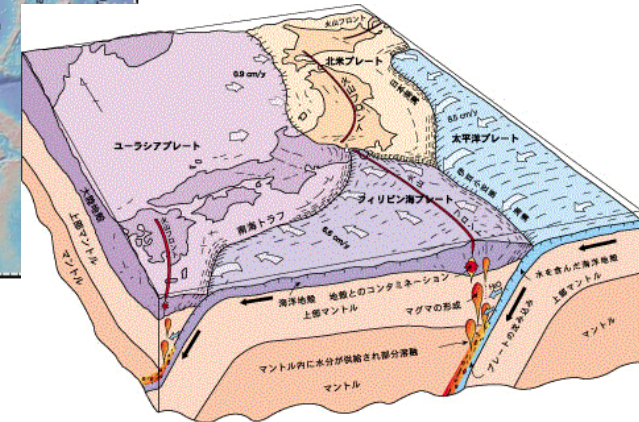
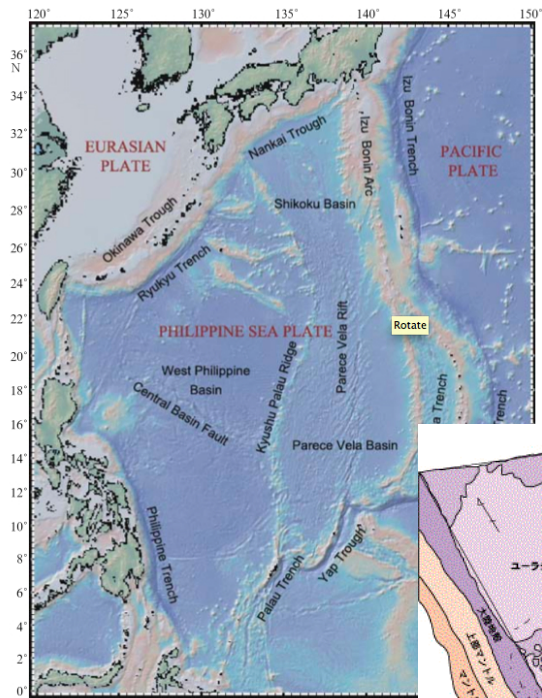


Subdukce v systému dvou desek – migrace subdukční zóny ve Filipínském moři

Hana Čížková
Charles University in Prague

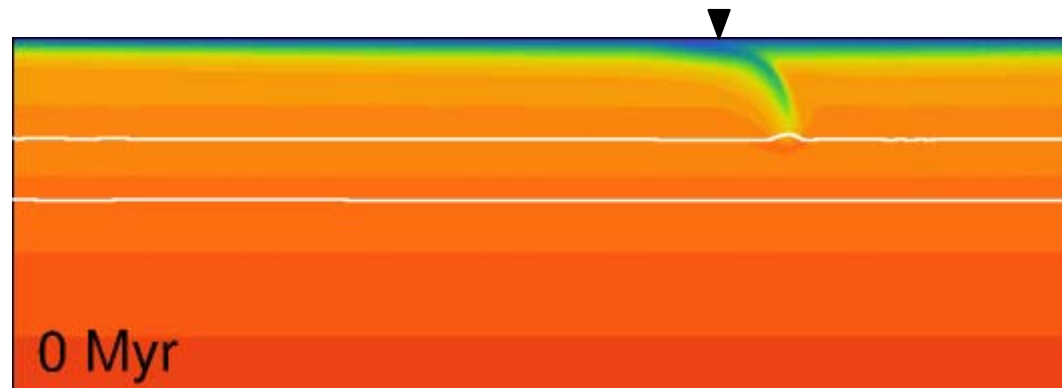
Craig Bina
Northwestern University Evanston



MOTIVACE

Modely interakce subdukující desky a fázových přechodů

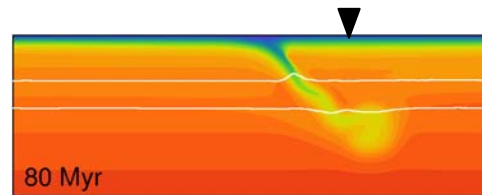
➔ migrace subdukční zóny proti směru subdukce



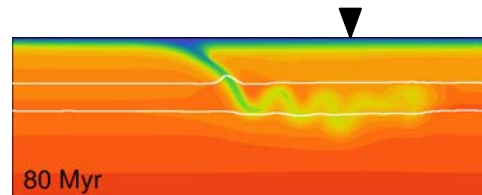
MOTIVACE

Modely interakce subdukující desky a fázových přechodů
➔ migrace subdukční zóny proti směru subdukce

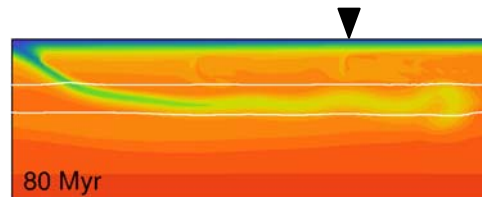
Vyšší viskozita kůry




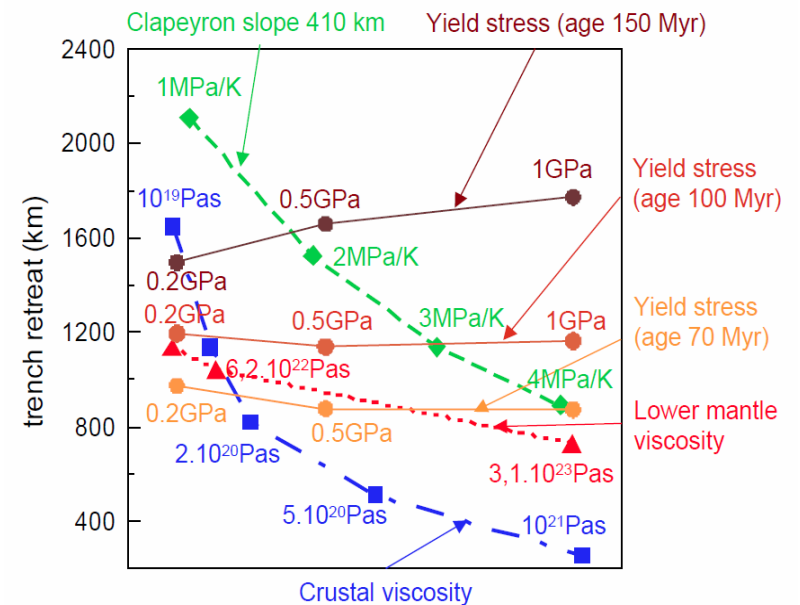
Nízká viskozita kůry



Malá směrnice
Clausiovy-Clapeyronovy
křivky



273  2000
T(K)

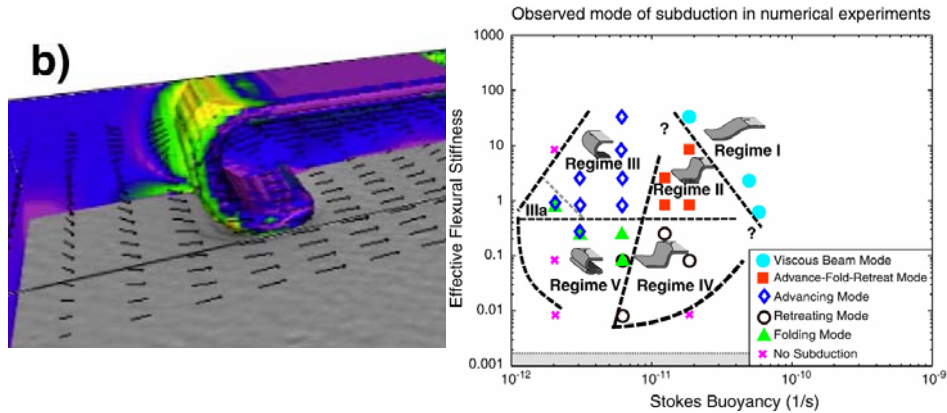


Modely migrace subdukční zóny nedávají pohyb ve směru subdukce.

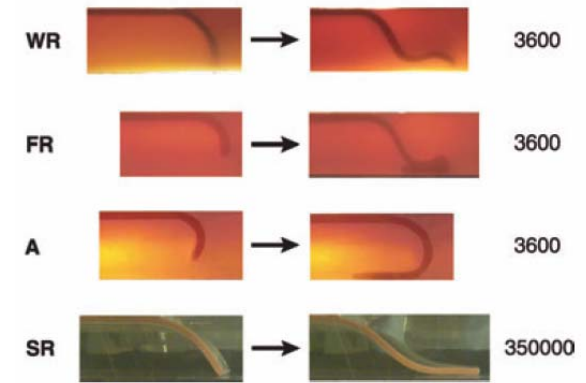
Co na to jiní autoři?

MIGACE VE SMĚRU SUBDUKCE – NUMERICKÉ MODELY

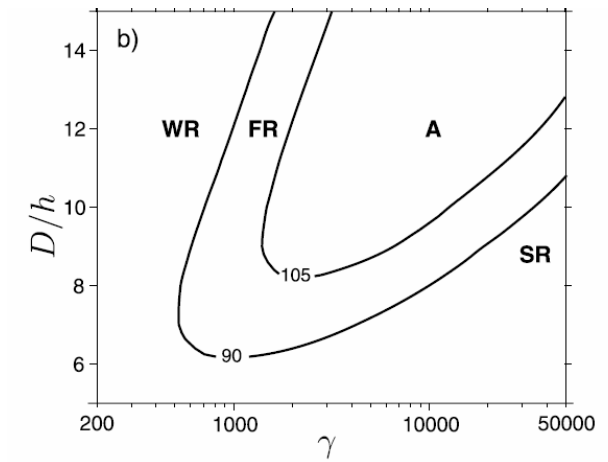
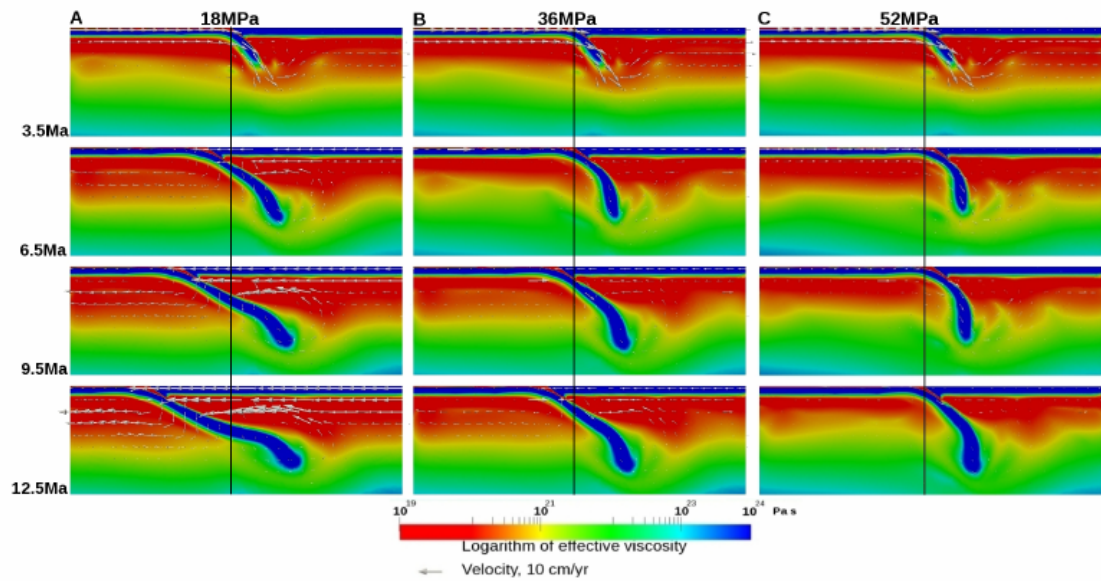
Tuhost slabů (Stegman et al., 2010)



