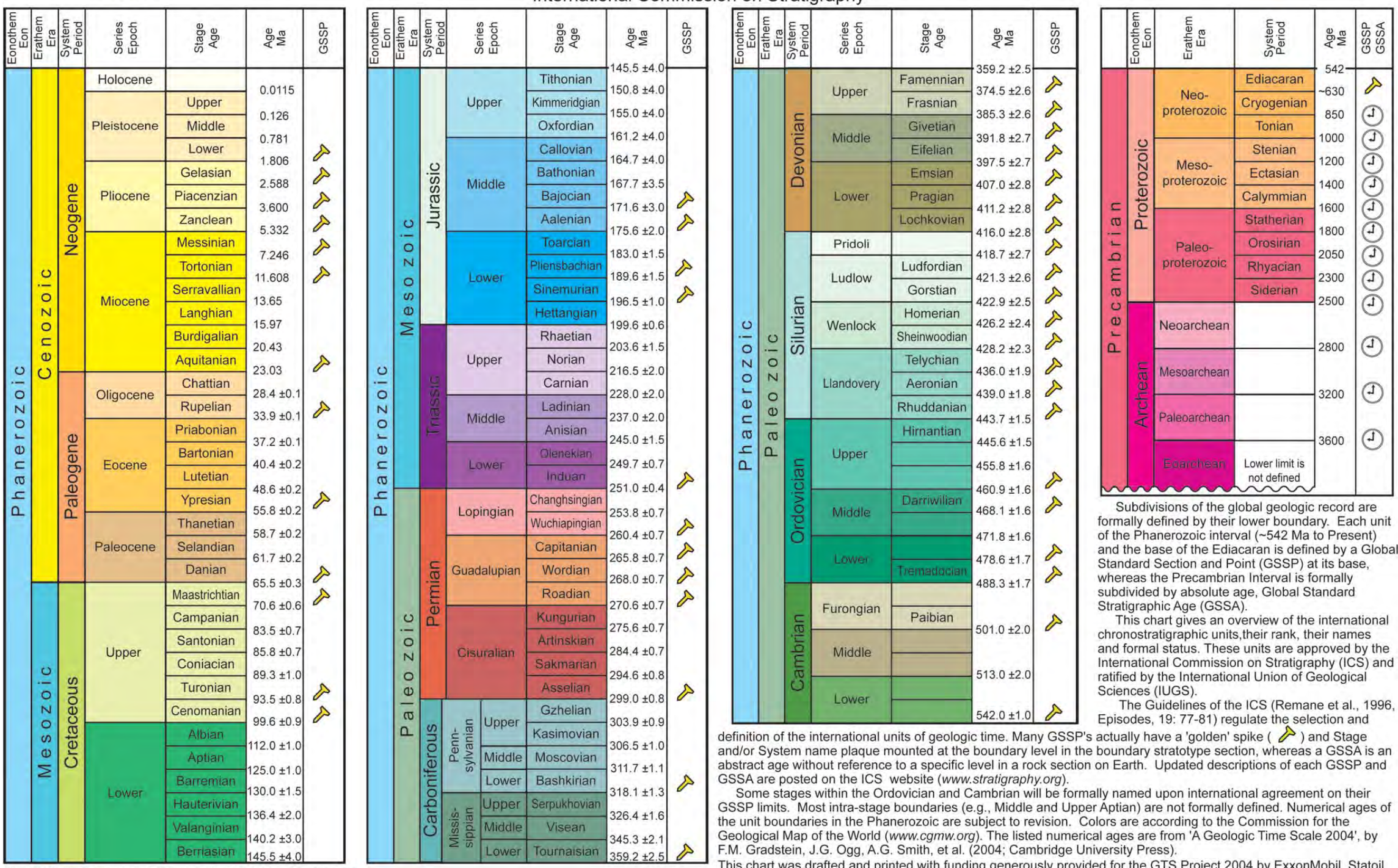
11-
Kollision zonen

INTERNATIONAL STRATIGRAPHIC CHART

ICS

International Commission on Stratigraphy

IUGS



Subdivisions of the global geologic record are formally defined by their lower boundary. Each unit of the Phanerozoic interval (~542 Ma to Present) and the base of the Ediacaran is defined by a Global Standard Section and Point (GSSP) at its base, whereas the Precambrian Interval is formally subdivided by absolute age, Global Standard Stratigraphic Age (GSSA).

This chart gives an overview of the international chronostratigraphic units,their rank, their names and formal status. These units are approved by the International Commission on Stratigraphy (ICS) and ratified by the International Union of Geological Sciences (IUGS).

