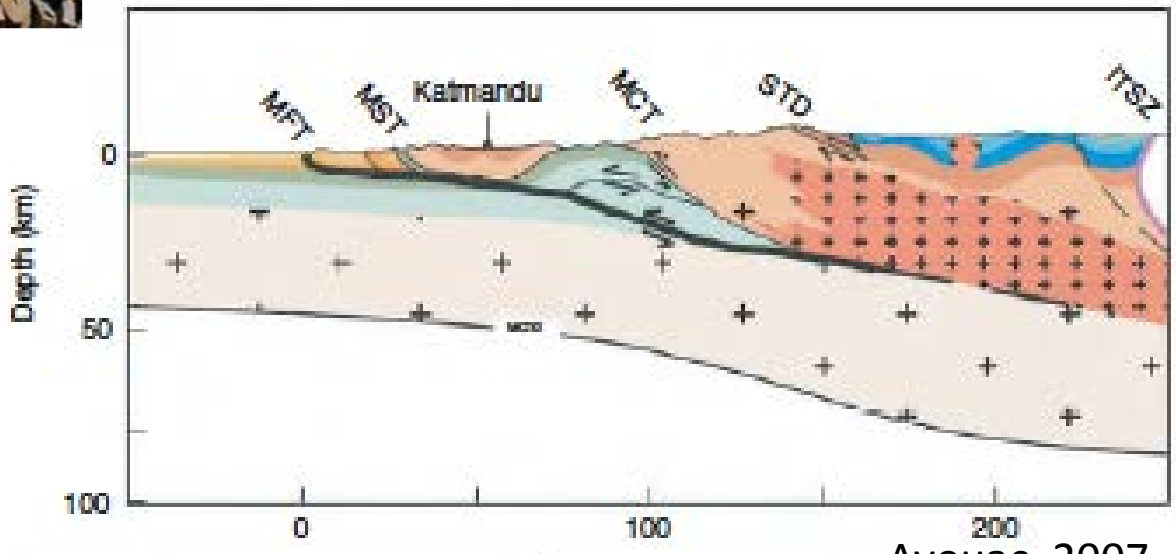
The Himalaya Seismogenic Zone

A GeoPrisms Mini-Worshop

San Francisco, Dec 15, 2015

http://www.abc.net.au/news/2015-04-28/nepal-earthquake-authorities-struggle-to-reach-gorkha/6427620