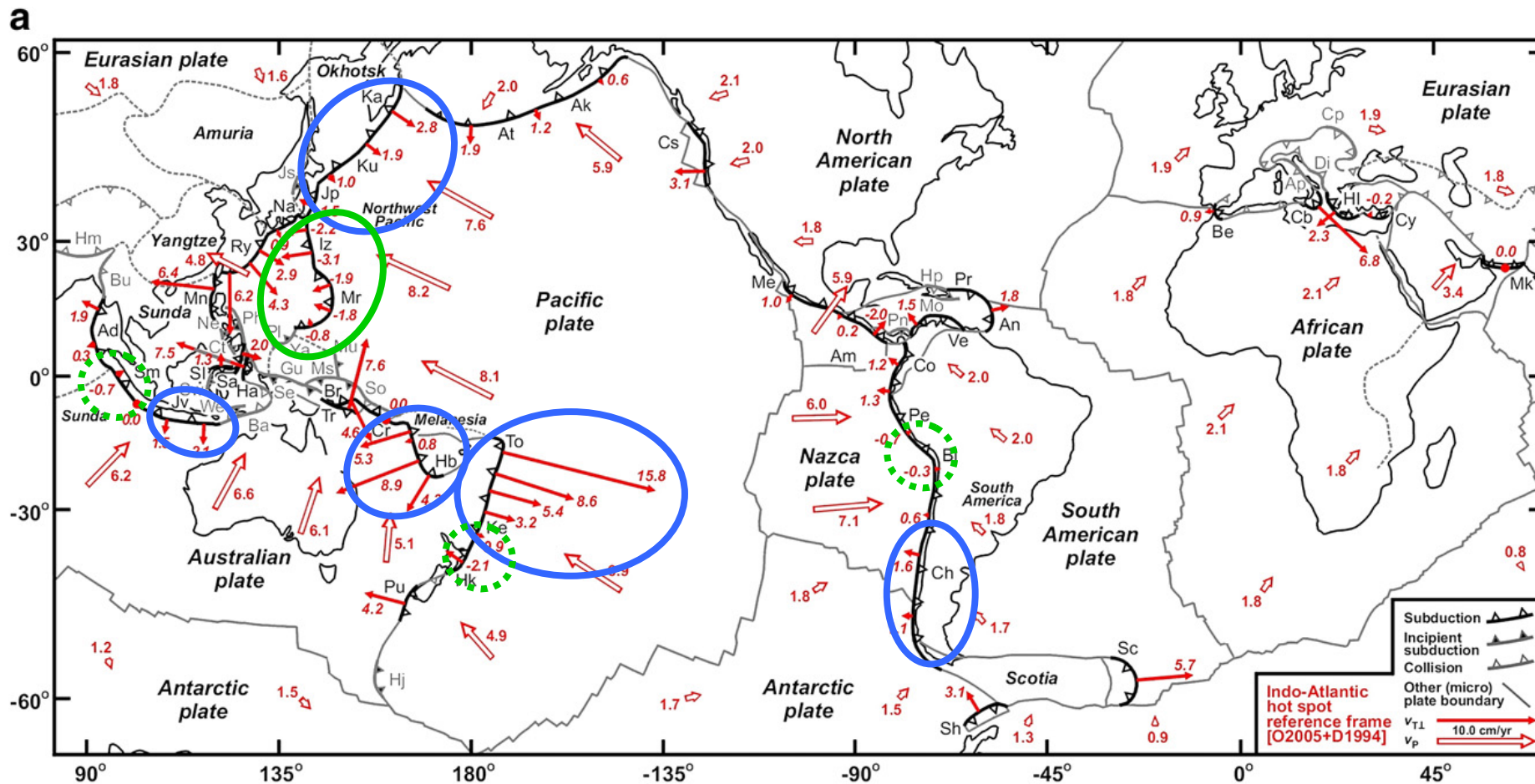
(Ribe et al., 2010)



Tah nadložní desky (Chertova et al. 2012)

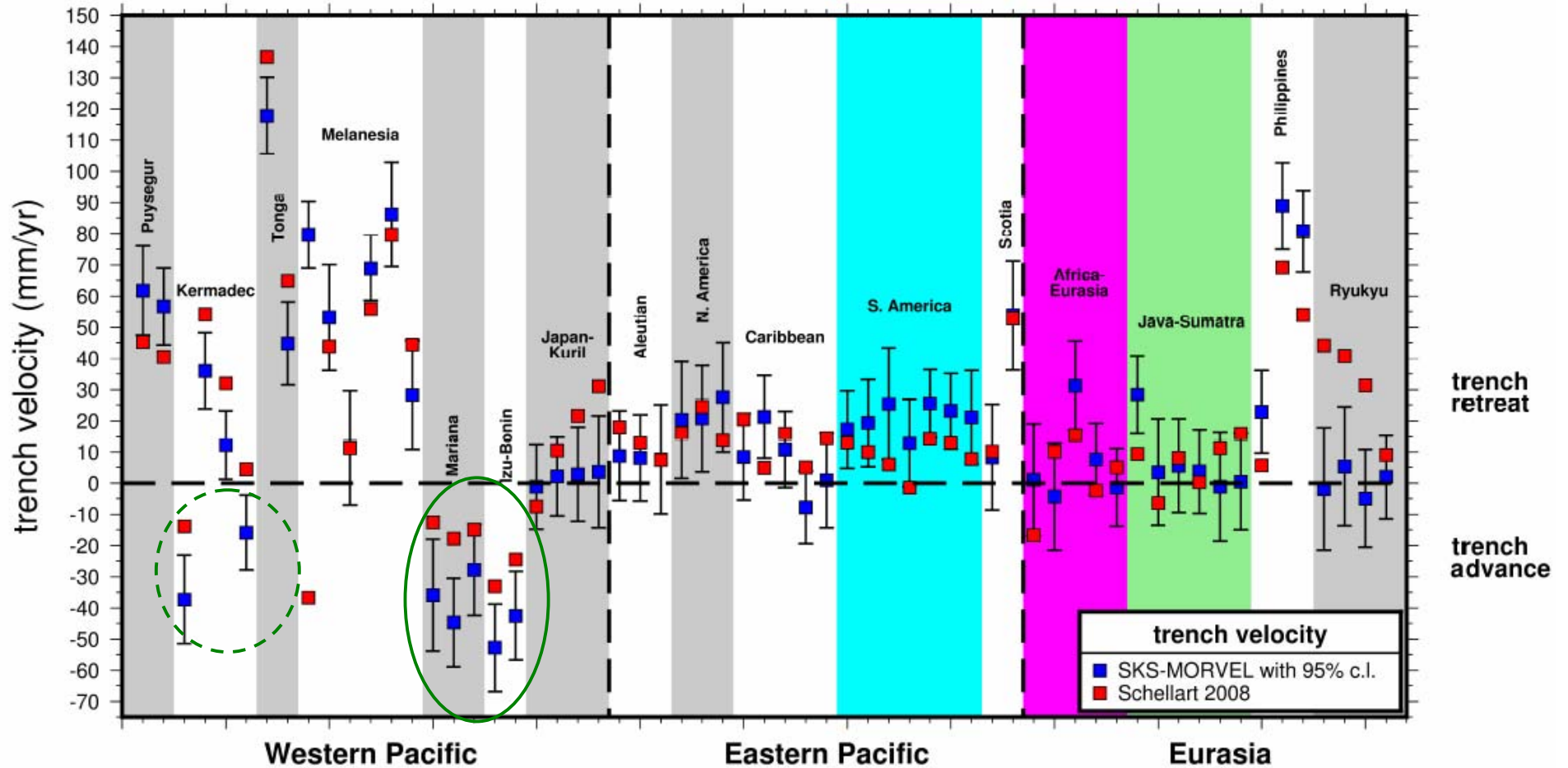


MIGRACE SUBDUKČNÍCH LINIÍ



Schellart et al. (2008)

