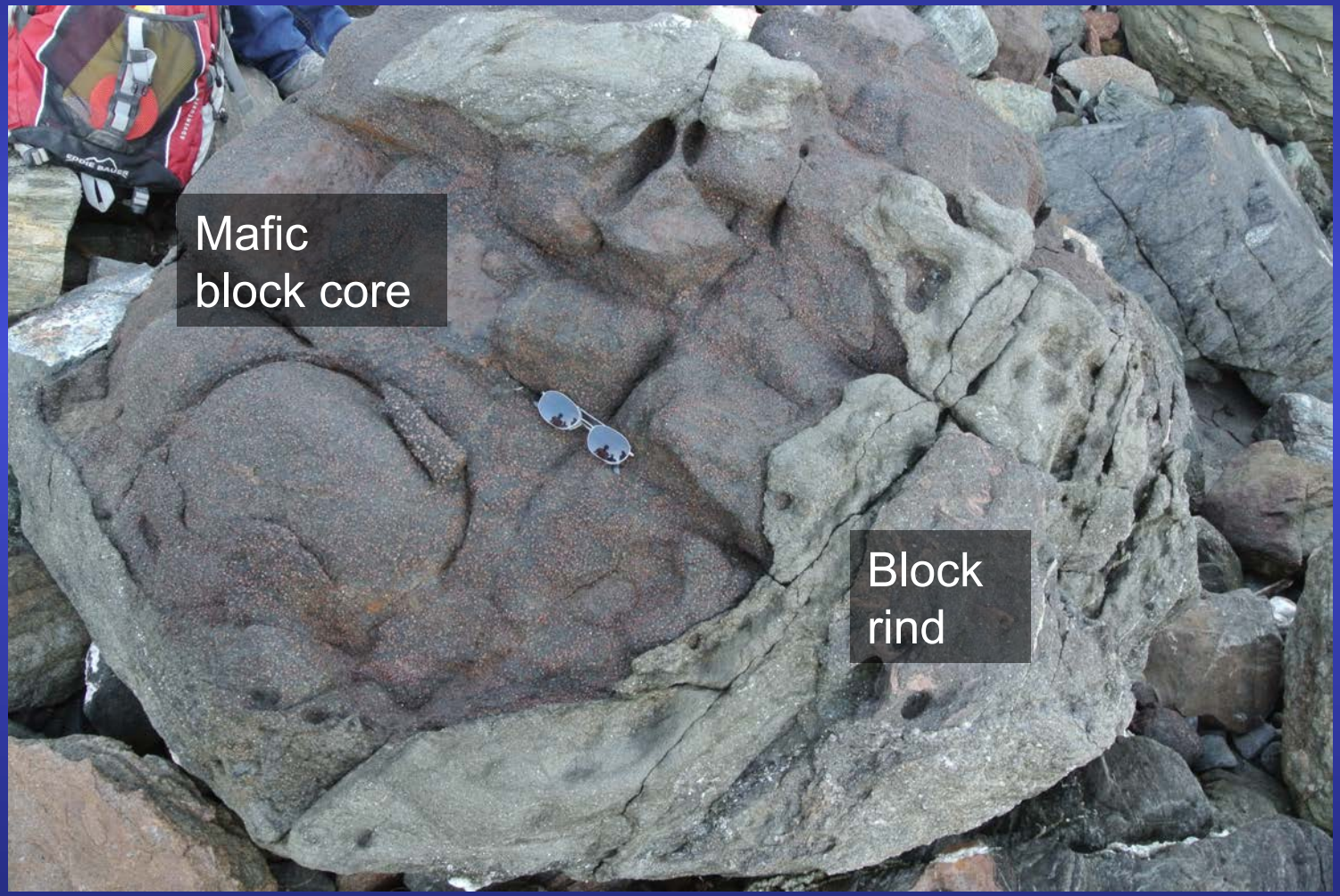
# Rocks and Minerals
# Amphibolite Facies