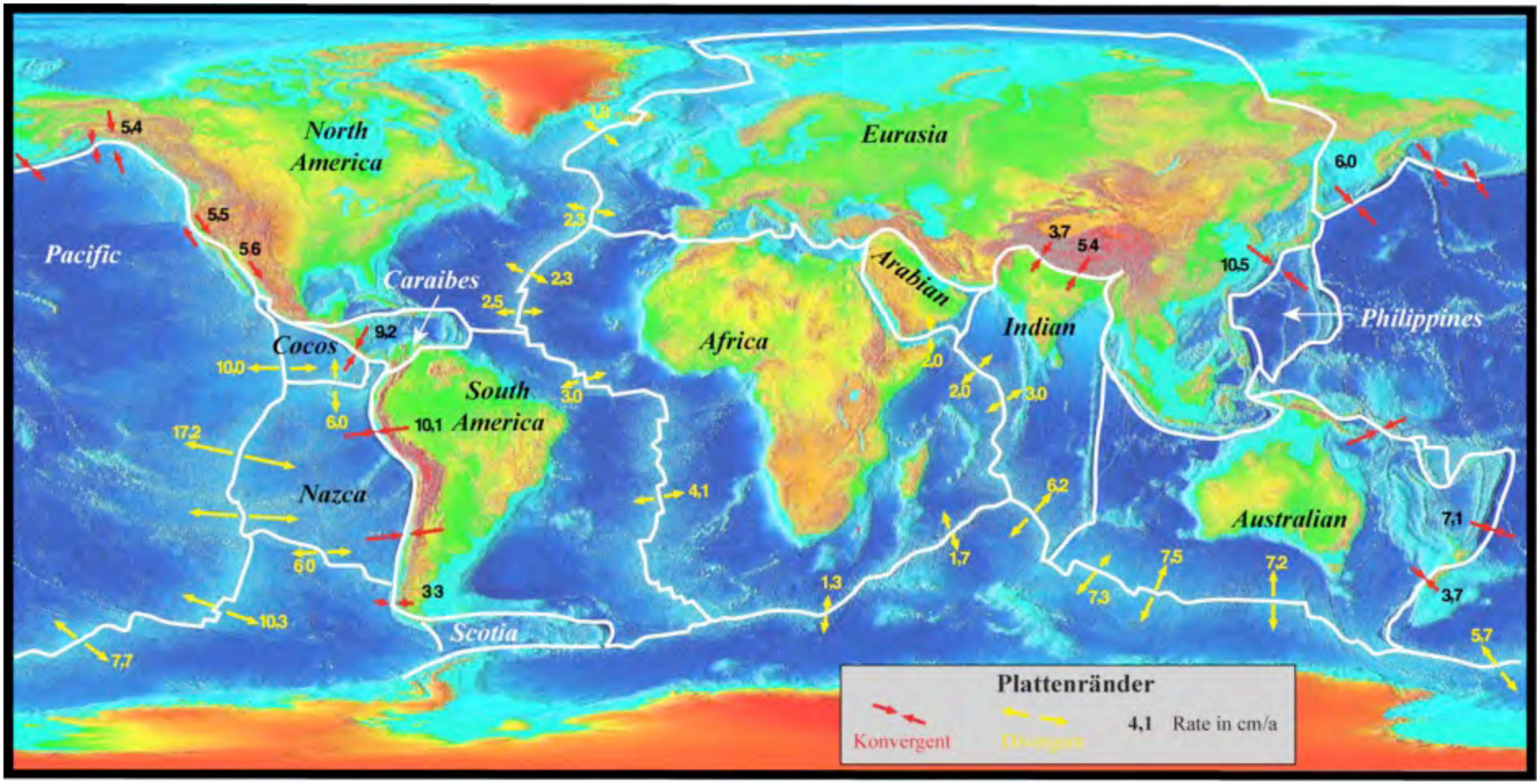
The Guidelines of the ICS (Remane et al., 1996, Episodes, 19: 77-81) regulate the selection and definition of the international units of geologic time. Many GSSP's actually have a 'golden' spike ( ) and Stage and/or System name plaque mounted at the boundary level in the boundary stratotype section, whereas a GSSA is an abstract age without reference to a specific level in a rock section on Earth. Updated descriptions of each GSSP and GSSA are posted on the ICS website (*www.stratigraphy.org*).

Some stages within the Ordovician and Cambrian will be formally named upon international agreement on their GSSP limits. Most intra-stage boundaries (e.g., Middle and Upper Aptian) are not formally defined. Numerical ages of the unit boundaries in the Phanerozoic are subject to revision. Colors are according to the Commission for the Geological Map of the World (*www.cgmw.org*). The listed numerical ages are from 'A Geologic Time Scale 2004', by F.M. Gradstein, J.G. Ogg, A.G. Smith, et al. (2004; Cambridge University Press).