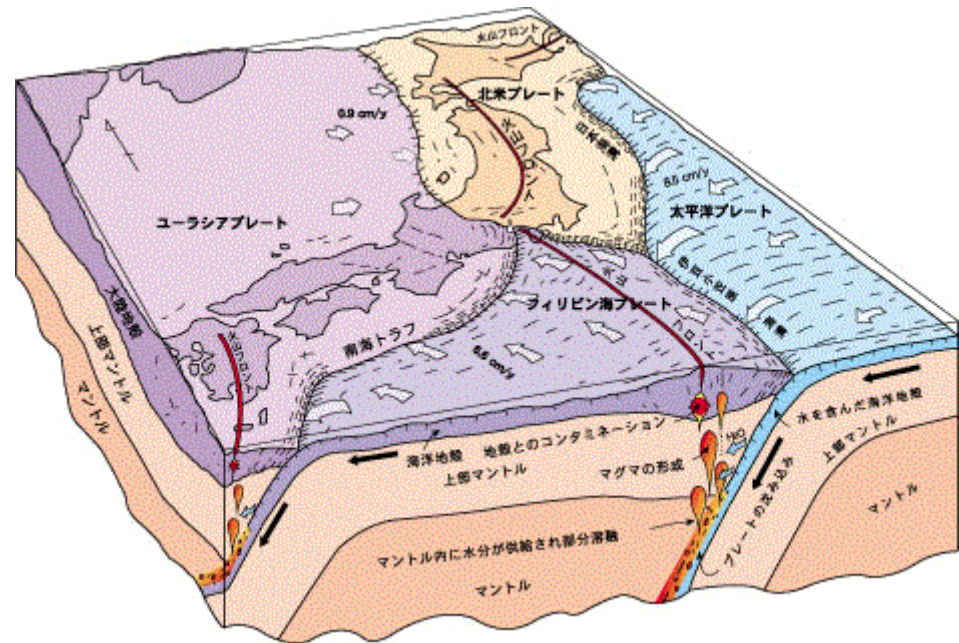
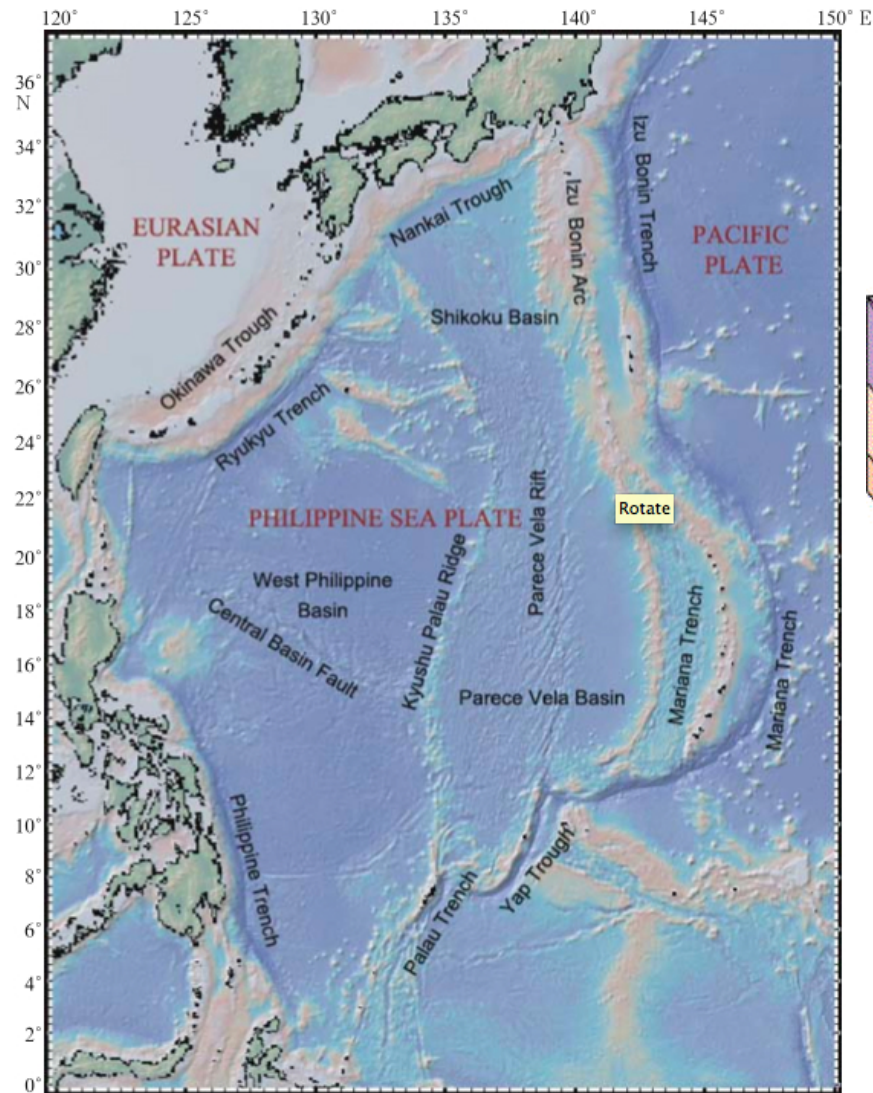
in search of trench advance ...



Trench advance fastest at Marianas-Izu-Bonin trench (53 ± 17 mm/yr).

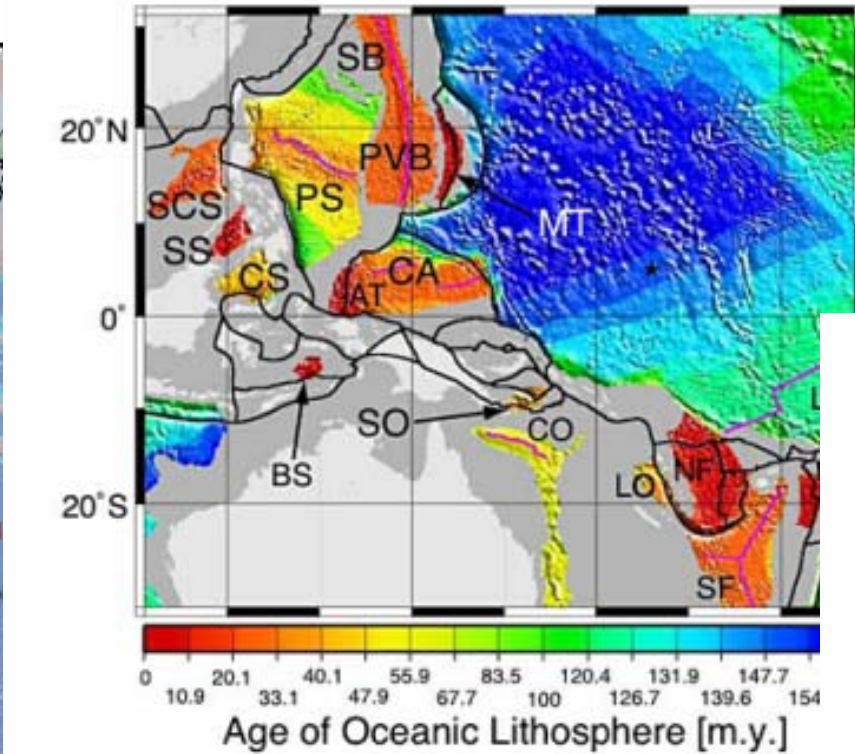
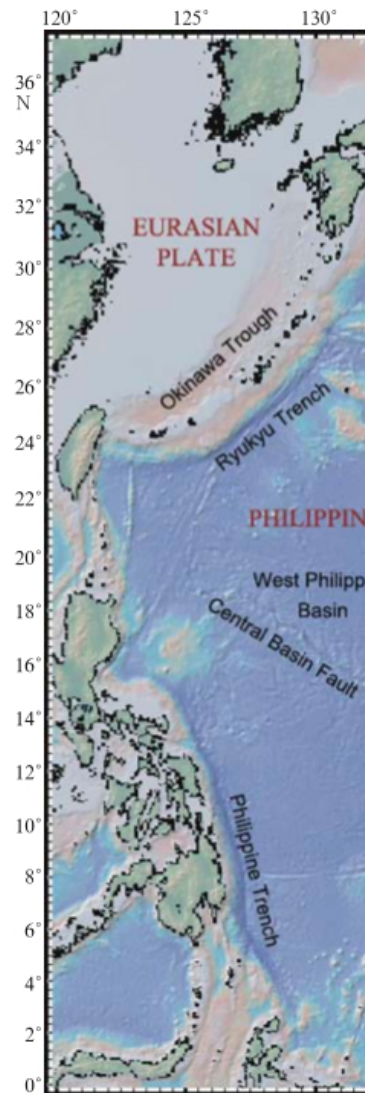
(Mathews, Zheng and Gordon, AGU, 2013)