## Siliceous Matrix–
Talc, anthophyllite, serpentine, enstatite, quartz

## Mafic Matrix–
Chlorite, actinolite, rutile, titanite

# Rocks and Minerals
# Amphibolite Facies

## Mafic reaction rind–
**Actinolite, chlorite, phengite, quartz, rutile**



# Rocks and Minerals
# Lawsonite-Blueschist Facies

## Mafic blocks –Chlorite, albite, Na-amphibole, titanite

## Metachert

## Metaconglomerate –
A variety of clasts, dominantly igneous

## Dioritic clasts include:
Lawsonite, phengite, Na-amphibole, relict hornblende and plagioclase

# Rocks and Minerals
# Lawsonite-Blueschist Facies

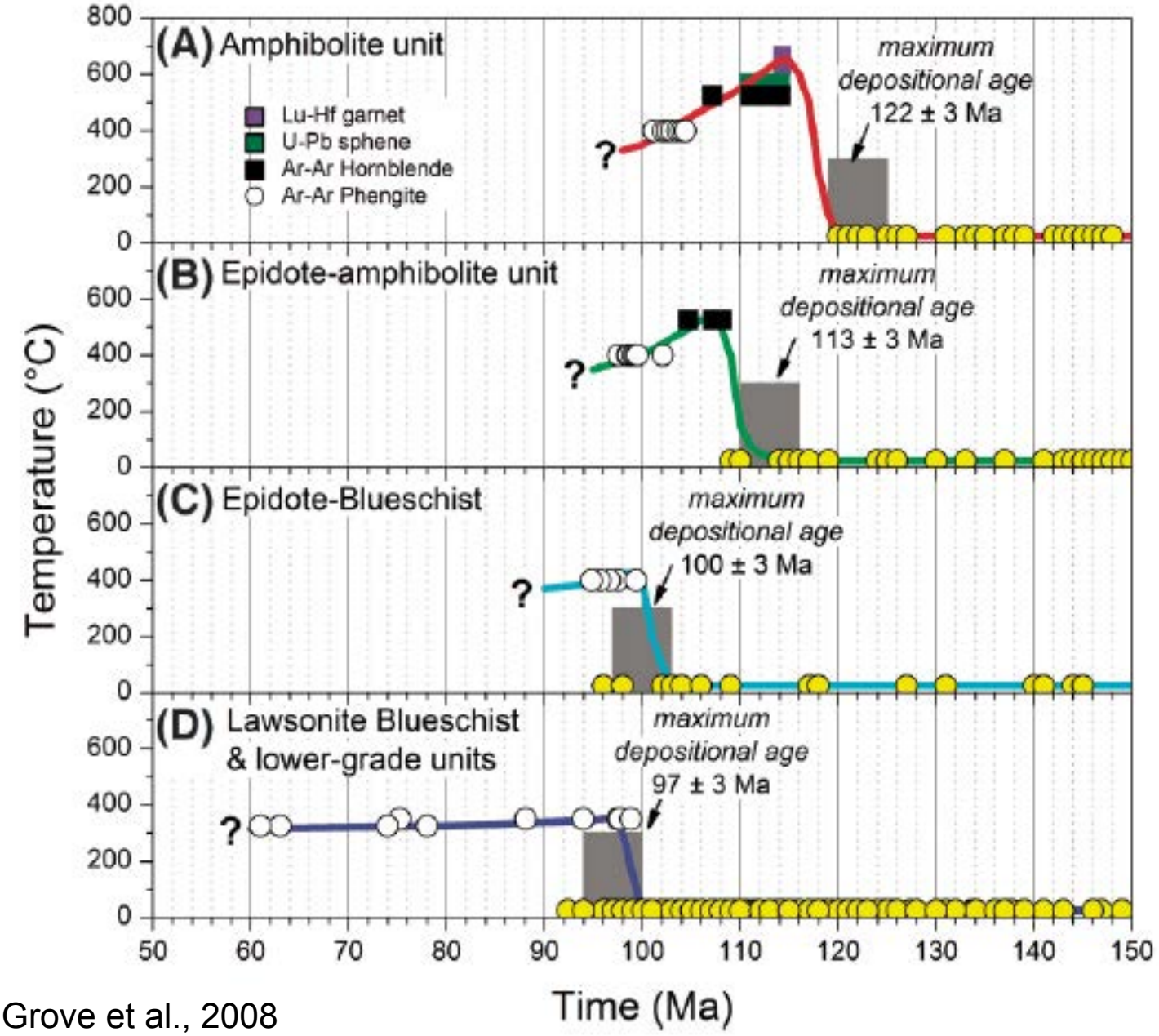
## Matrix –

**Mafic** component –
chlorite, actinolite, Na-amphibole

**Sedimentary** component –
graphite, Na-amphibole

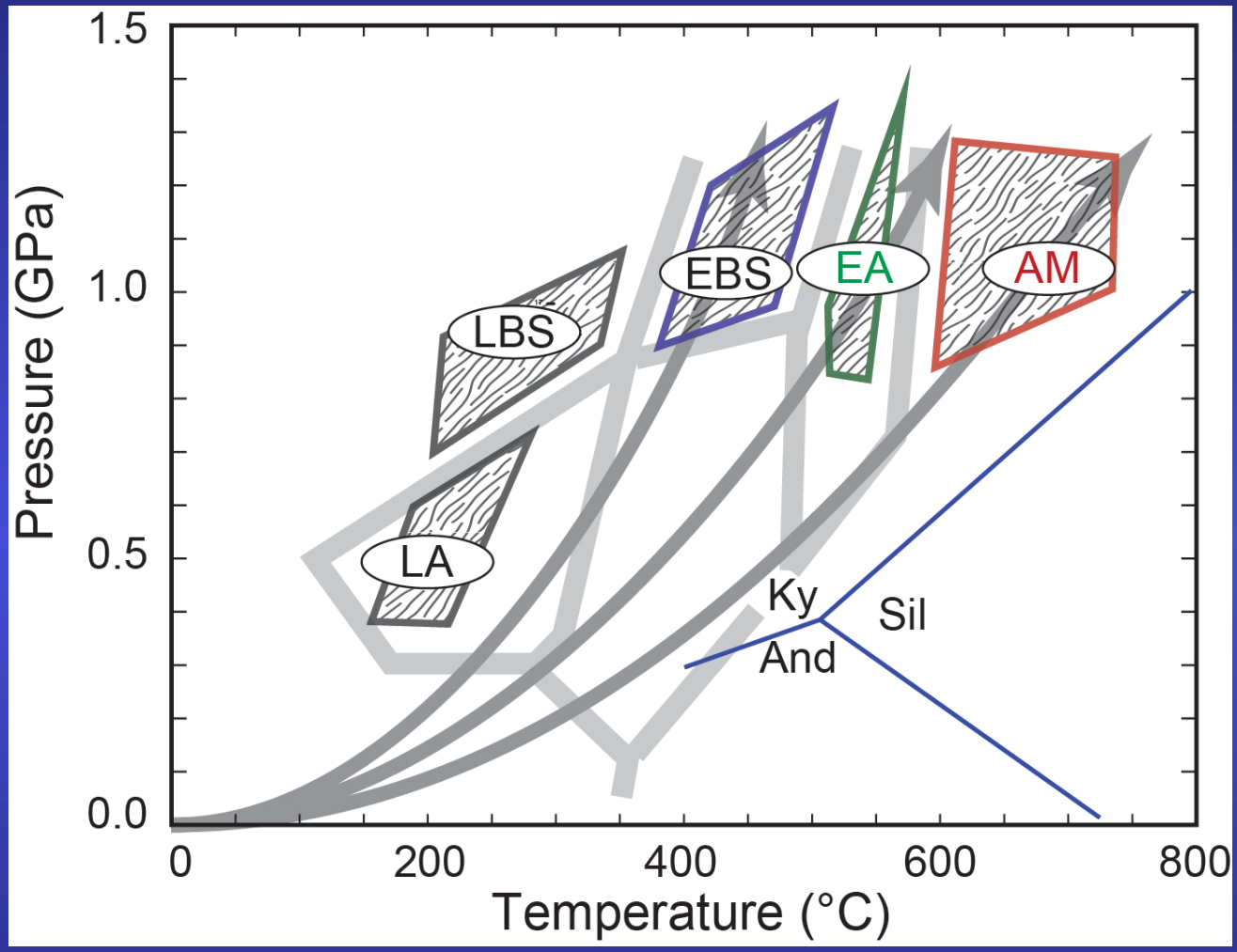
**Ultramafic** component –
fuchsite, talc

