T054-009 Room: 303 Time: May 28 11:15-11:30

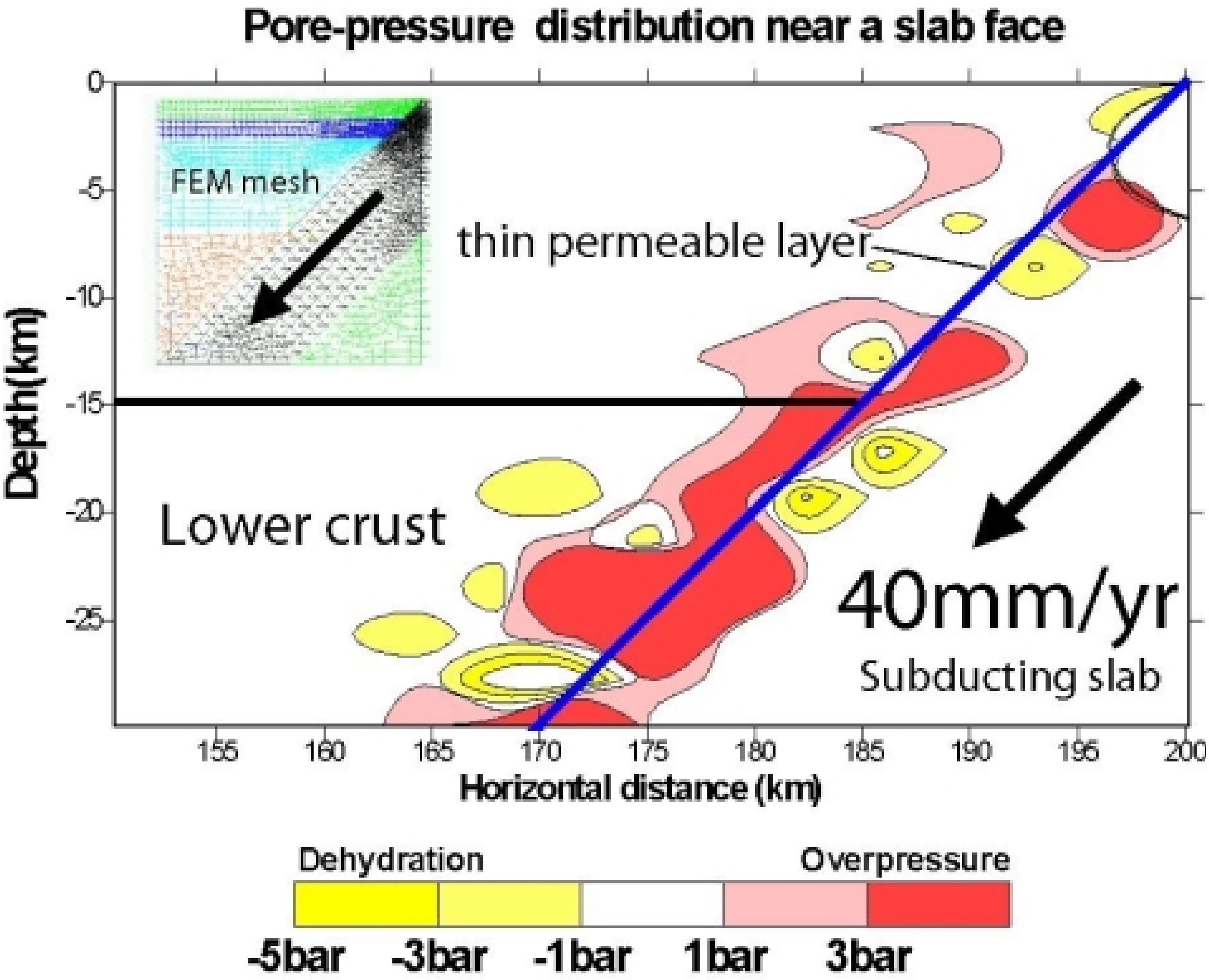
Pore-fluid flow, overpressure and dehydration near a subducted plate interface

S. Jason Zhao[1], Yoshiyuki Kaneda[2]

[1] IFREE,JAMSTEC, [2] JAMSTEC,Frontier,IFREE

Motion of a subducting slab at plate boundaries exerts a primary control on the stress distribution around the plate interfaces. Visco-elastic flow in the lower crust and upper mantle induced by the subducting slab also affects the pattern of stress at subduction zones. The resultant stress or strain significantly affects the pore-pressure distribution and the pattern of pore-fluid flow. Therefore, the coupling of visco-elastic stress and pore-fluid flow should be taken into consideration. We solved the coupled equations of visco-elastic deformation and pore-fluid flow with the finite element method (FEM) and investigated the pore-pressure distribution associated with a subducting slab. The model space is 200 x 200 km containing a slab of 100 km thick, which is subducting at a rate of 40mm/yr (see figure). Modelling analysis has been carried out for different visco-elastic structures and permeability parameters: (1) For an impermeable slab, pore-fluid is distributed almost uniformly along the plate interface and overpressure appears near the plate interface with dehydration mainly occurs in the lower crust. The visco-elastic channel flow in the lower crust promotes pore-fluid flow and the lower crust serves as a fluid trap in some cases. (2) For a slab with a high permeability, pore-fluid flows into the slab, which results in a large extent of pore-fluid inside the slab. Pore-fluid is also concentrated in the lower crust and dehydration occurs at the down-dip part of the upper face of the slab. (3) For a subducted slab with its upper face locked, pore-fluid flow is concentrated mainly in the lower crust. Dehydration is observed between 20-25 km inside the slab. Overpressure and dehydration in the lower crust could be two of the mechanisms for generating earthquakes at a depth of more than 15 km near a plate subduction zone. (4) For a slab with a thin permeable layer (permeability = 10**-18) on the upper face (see the figure), pore-fluid appears in or around the thin layer along the plate interface with its concentration between 15 and 28 km in the lower crust. Slab dehydration occurs in a belt parallel to and beneath the thin permeable layer. These results suggest that a thin permeable layer on the subducted plate interface arrests pore-fluid and promotes dehydration of the underlain slab part.

http://www.geocities.com/subduction99/index.html


Pore-pressure distribution near a slab face
FEM mesh
thin permeable layer
Lower crust
40mm/yr
Subducting slab
Depth(km)
0
-5
-10
-15
-20
-25
155
160
165
170
175
180
185
190
195
200
Horizontal distance (km)
Dehydration
Overpressure
-5bar
-3bar
-1bar
1bar
3bar