FILIPÍNSKÁ DESKA

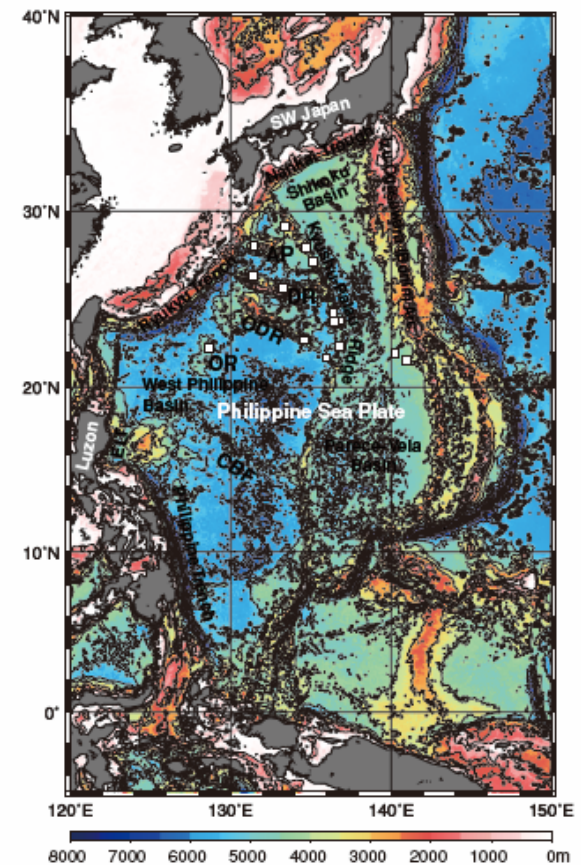


FILIPÍNSKÁ DESKA – STÁŘÍ A BATYMETRIE

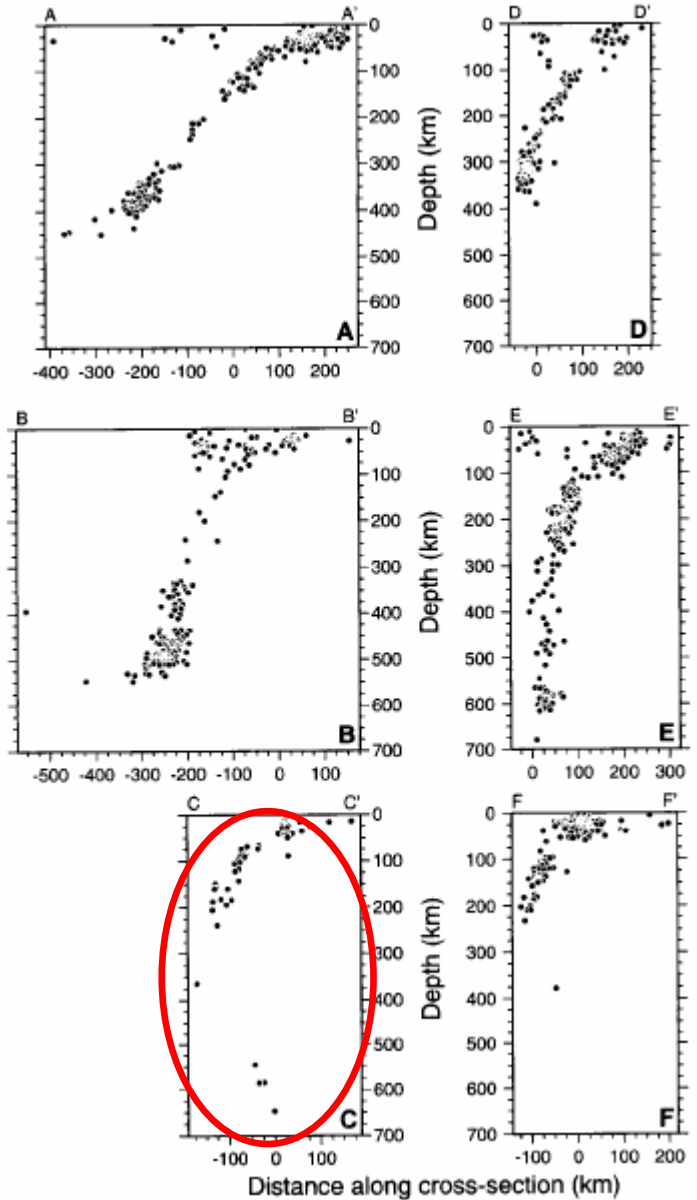
Muller et al., 2008



Yamazaki et al., 2010



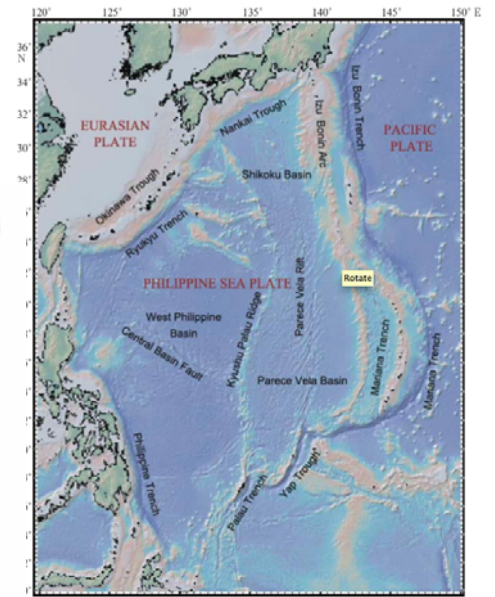
SEISMICITA



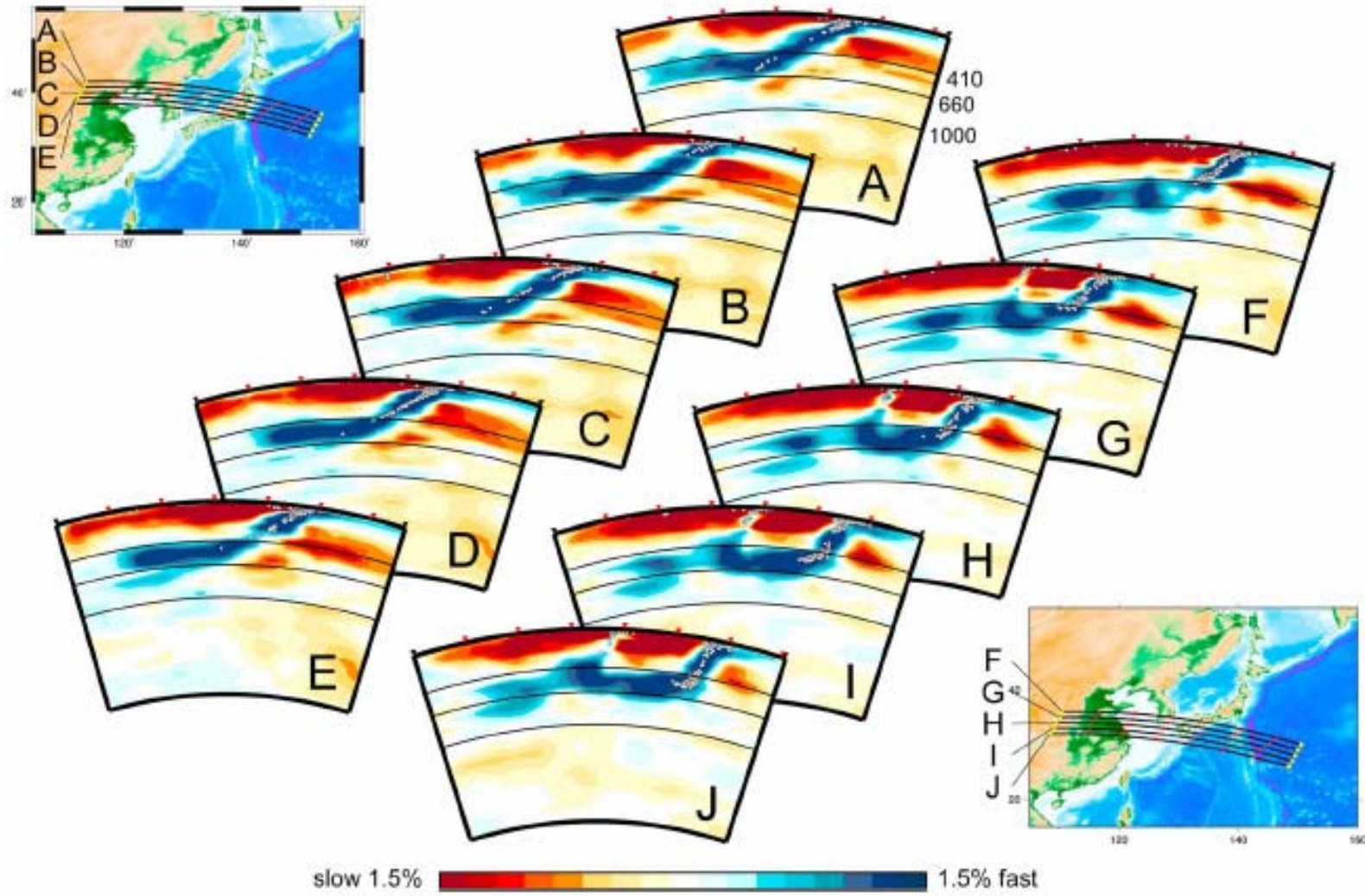
Stern et al., 2003



MĚNÍ SE OD SEVERU K JIHU

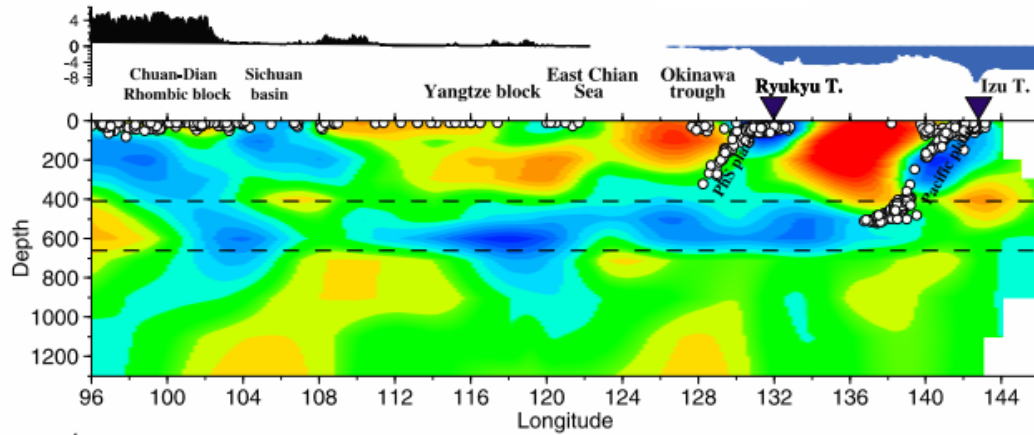
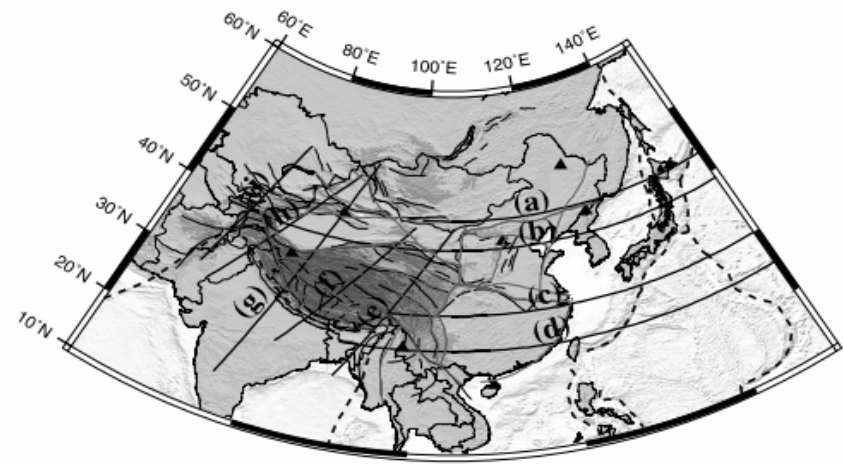