# Geochronology of the Catalina Schist



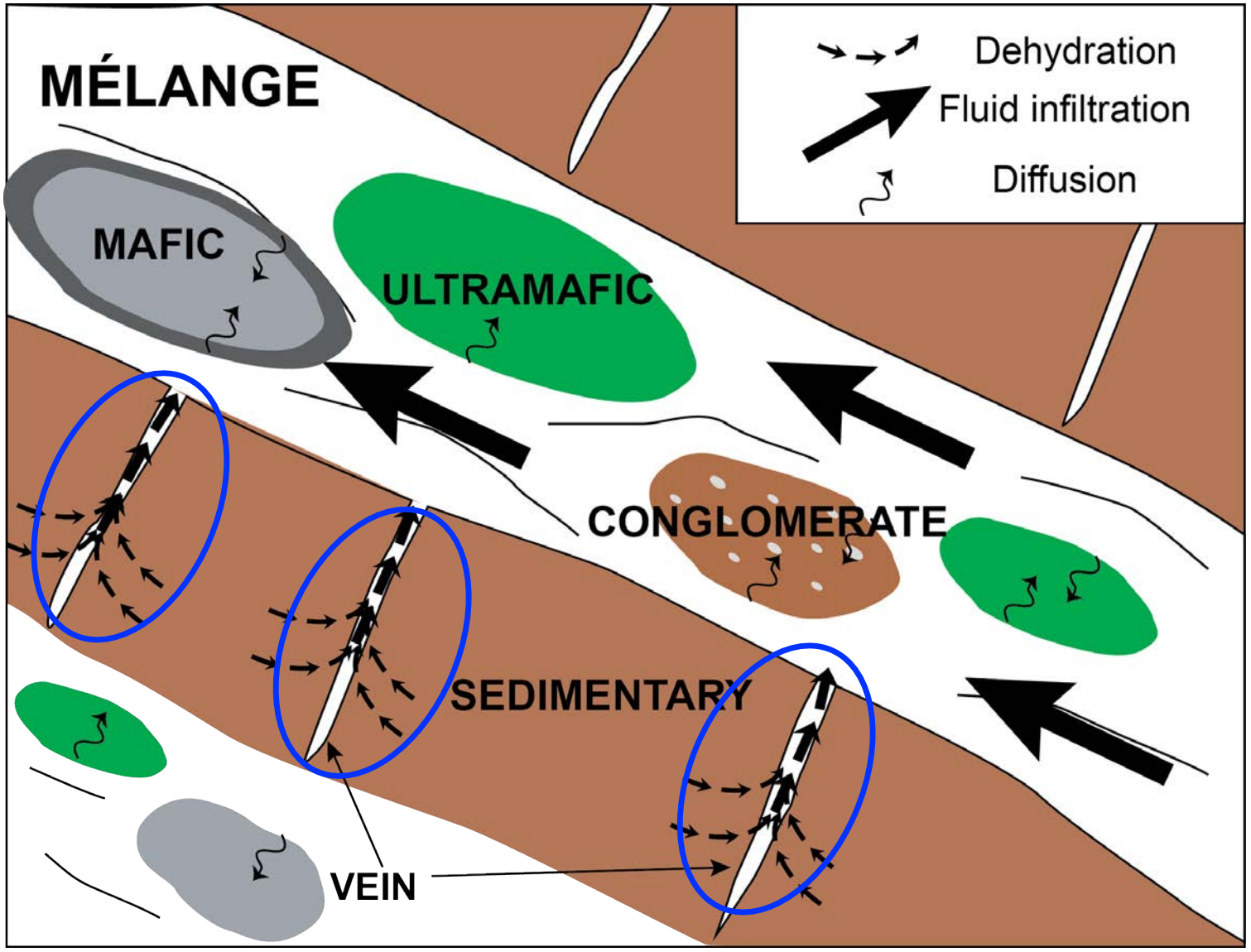

Grove et al., 2008

# P-T conditions of the Catalina Schist




Sorensen and Barton, 1987; Grove and Bebout, 1995; Bebout, 2007

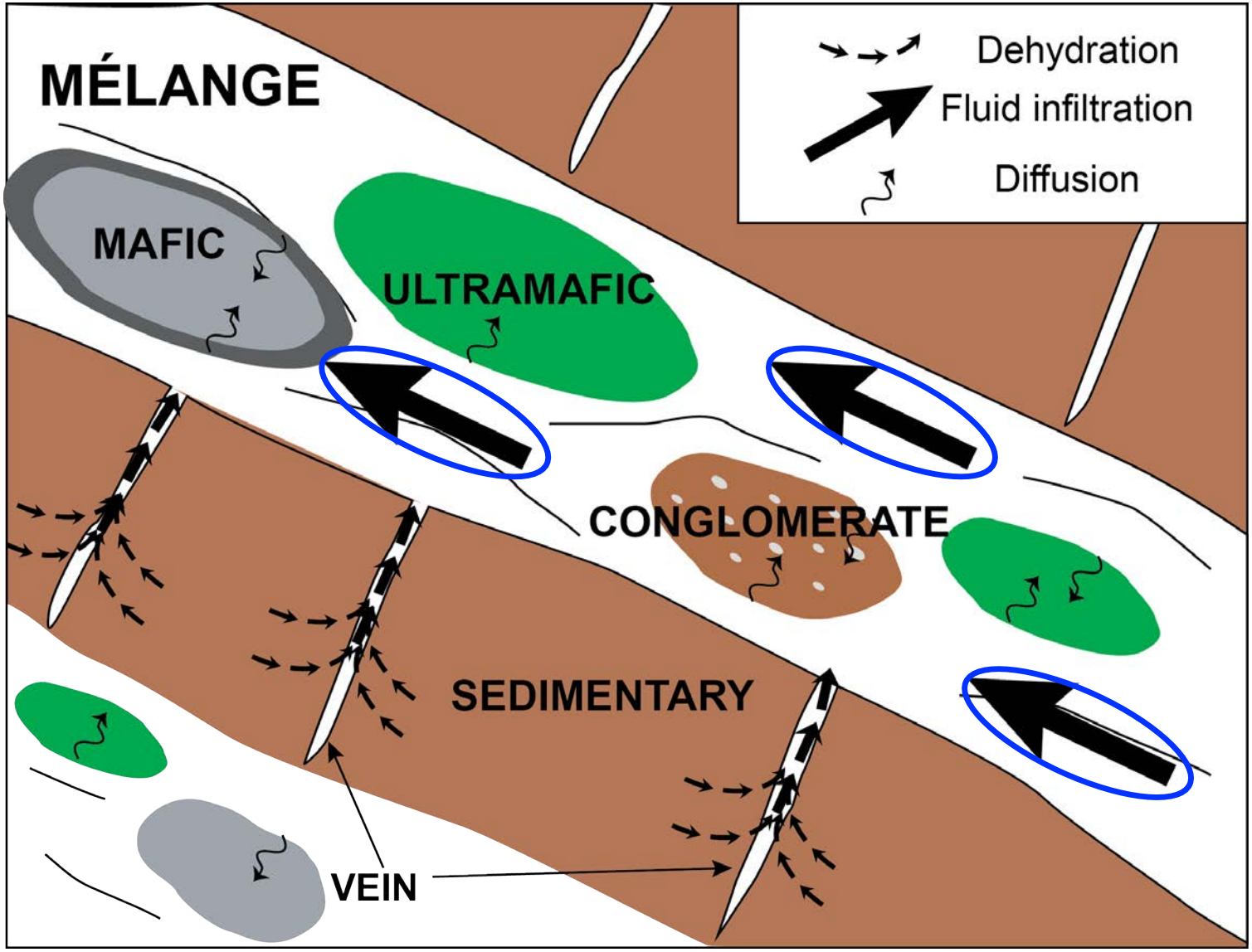
# Conceptual model for metasomatism and fluid flow in Catalina Schist