Avouac, 2007

Goals

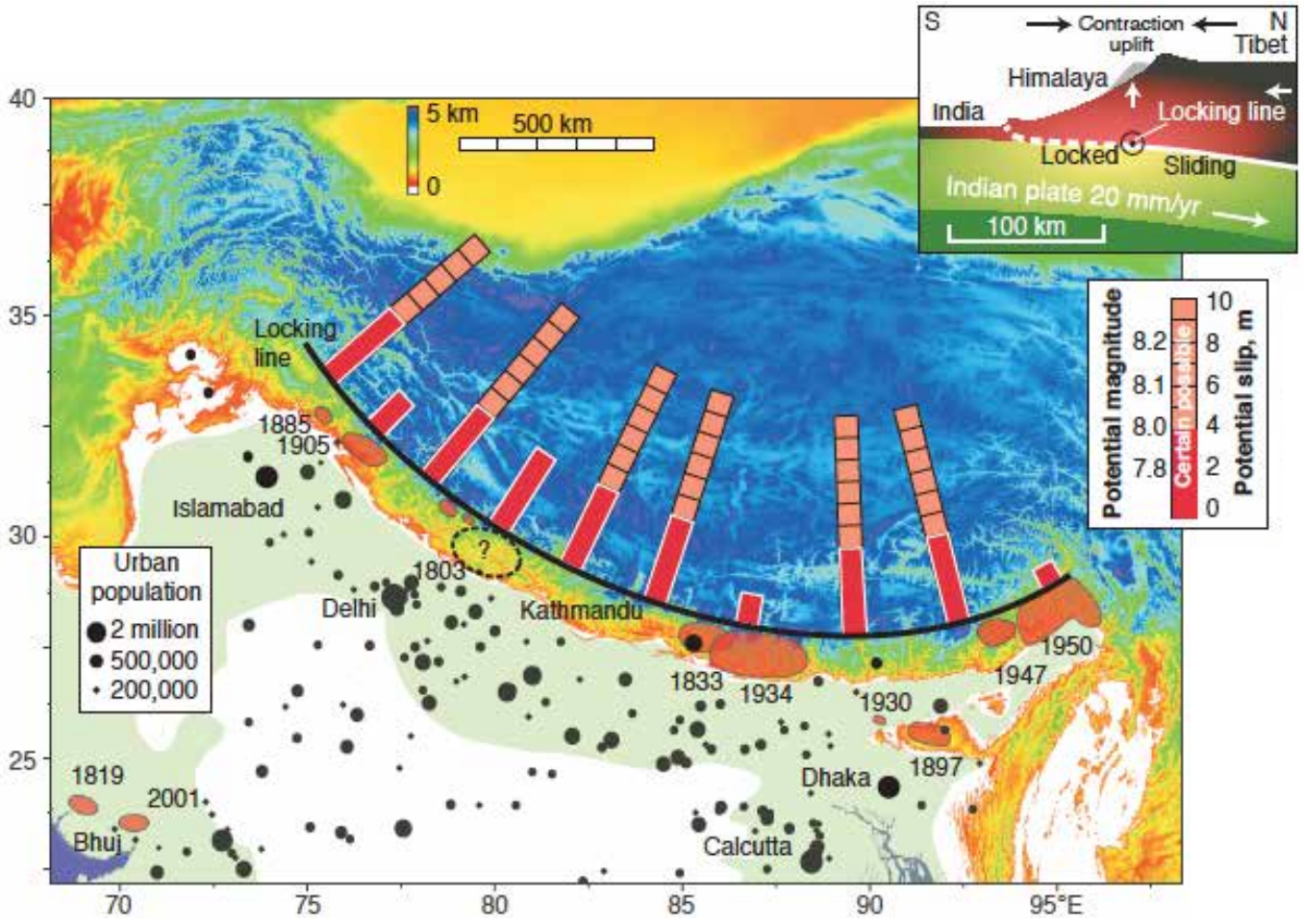
- Who are we?
- What are the important earthquake issues that are best, if not uniquely, addressed in the Himalaya?
- What future geoscience experiments are needed to answer key questions?
- How can our community organize to attract the necessary resources to carry out these studies?
- What are the next steps forward?

Workshop Organization

- 7:00 Welcome and refreshments (Larry Brown)
- 7:05 **Session I: Persistent issues of Himalayan tectonics** (leadoff presentation: Jean-Philippe Avouac)
- 7:20 Discussion on key scientific questions (discussion leader: Simon Klemperer)
- 7:40 Break
- 7:50 **Session II: Seismic hazards and mitigation in the Himalayan region** (leadoff presentation: Judith Hubbard)
- 8:05 Discussion on seismicity and seismic hazard (discussion leader: Marianne Karplus)
- 8:30 **Session III: Organizational strategies for future action** (leadoff presentation: Greg Moore)
- 8:45 Final discussion (Discussion leader: Judith Hubbard)
- 9:00 End for formal session