TOMOGRAFIE

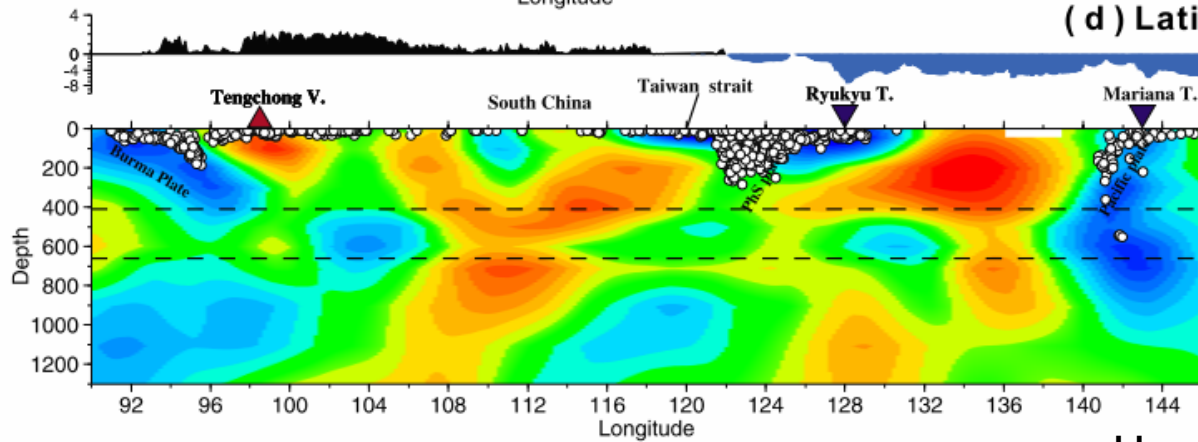


Fukao a Obayashi, 2003

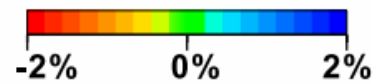
TOMOGRAFIE



(c) Latitude=30°

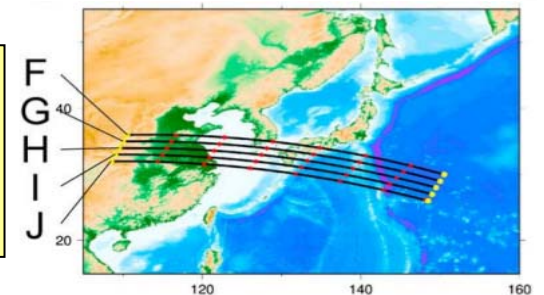
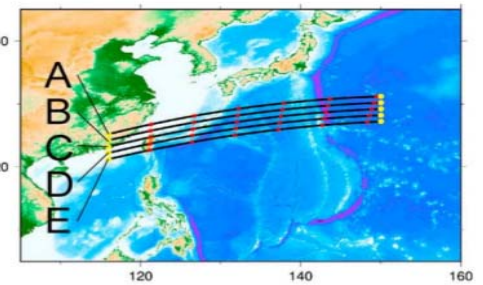
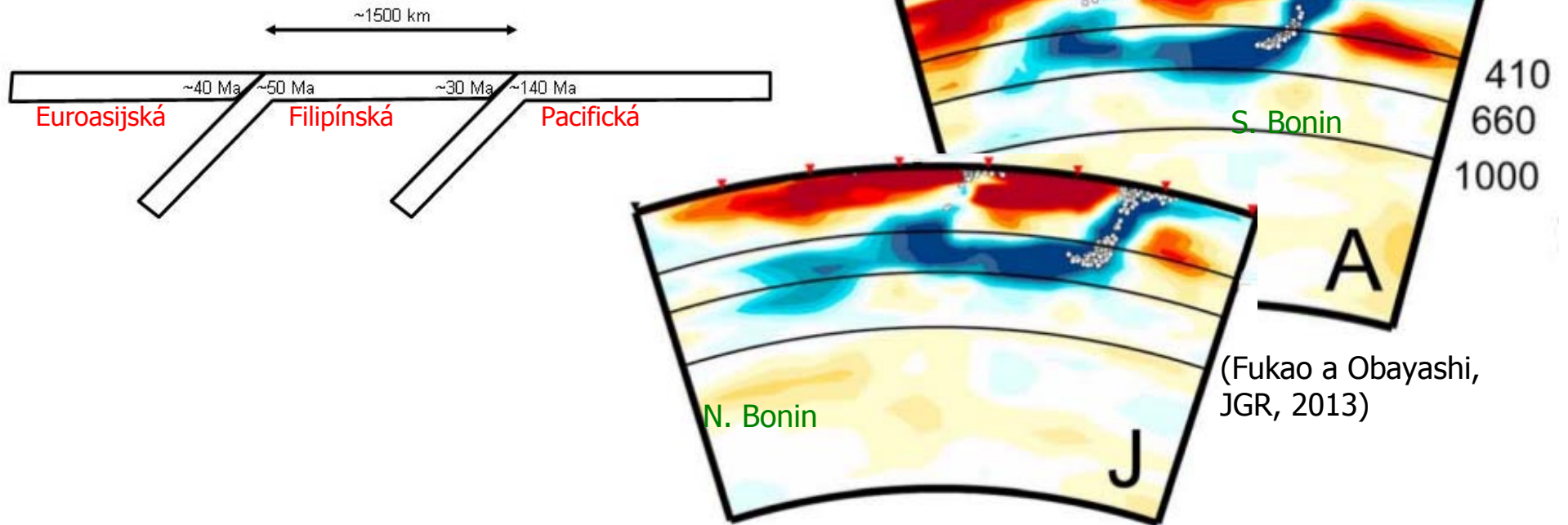


(d) Latitude=25°

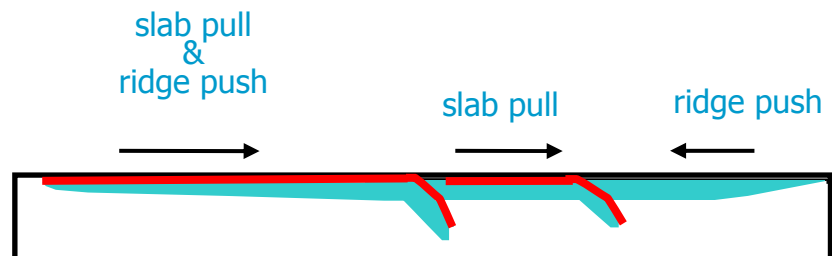
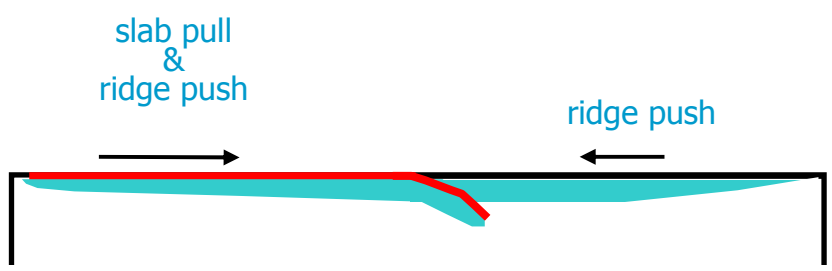


Huang and Zhao, 2006

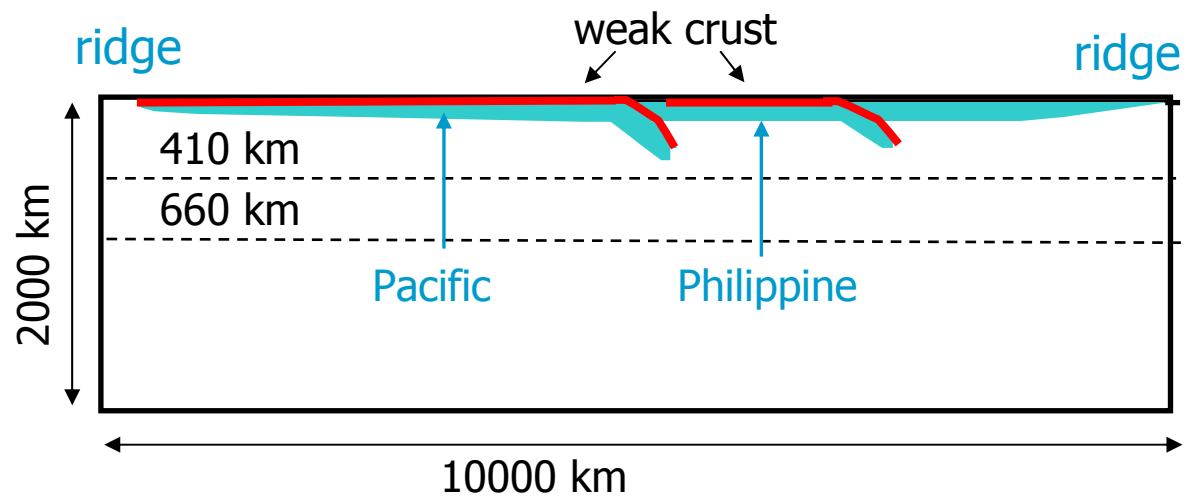
Filipínská oblast



Může tah Filipínské desky vysvětlit migraci pacifické subdukce?



MODEL FILIPÍNSKÉ OBLASTI



RHEOLOGY

Upper mantle: diffusion creep, dislocation creep, stress-limiter

$$\dot{\varepsilon}_{diff} = A_{diff} \sigma \exp\left(-\frac{E_{diff} + pV_{diff}}{RT}\right) \quad \dot{\varepsilon}_{disl} = A_{disl} \sigma^n \exp\left(-\frac{E_{disl} + pV_{disl}}{RT}\right)$$

Activation parameters according to Hirth and Kohlstedt (2003)

$$\dot{\varepsilon}_{sl} = C_L \left(\frac{\sigma}{\sigma_L}\right)^{n_L}$$

Crust: $\eta_c = 5 \cdot 10^{20}, 10^{21}$ Pas

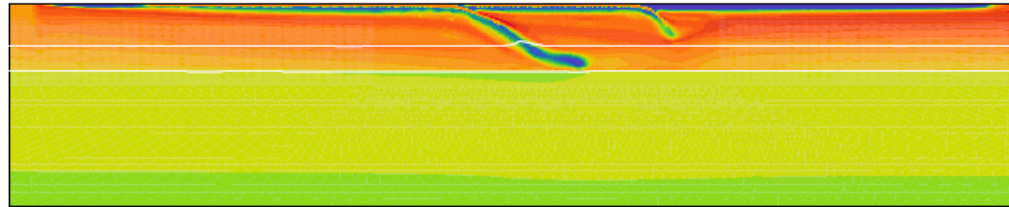
Yield stress 0.5 GPa

Lower mantle: diffusion creep

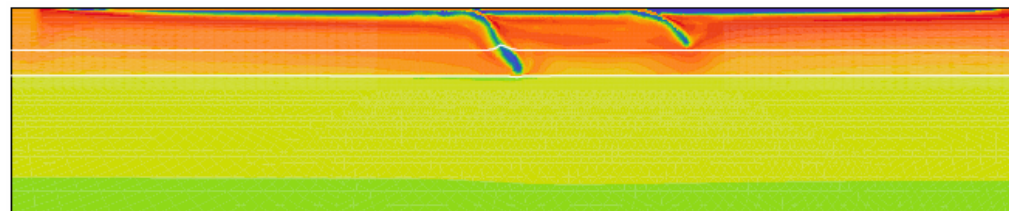
Activation parameters Čížková et al. (2012)