after Bebout et al., 1997

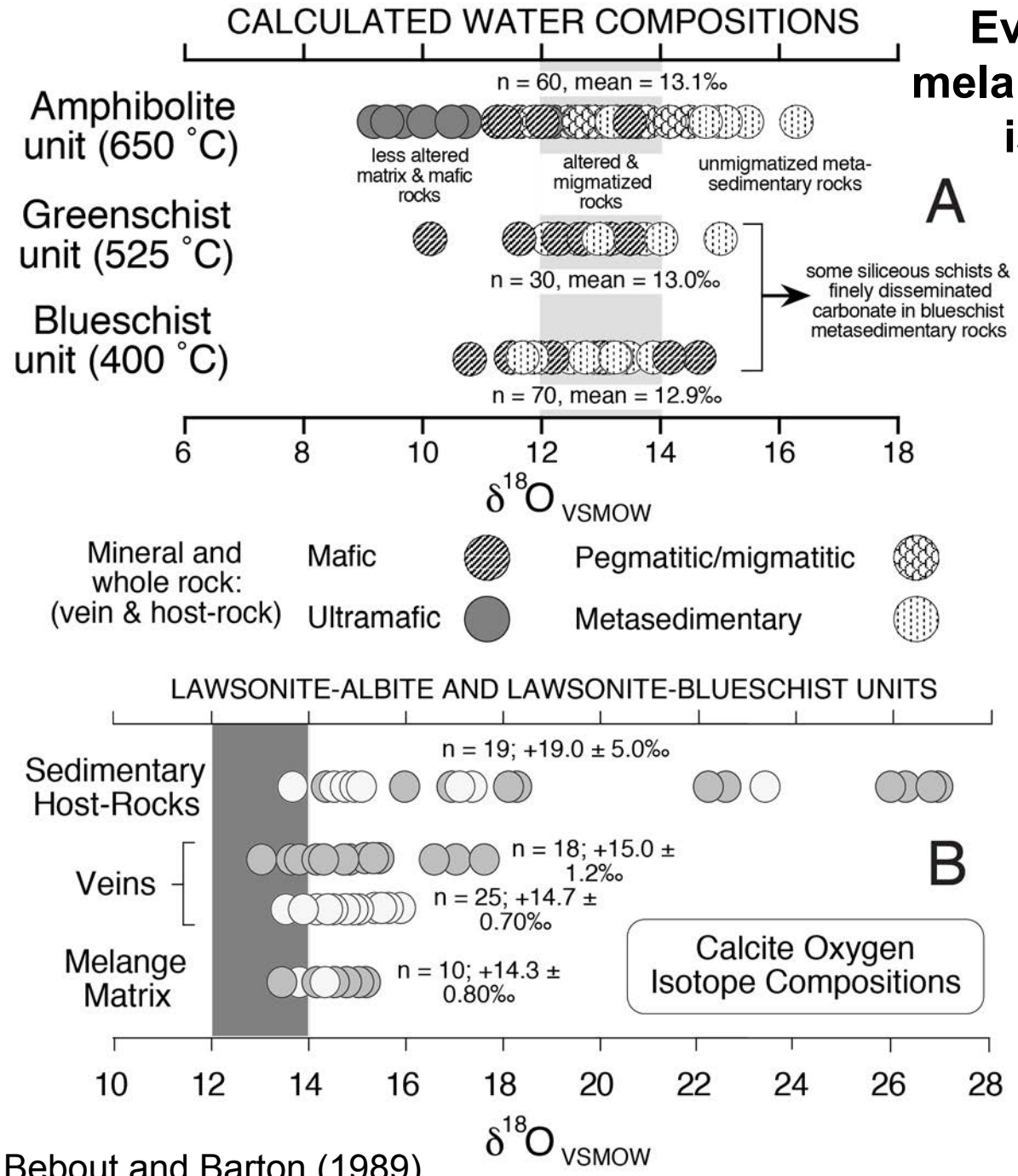
# Fluid flow in melange: Veins

# Conceptual model for metasomatism and fluid flow in Catalina Schist




after Bebout et al., 1997

# Evidence for fluid flow in melange: Homogenized stable isotope compositions

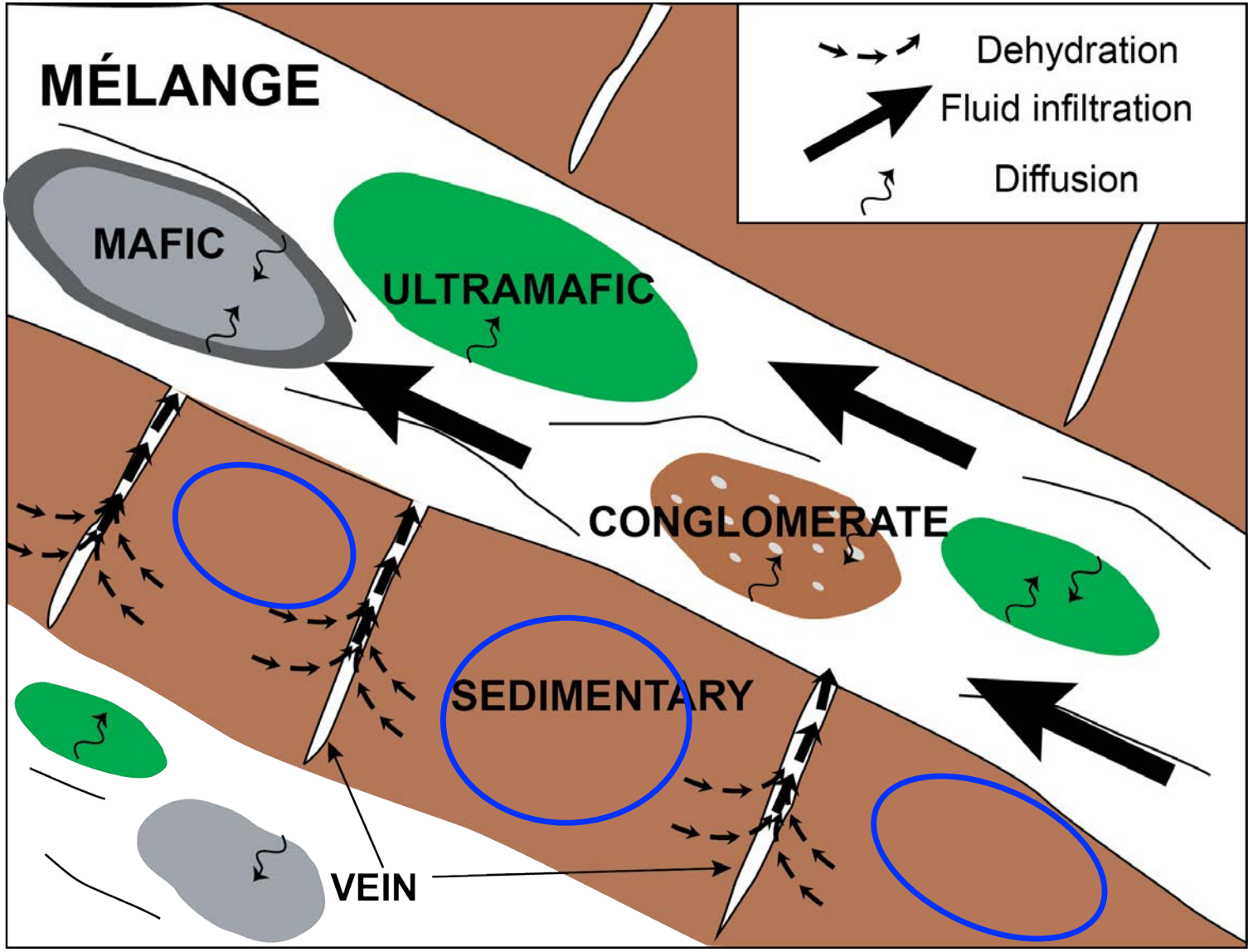



Bebout and Barton (1989)