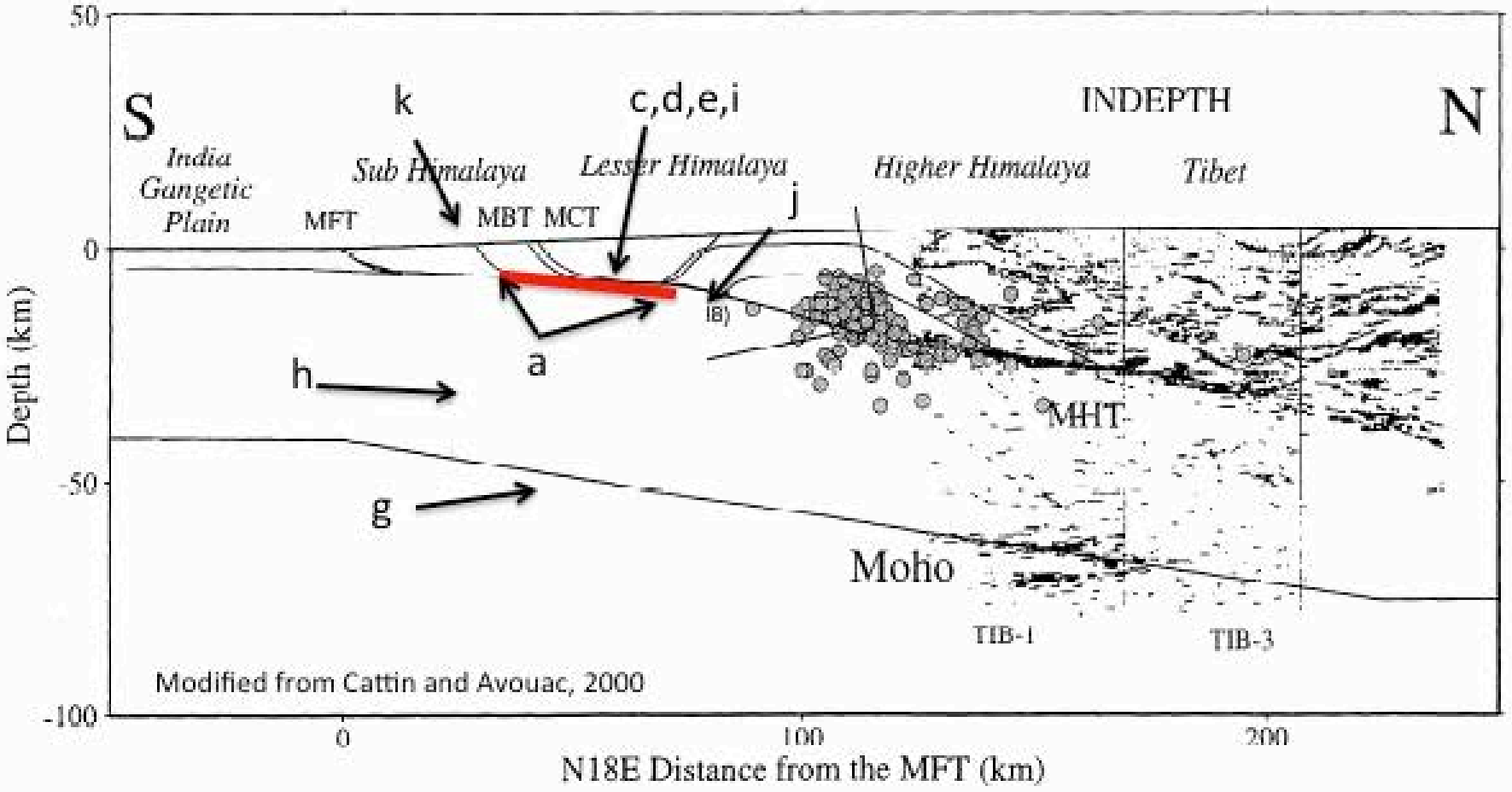
Auxiliary Slides

Seismic Risk



Bilham et al, 2006

THE HSZ


S
N
k
c,d,e,i
INDEPTH
India
Gangetic
Plain
Sub Himalaya
Lesser Himalaya
Higher Himalaya
Tibet
MFT
MBT
MCT
j
a
h
g
MHT
Moho
TIB-1
TIB-3
Modified from Cattin and Avouac, 2000
Depth (km)
50
0
-50
-100
0
100
200
N18E Distance from the MFT (km)

Common Issues

The Himalayan seismogenic zone shares with its oceanic counterparts a number of fundamental questions with respect to the accumulation of strain and its release by major earthquakes. These include:

a. What controls the updip and downdip limits of rupture?
b. What controls the lateral segmentation of rupture zones (and hence magnitude)?
c. What is the role of fluids in facilitating slip and or rupture?
d. What nucleates rupture (e..g. asperities?)?
e. What physical properties can be monitored as precursors to future events?
f. How effectively can the radiation pattern of future events be modeled?

Special Issues

The underthrusting of continental, as opposed to oceanic, lithosphere in the Himalayas places seismogenic zone issues in a very different context:

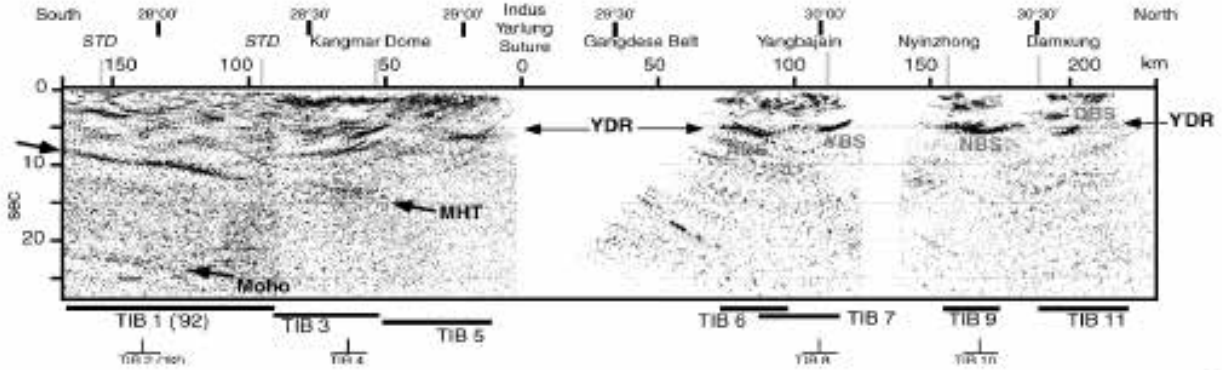
g. How does the greater thickness and weaker rheology of continental crust/lithosphere affect locking of the seismogenic zone?
h. How does the different thermal structure of continental vs oceanic crust affect earthquake geodynamics?
i. Are fluids a significant factor in intercontinental thrusting?
j. How does the basement morphology of underthrust continental crust affect locking/creep, and how does it differ from the oceanic case?
k. What is the significance of blind splay faulting in accommodating slip?
l. Do lithologic contrasts juxtaposed across the continental seismogenic zone play a role in the rheological behavior of the SZ in the same manner as proposed for the ocean SZ?

Imaging the roots of the HSZ

INDEPTH

CS Reflection

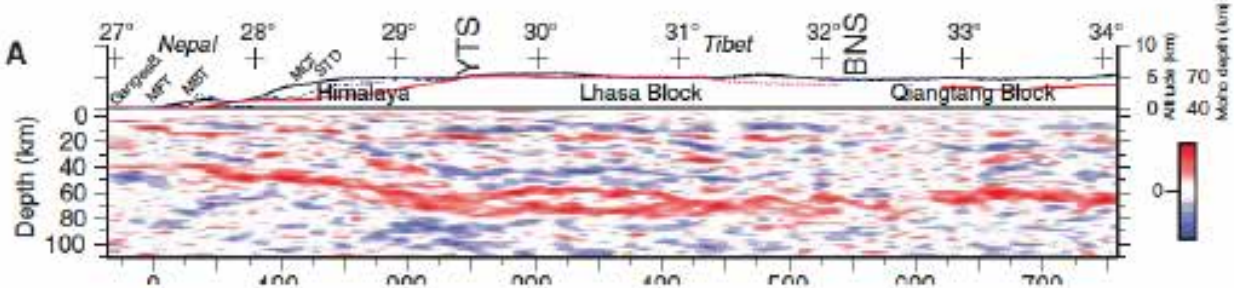
(Brown et al., 1996)



HiClimb

PS Receiver Function

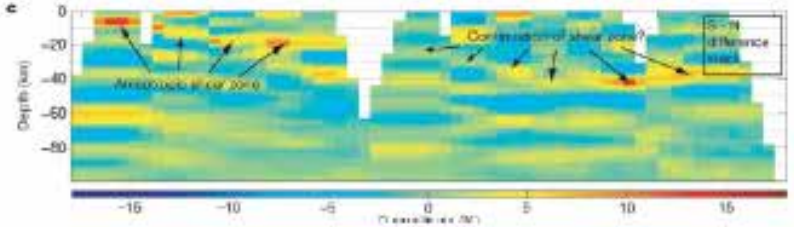
(Nabelek et al., 2009)



Eastern Nepal

PS Anisotropy

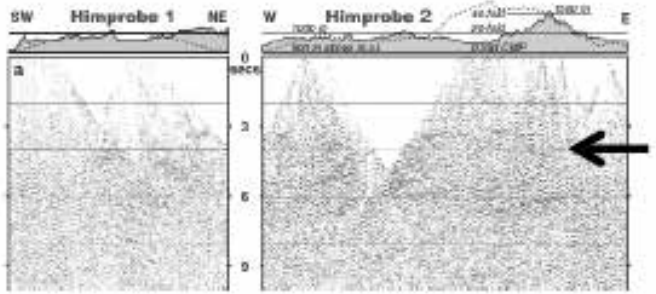
(Schulte Pelkum et al., 2005)



HIMPROBE

CS Reflection

(Rajendra Prasad et al., 2011)



A Geophysical Backbone for the HSZ

Margins SEIZE