POČÁTEČNÍ PODMÍNKA

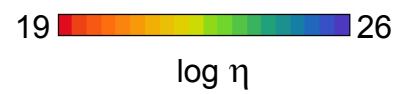
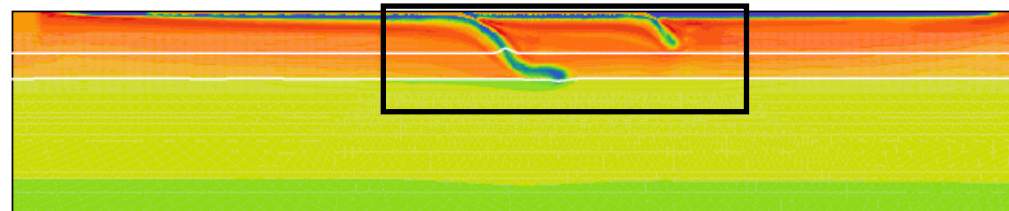
MODEL A



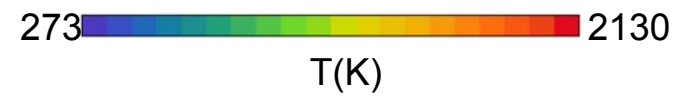
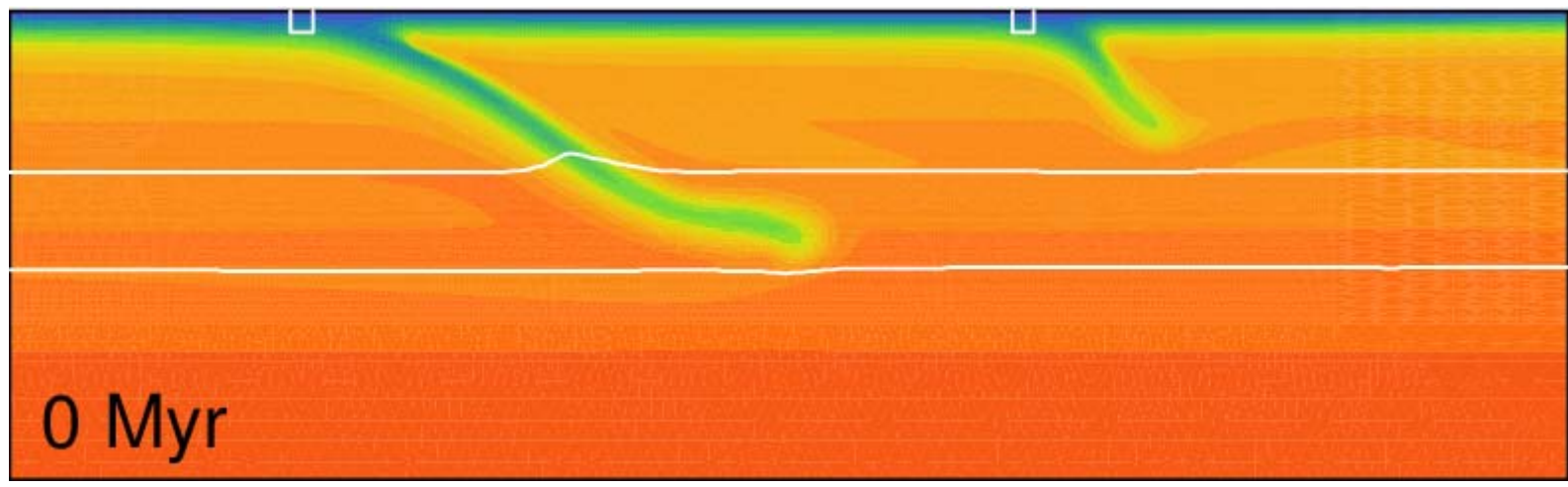
MODEL B



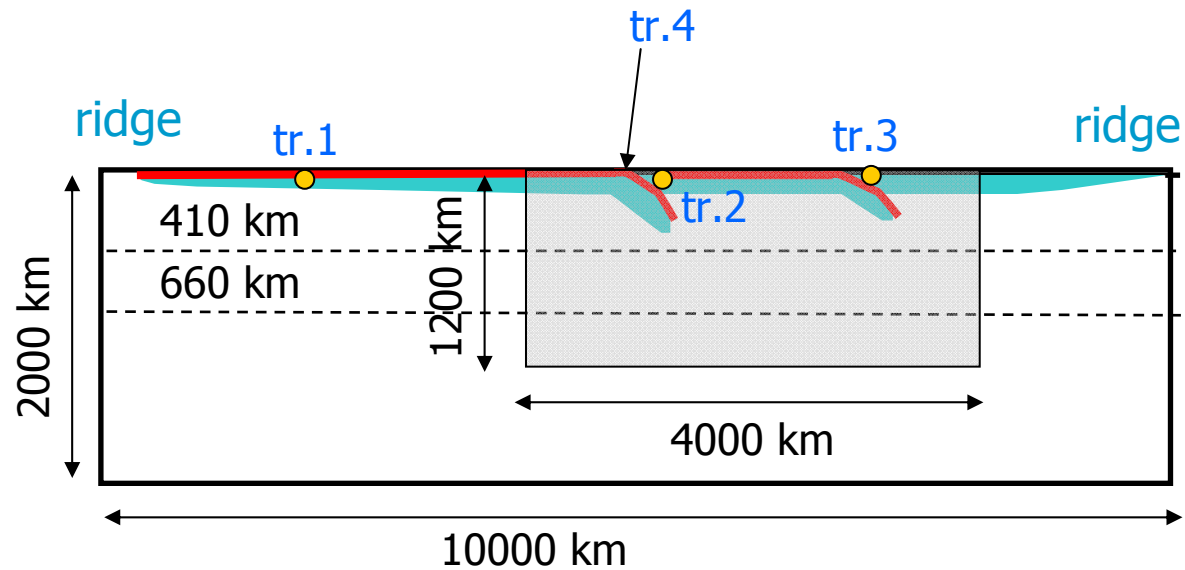
MODEL C



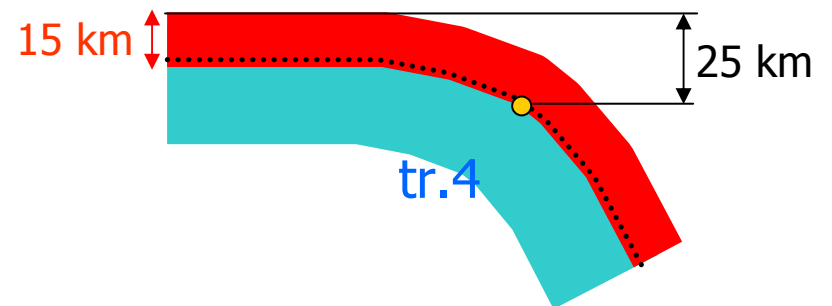
MODEL C, $\eta_c = 10^{21}$ Pas

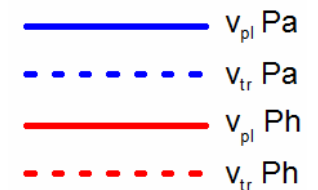
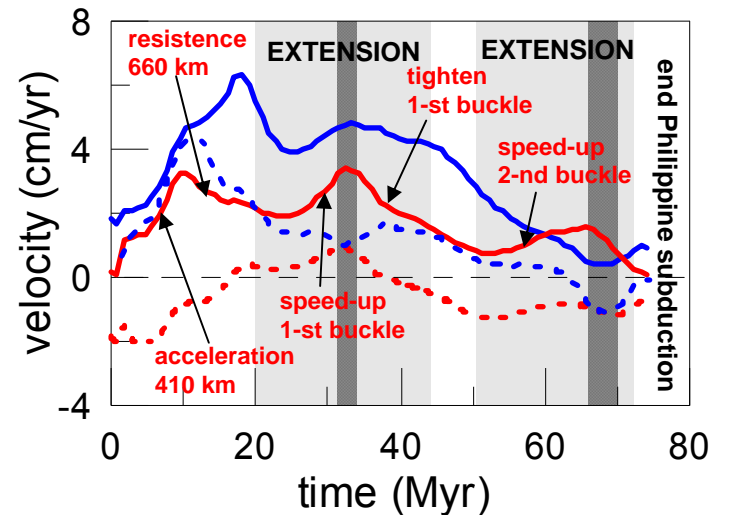
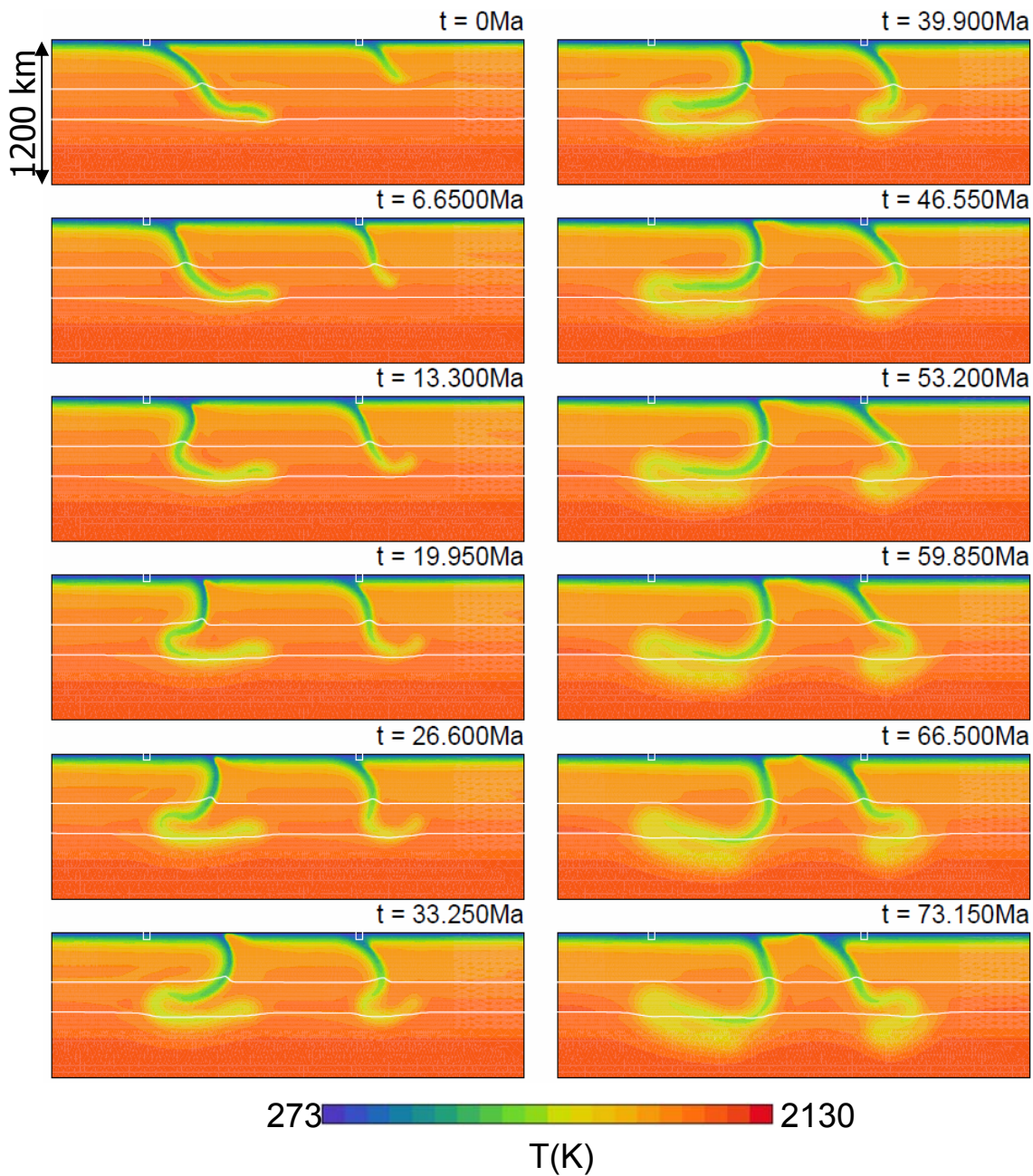