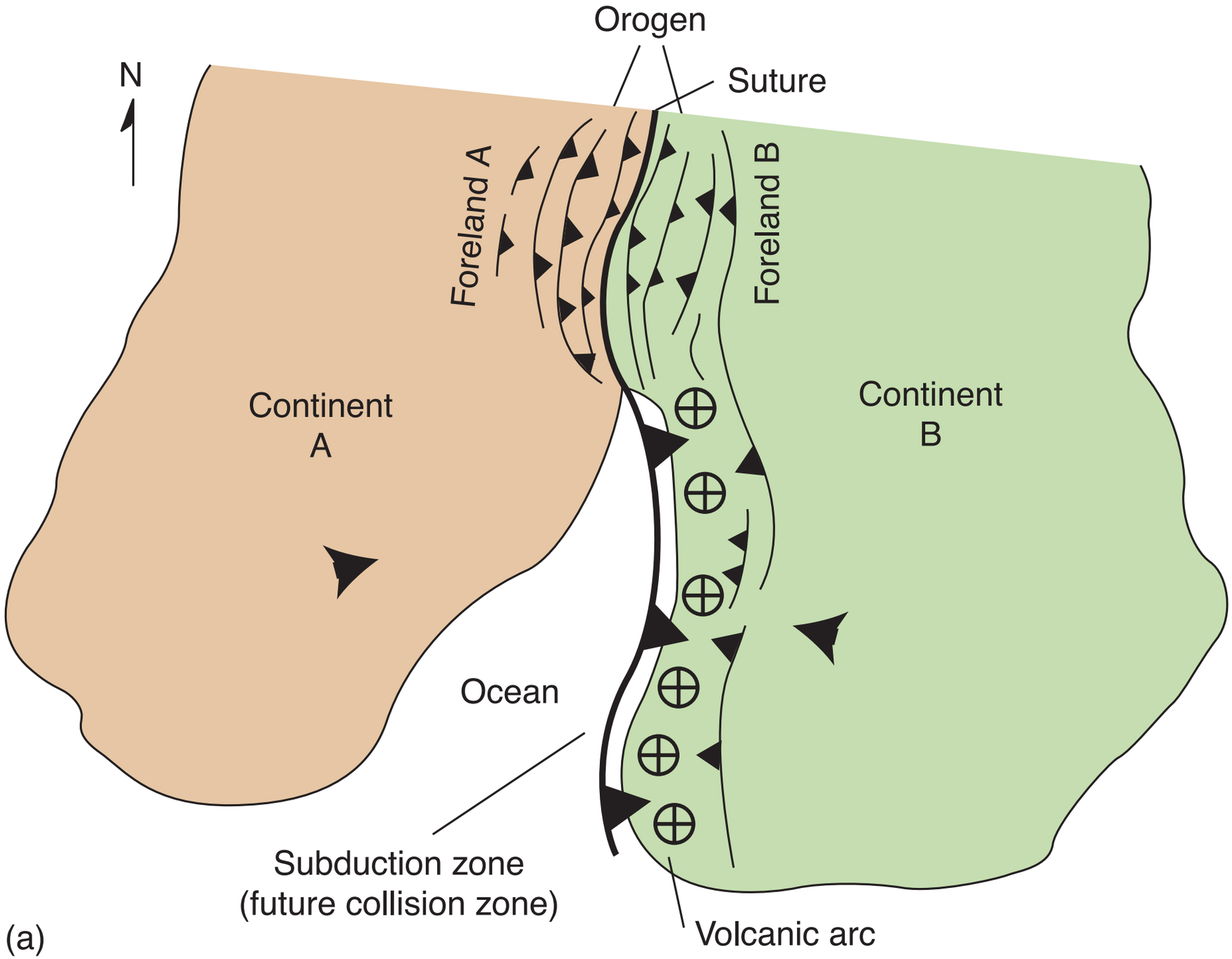
This chart was drafted and printed with funding generously provided for the GTS Project 2004 by ExxonMobil, Statoil Norway, ChevronTexaco and BP. The chart was produced by Gabi Ogg.

R. Bousquet 2009-2010

Konvergente Plattenräder



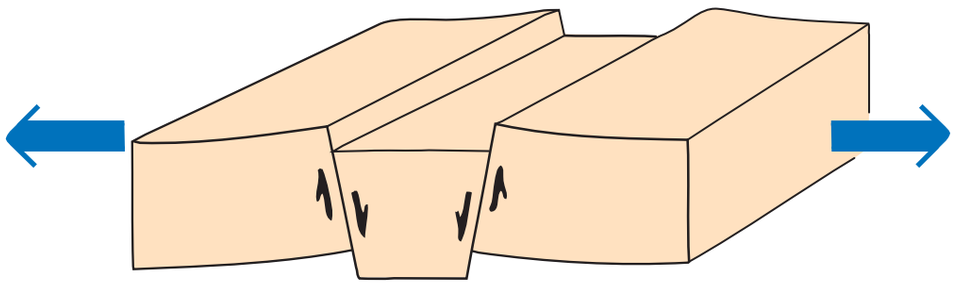
From subduction to collision



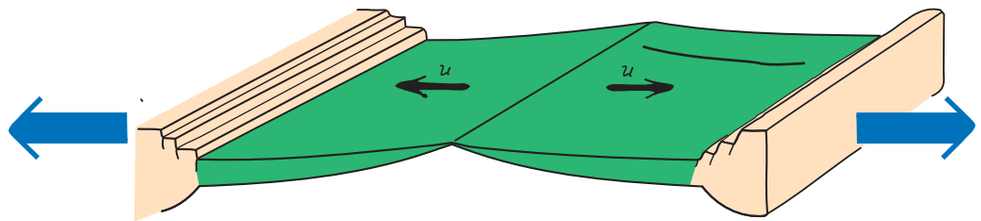
A map showing a zipper-like collision between two continents. Here,the ocean between the two continents is closing progressively from north to south. In the collision zone, the boundary between what had originally been two separate continents.