Amphibolite

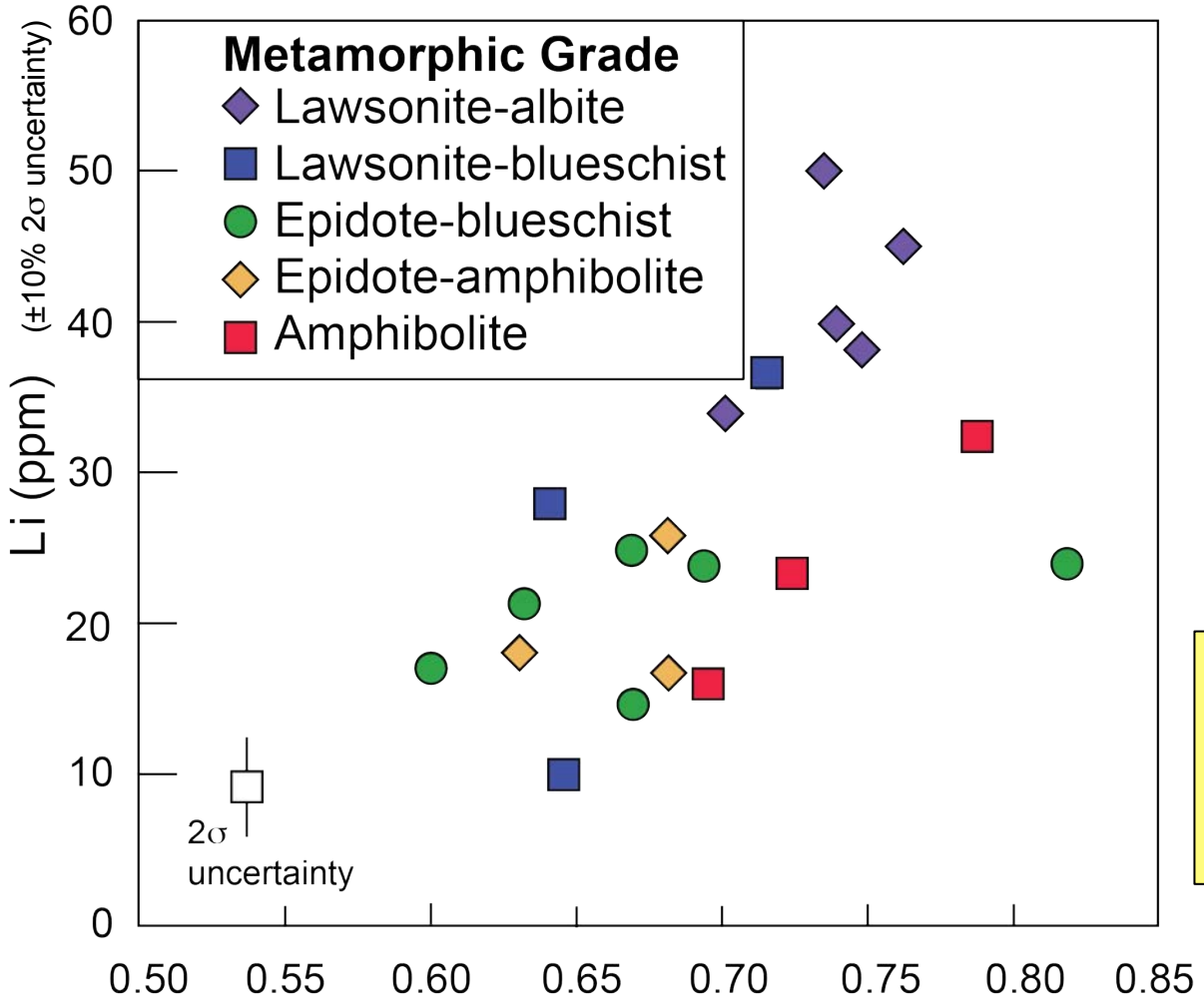
Lawsonite-Blueschist

# Conceptual model for metasomatism and fluid flow in Catalina Schist




after Bebout et al., 1997

# Evidence for lack of major effect of fluids on metasedimentary rocks



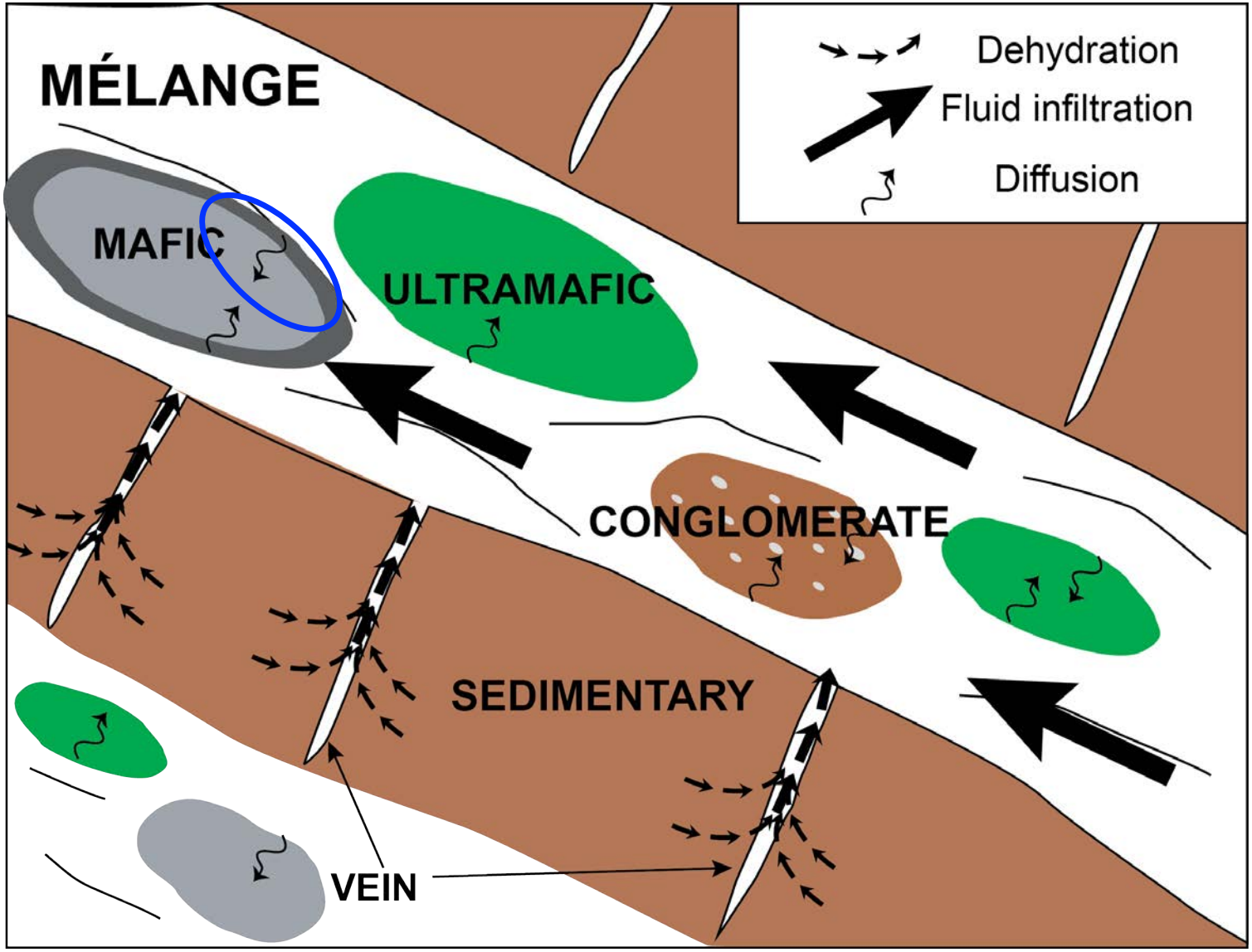

Li concentration correlates with Chemical Index of Alteration (CIA)

Li reflects degree of weathering of source of protolith

Penniston-Dorland et al., 2012

$$CIA = \frac{wt\%Al_2O_3}{\left(wt\%Al_2O_3 + wt\%Na_2O + wt\%K_2O + wt\%CaO^*\right)}$$