MODEL FILIPÍNSKÉ OBLASTI

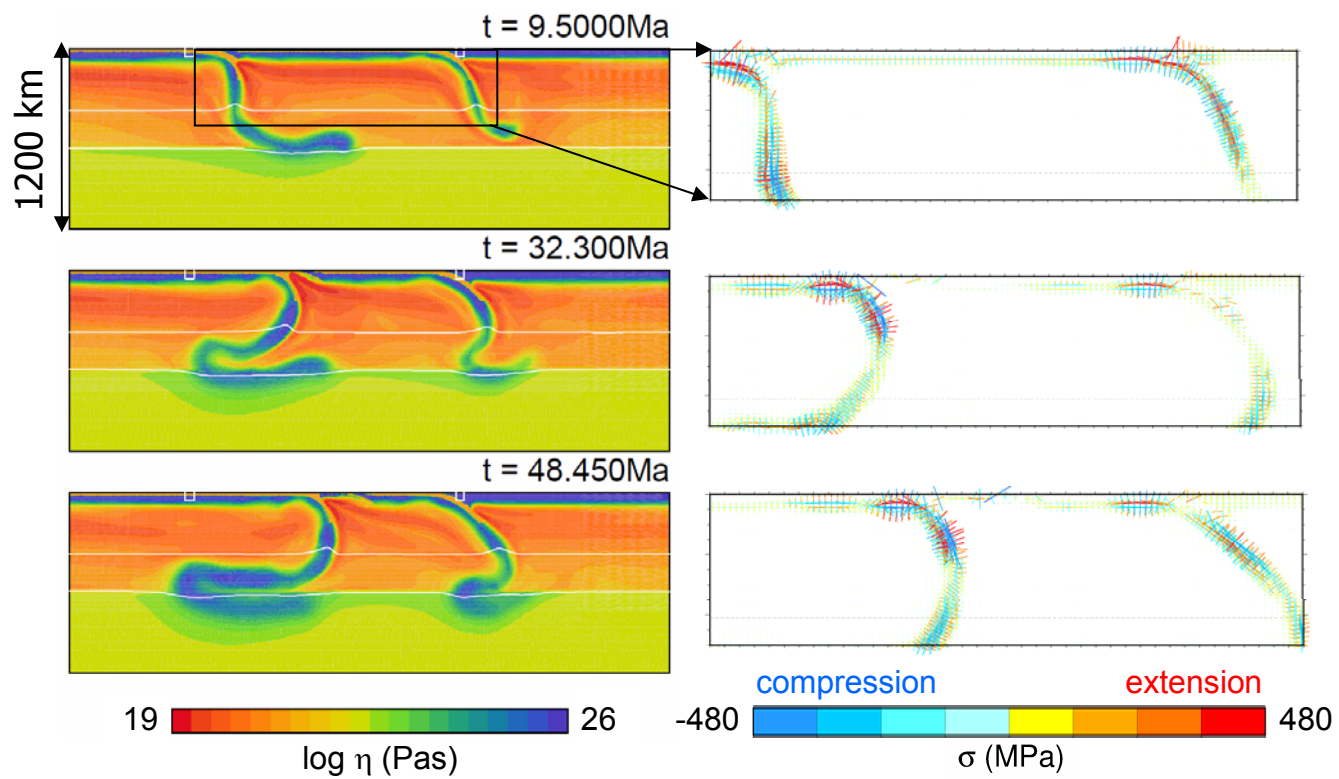


- tracer 1 ... rychlost Pacifické desky
- tracer 2 ... rychlost Filipínské desky
- tracer 3 ... rychlost Filipínského příkopu
- tracer 4 ... rychlost Pacifického příkopu

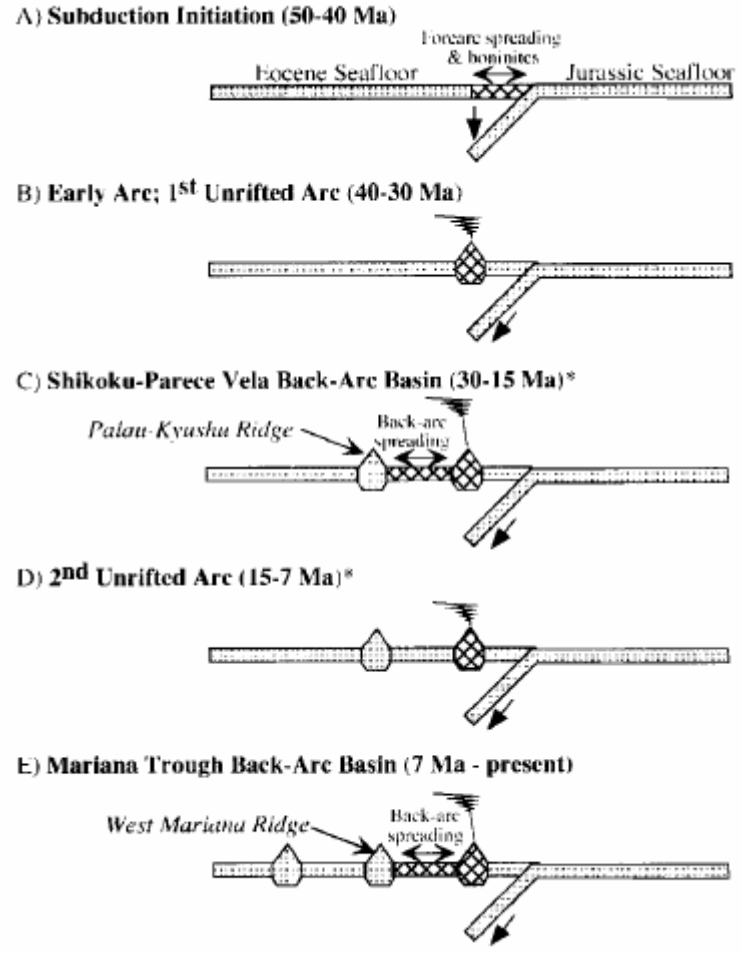
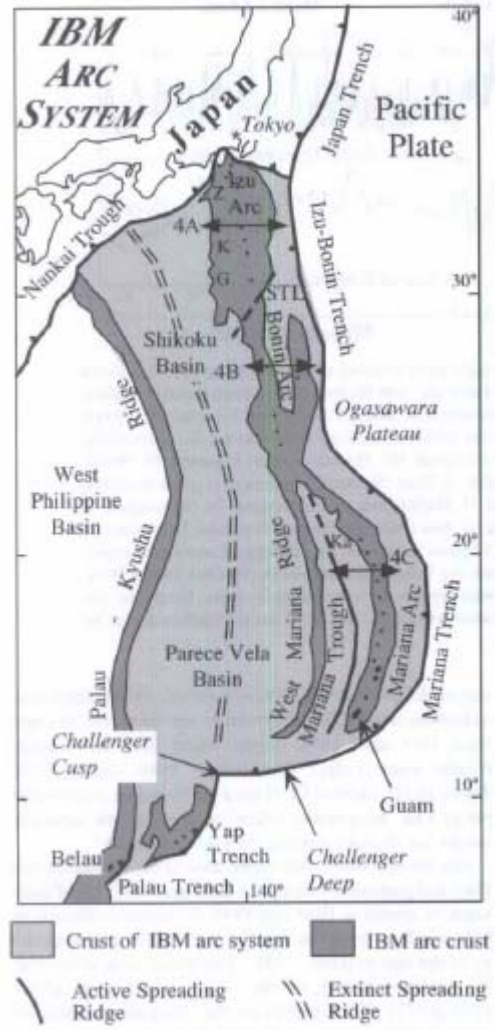