Wilson cycle

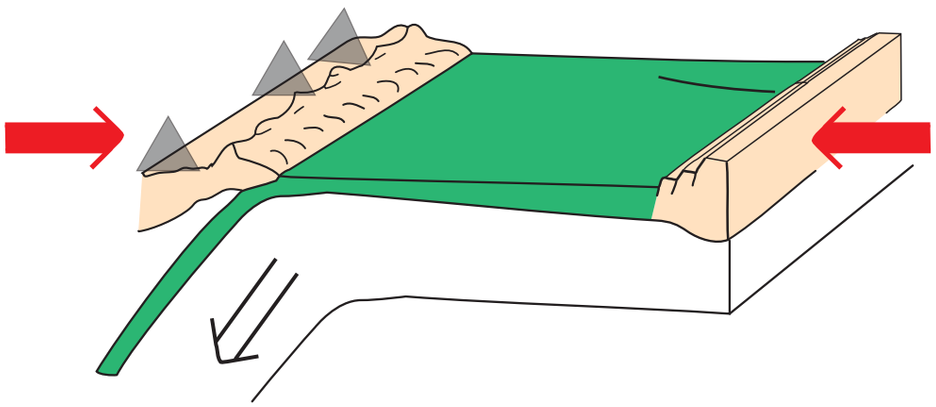
Rifting



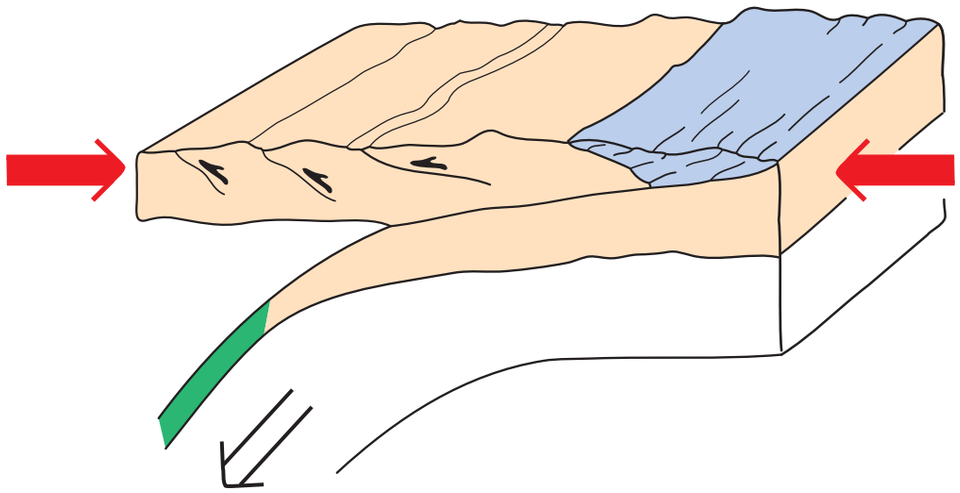
Ocean formation