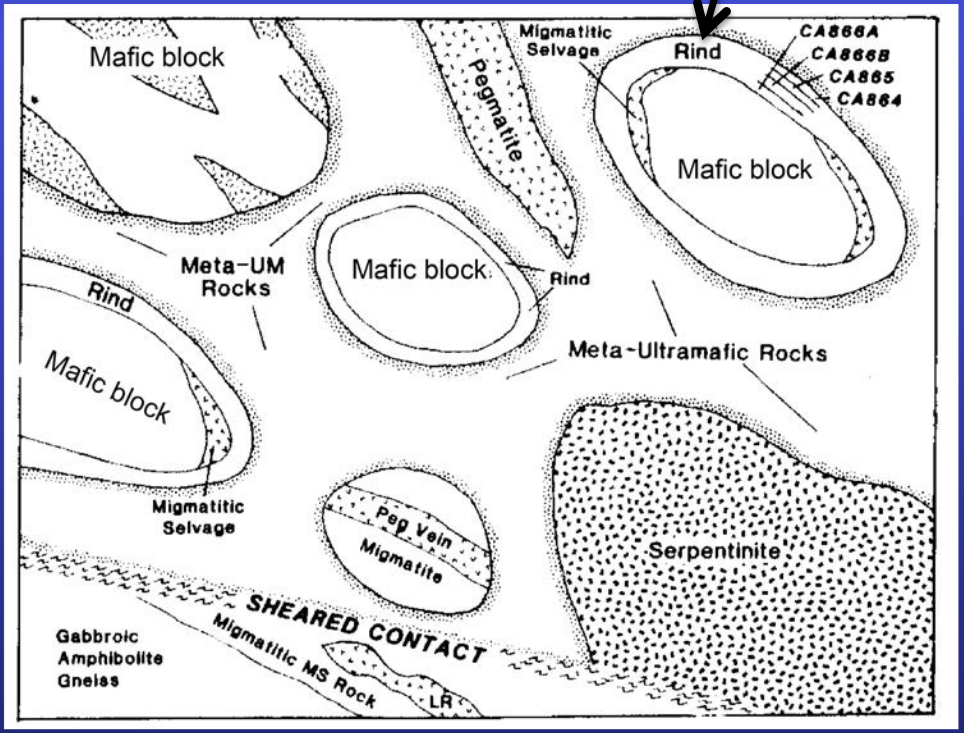
# Conceptual model for metasomatism and fluid flow in Catalina Schist