VISKOZITA A NAPĚTÍ

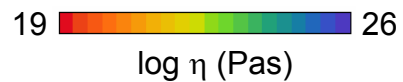
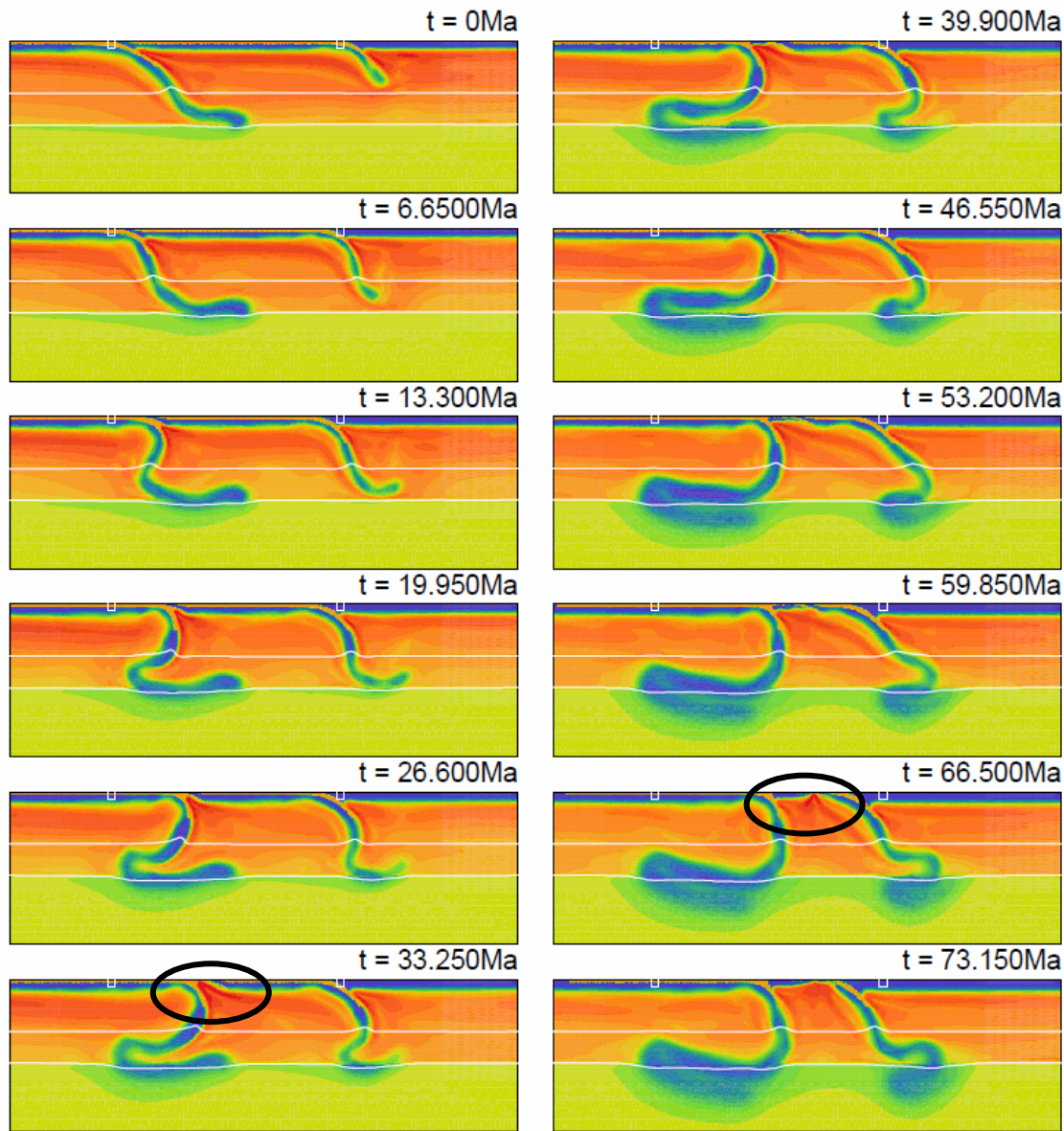


EPIZODICKÁ EXTENZE A RIFTING

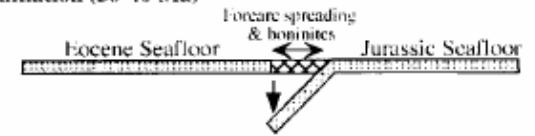


Stern et al., 2003

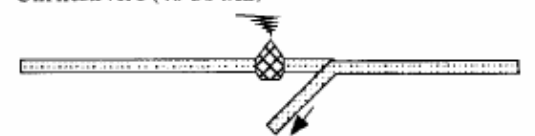
EPIZODICKÁ EXTENZE A RIFTING



A) Subduction Initiation (50-40 Ma)



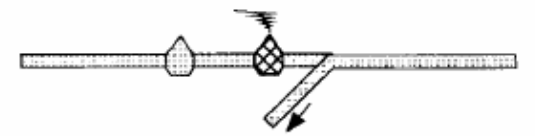
B) Early Arc; 1st Unrifted Arc (40-30 Ma)



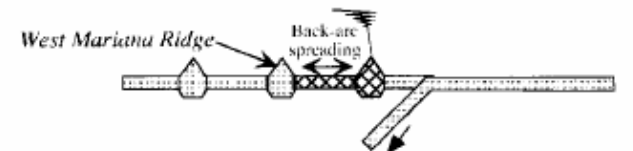
C) Shikoku-Parece Vela Back-Arc Basin (30-15 Ma)*



D) 2nd Unrifted Arc (15-7 Ma)*



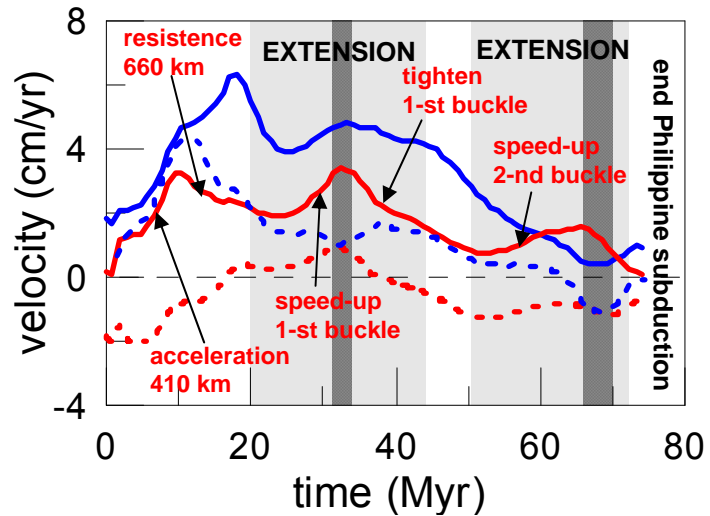
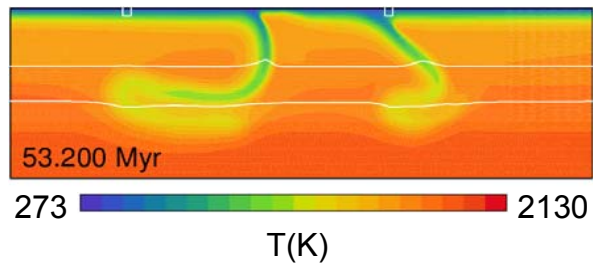
E) Mariana Trough Back-Arc Basin (7 Ma - present)



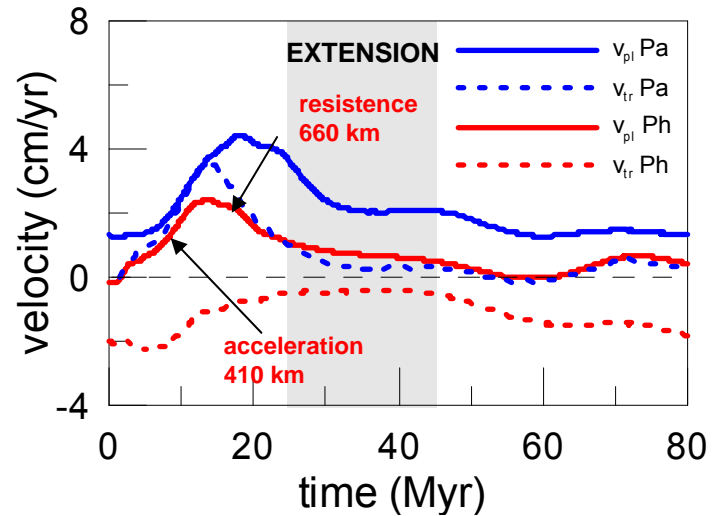
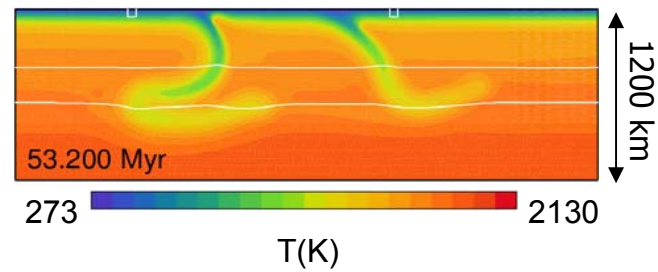
Stern et al., 2003

VLIV FÁZOVÉHO PŘECHODU V HLOUBCE 410 KM

$\gamma_{410} = 2 \text{ MPa/K}$

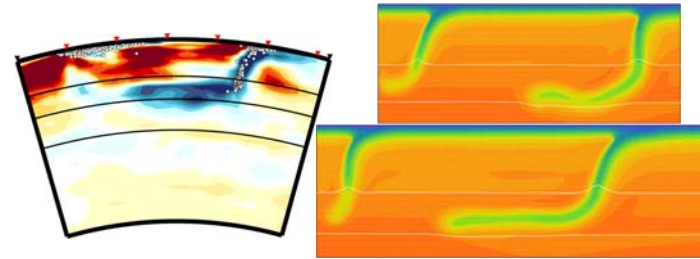


$\gamma_{410} = 1 \text{ MPa/K}$

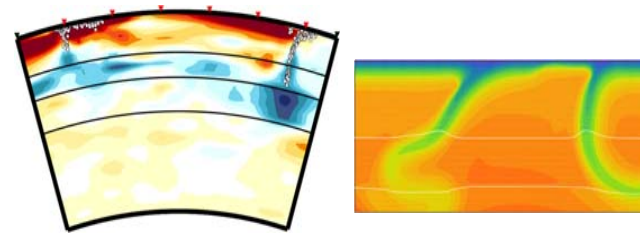


ZÁVĚR

Většina modelových situací vede na migraci subdukční zóny proti směru subdukce



Migraci ve směru subdukce lze zřejmě vysvětlit tahem Filipínské desky v systému dvou za sebou se zanořujících desek a to i pro realistický reologický model



Tento model postihuje také epizodickou extenzi Filipínské desky