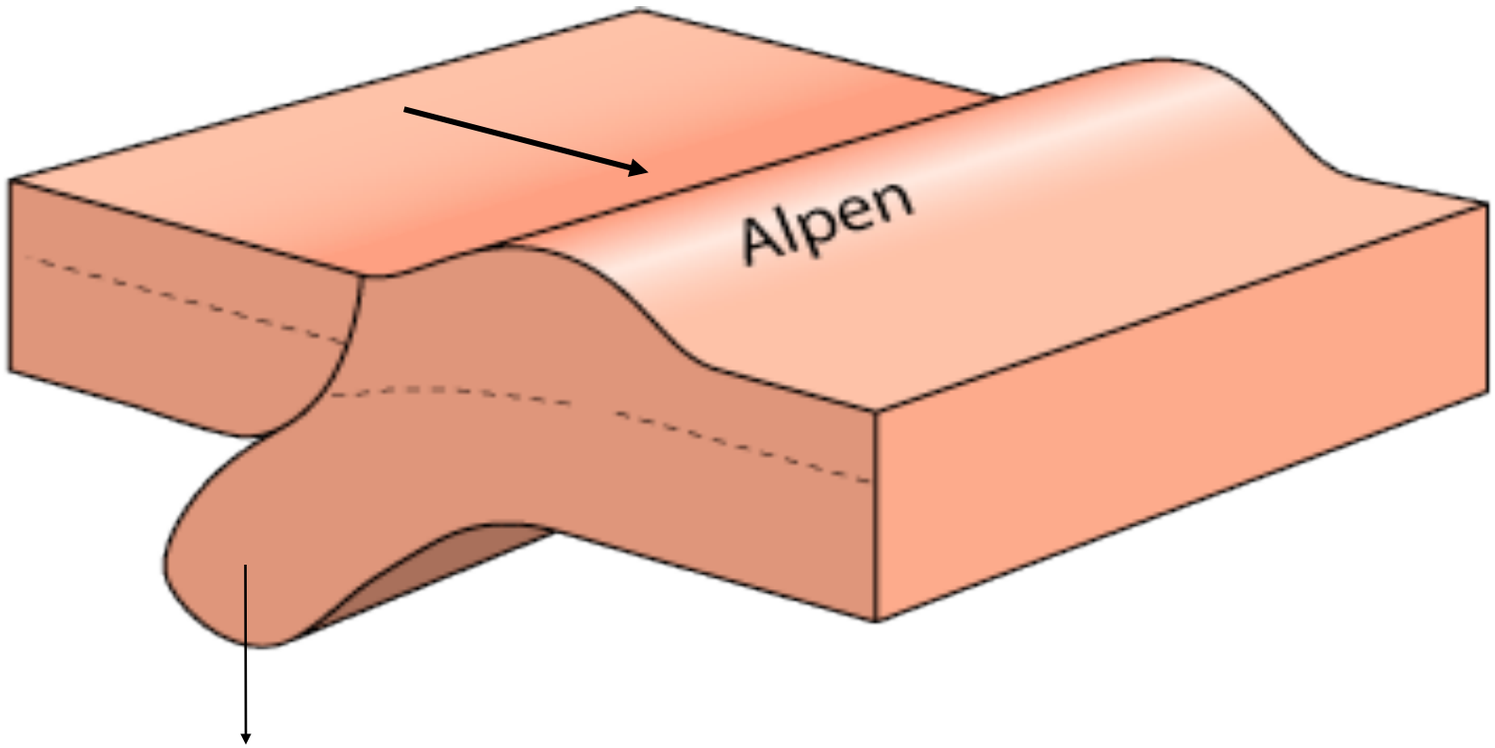
Subduction

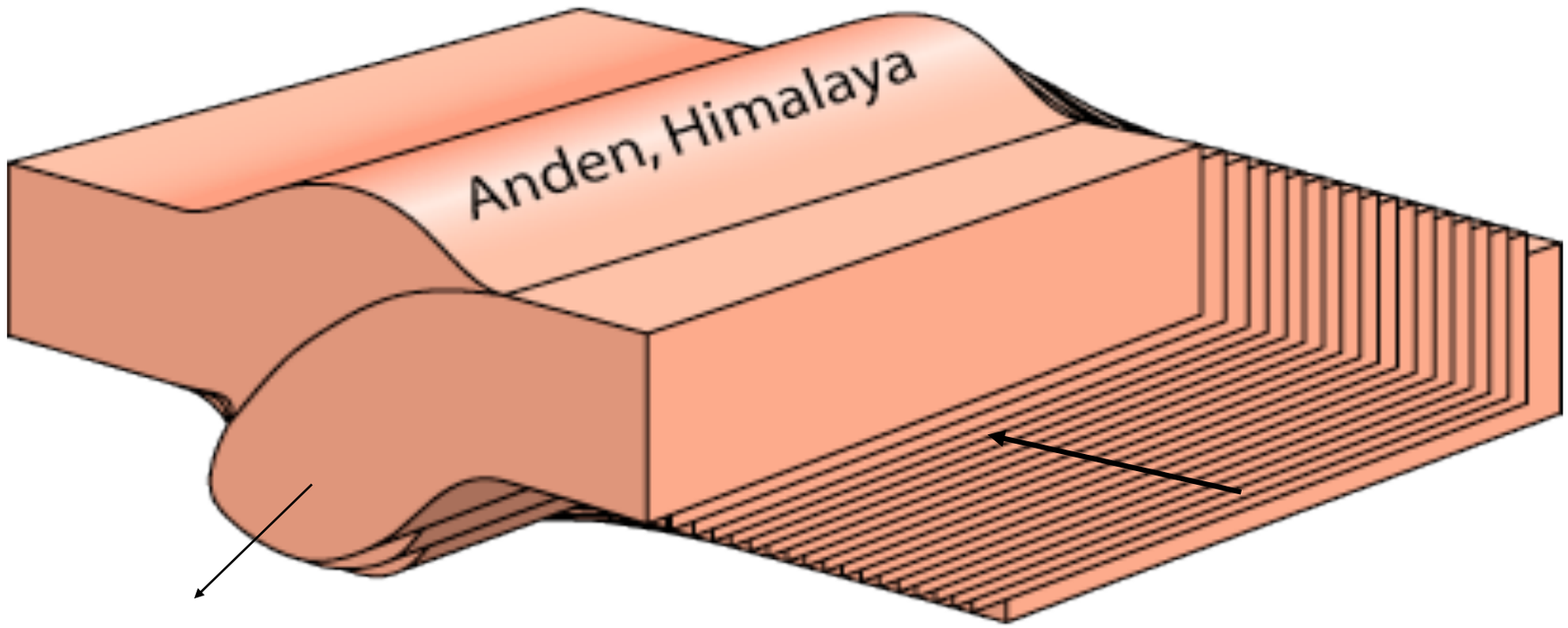


Collision