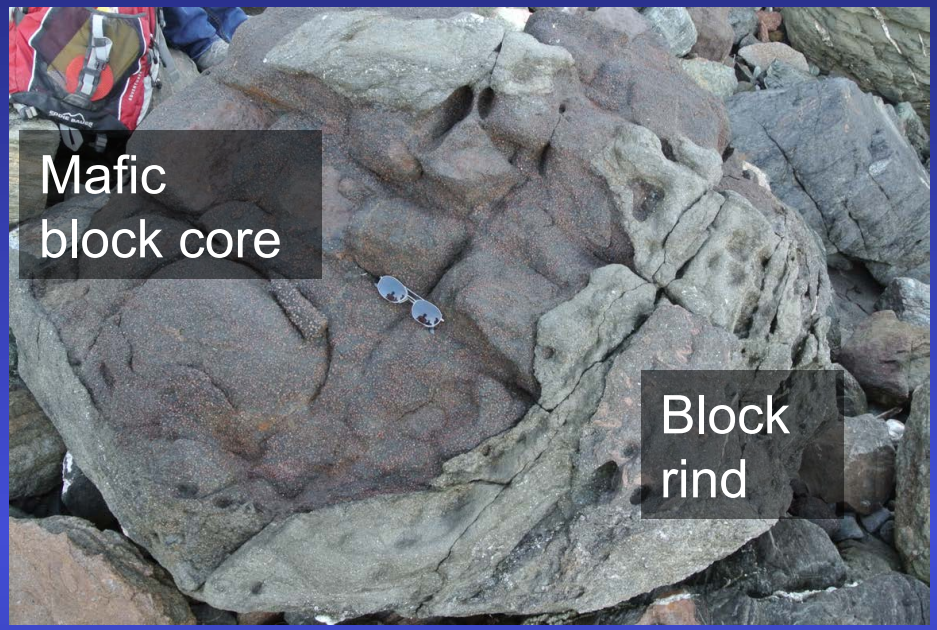



after Bebout et al., 1997

# Fluid flow in melange: Reaction rinds

Elevated concentrations of K, Rb, Th, Ba ± Sr but also Mg, Ni, Cr, Os…

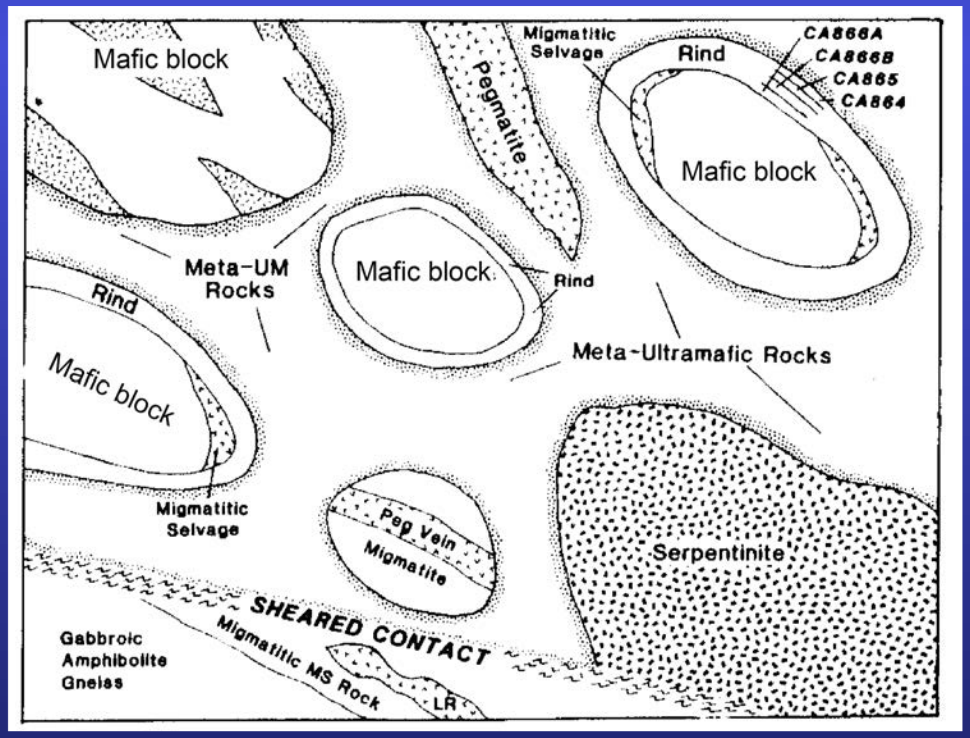


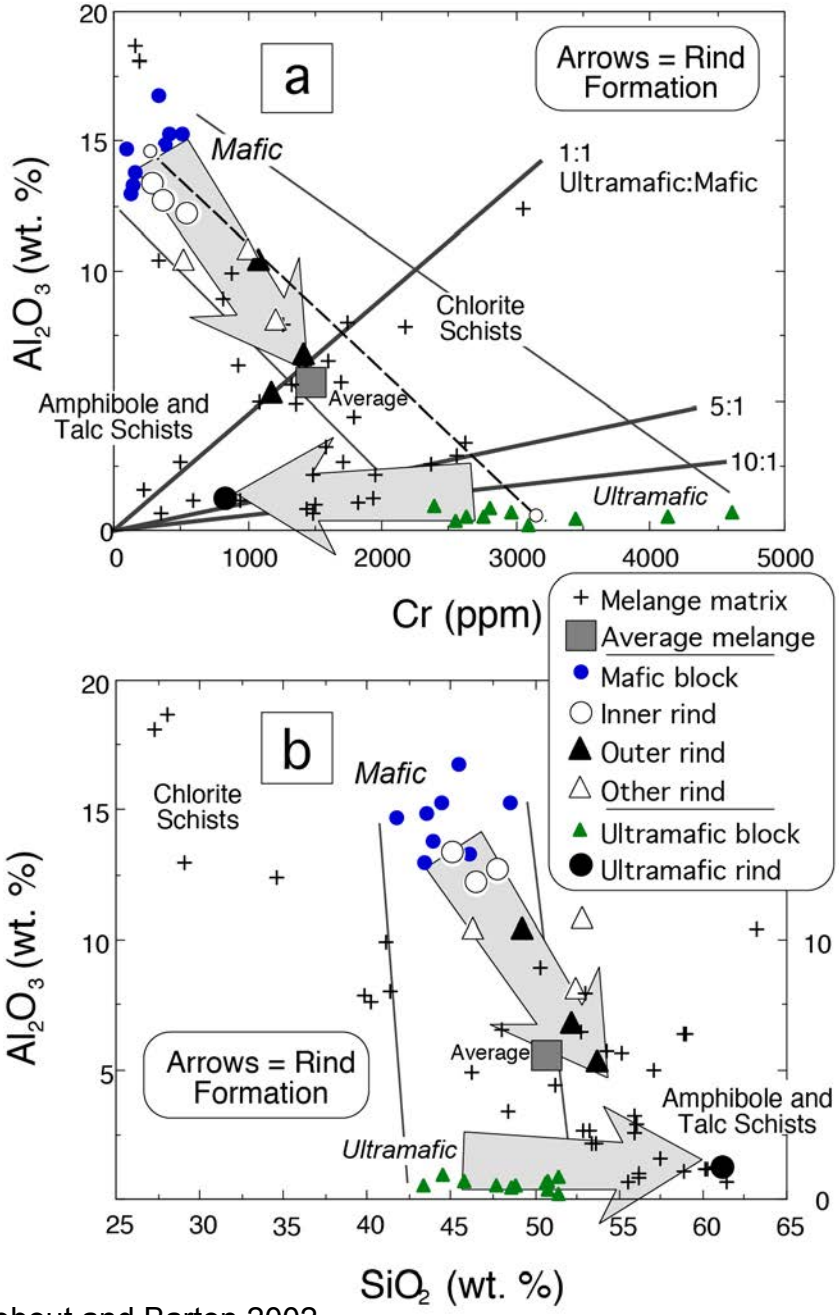

Sorensen and Grossman, 1989

# Partial melting

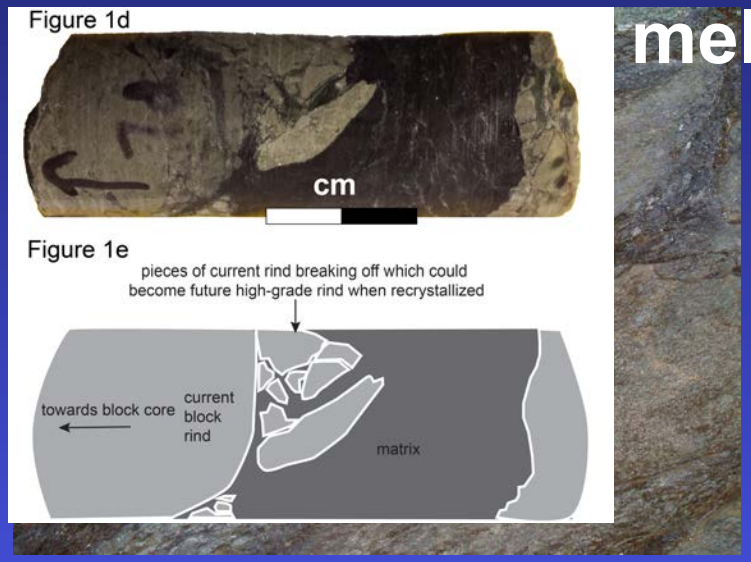
Sorensen and Grossman, 1989

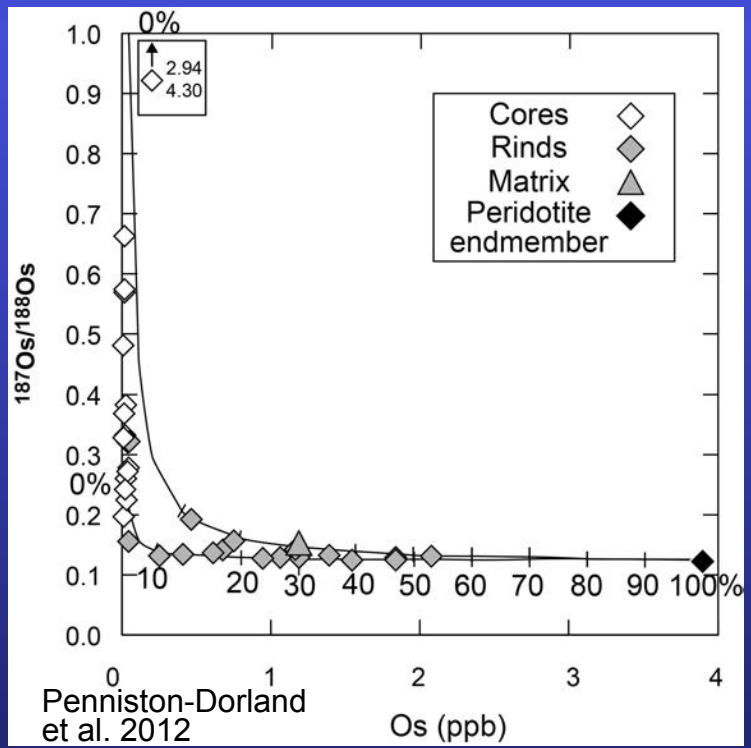



# Mechanical mixing in melange



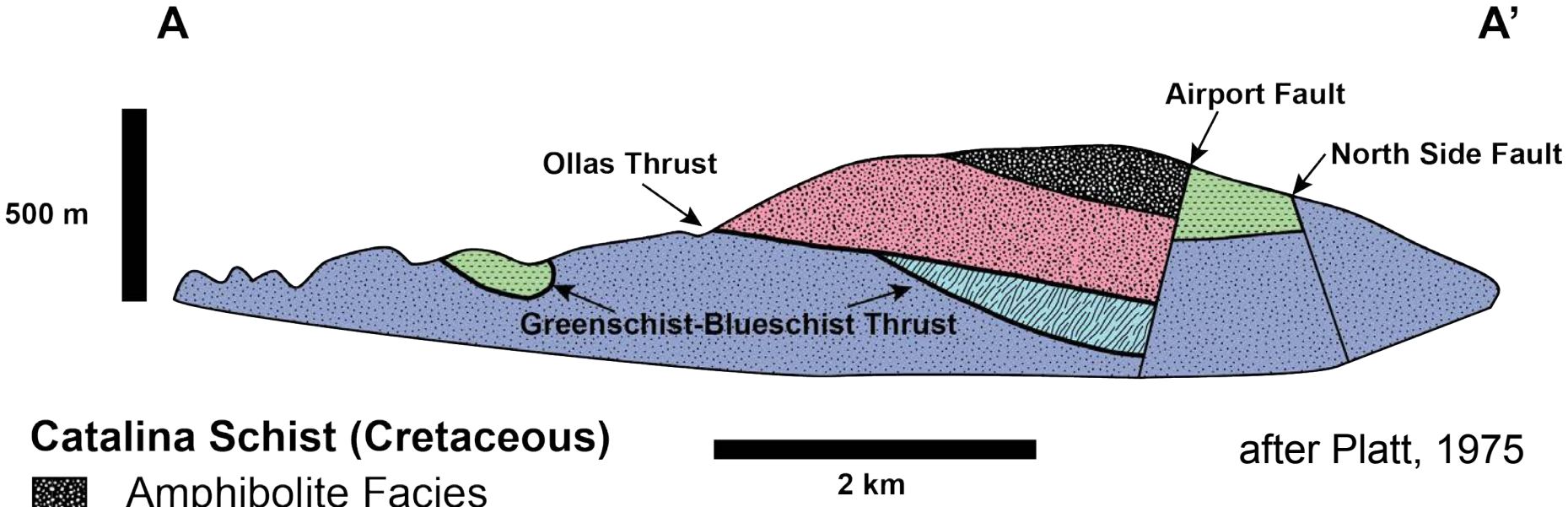

Bebout and Barton 2002



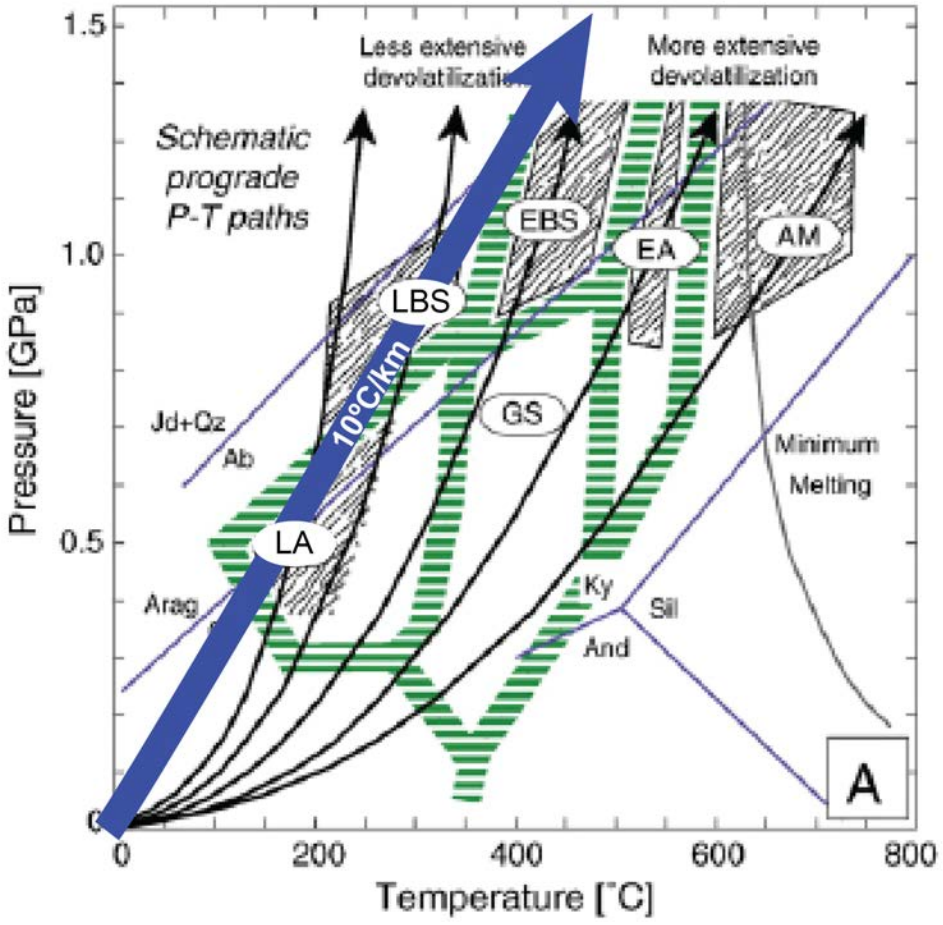

Penniston-Dorland et al. 2012

# Clues to the tectonic environment…




- Thrust faults exist between different metamorphic facies

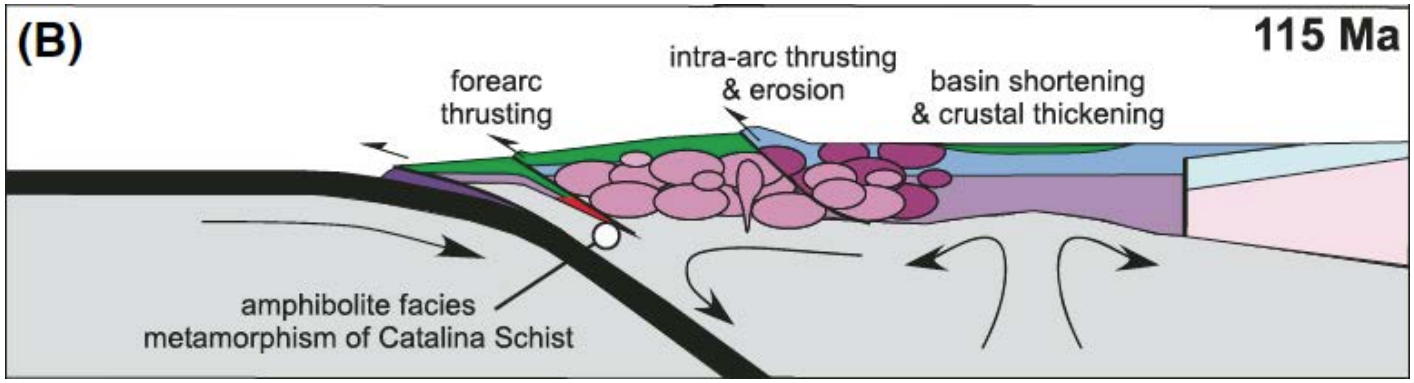