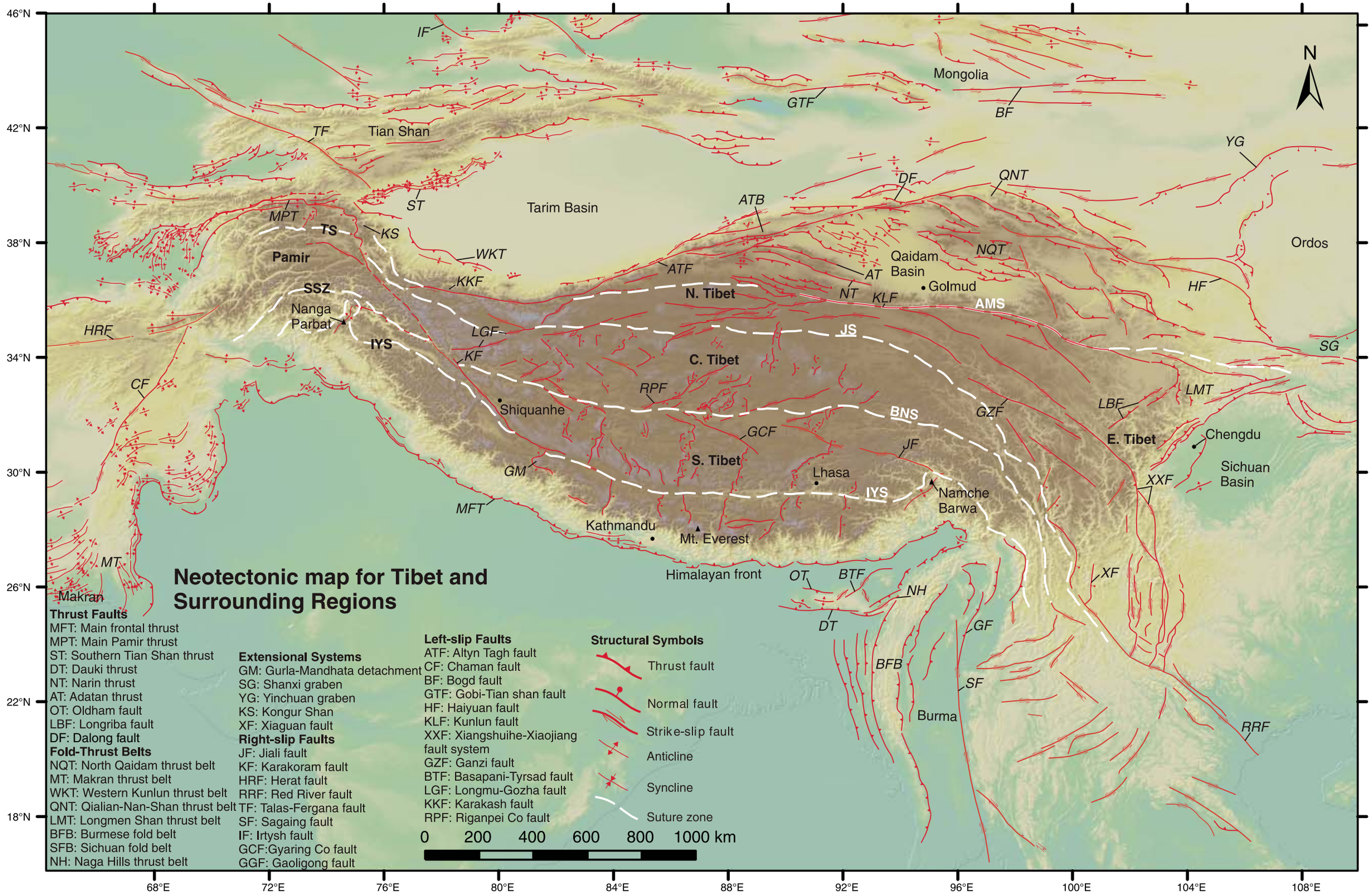


Topography: Alps vs Himalaya



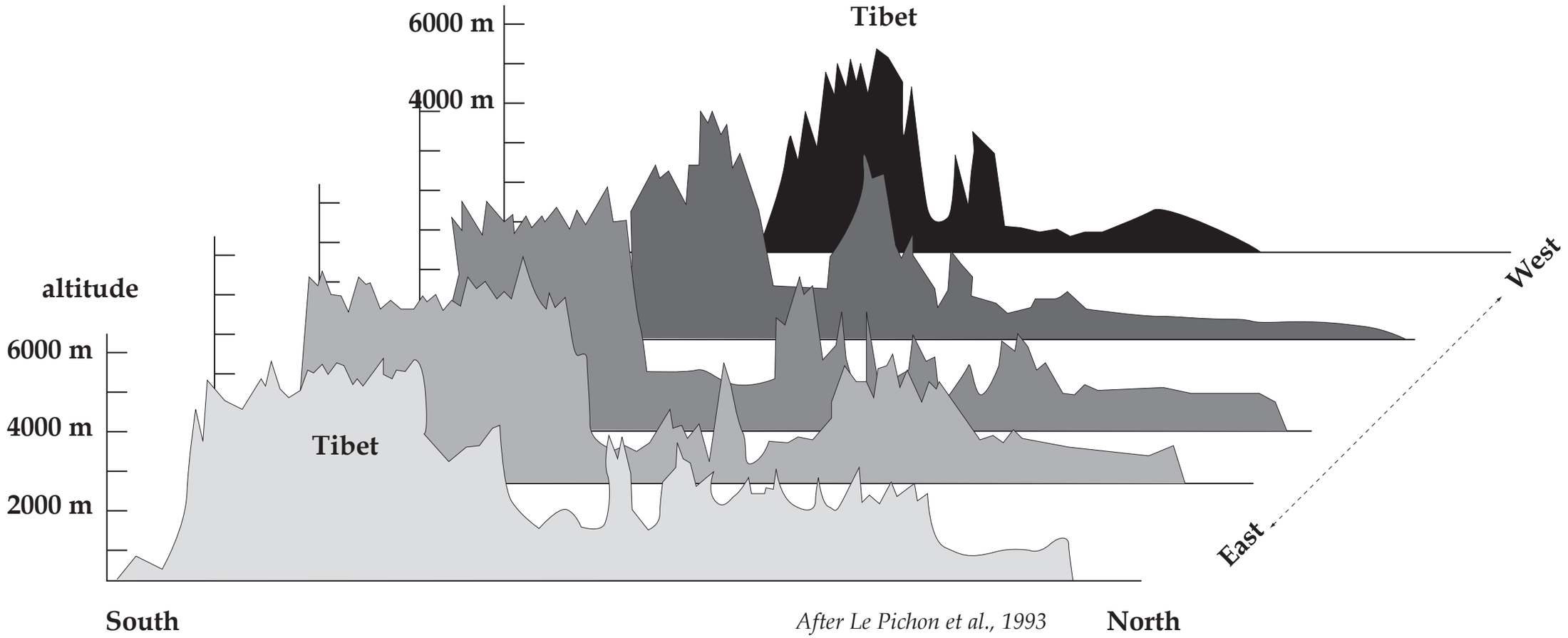