# Clues to the tectonic environment…



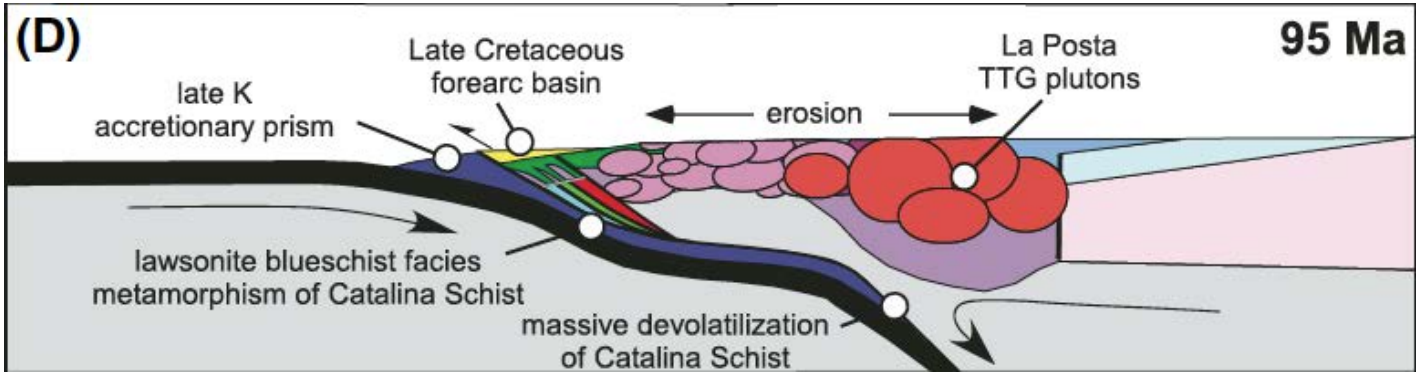

Platt, 1975; Sorensen and Barton, 1987; Grove and Bebout, 1995, Bebout 2007

- Lower-grade facies typical of subduction zone environment
- Higher-grade facies are anomalous for a steady-state subduction zone environment

→ subduction initiation? (Platt, 1975)




# Clues to the tectonic environment




Grove et al., 2008

- Associated arc plutons (Peninsular Ranges batholith) are older (up to 140 Ma) than youngest detrital zircons in the high-grade rocks (122 Ma, Grove et al., 2008) and metamorphic ages (up to 115 Ma) → subduction already happening prior to high-grade metamorphism

- Model of high-grade metamorphism in fore-arc thrust, low-grade metamorphism in the main subduction channel