Himalaya-Tibet system: topography



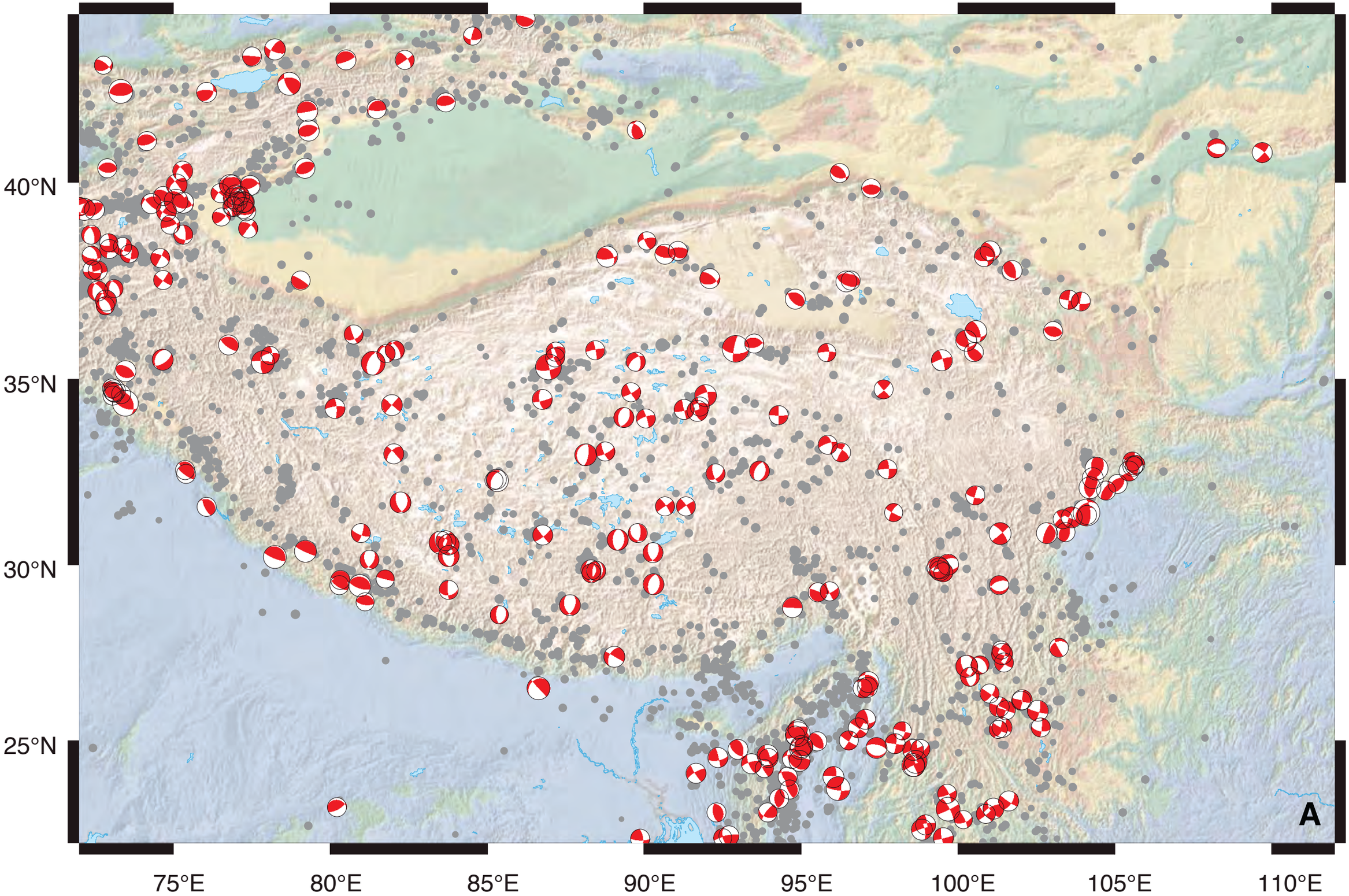
R. Bousquet 2009-2010

Himalaya-Tibet system: topography



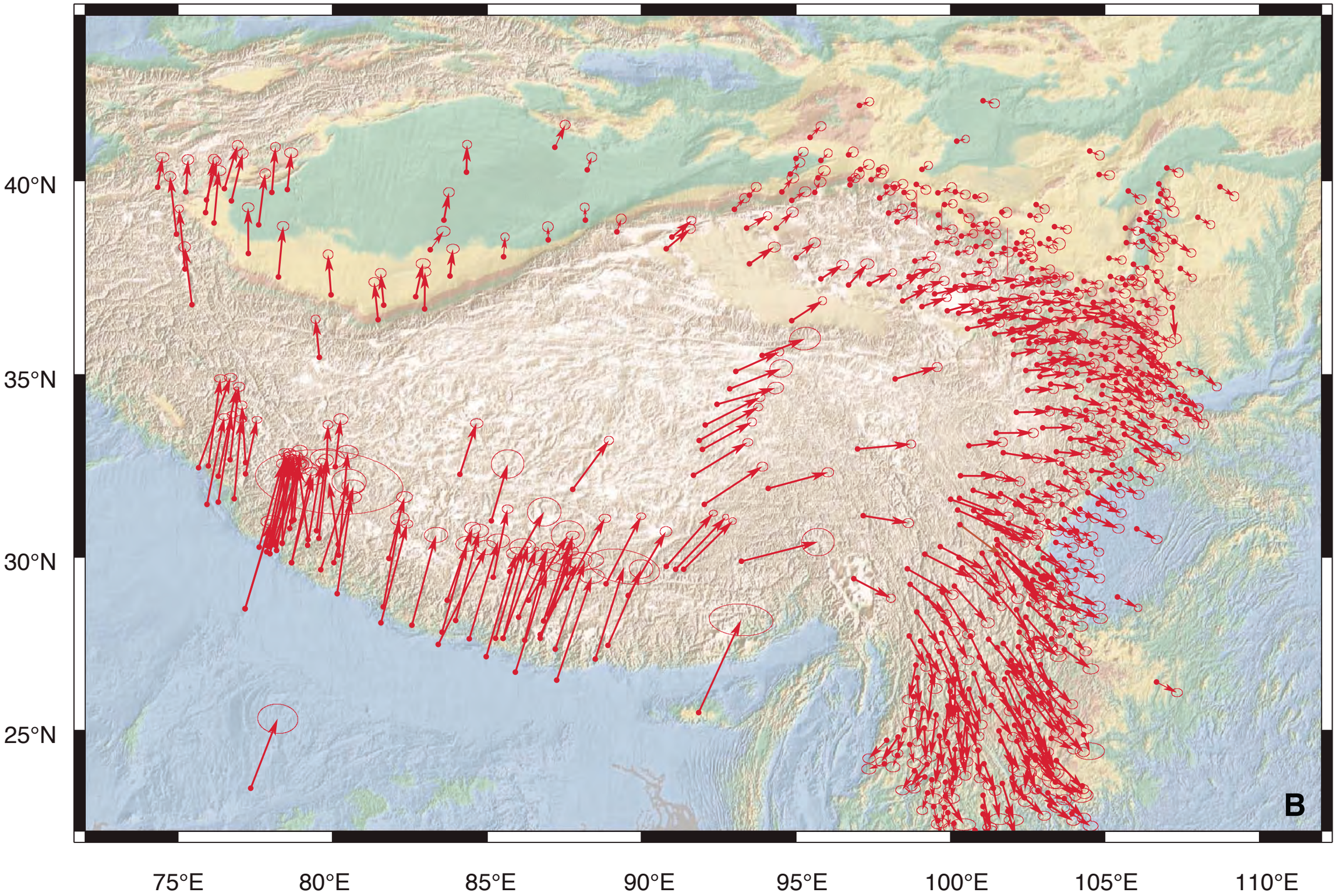
After Le Pichon et al., 1993

Himalaya-Tibet system: earthquakes



R. Bousquet

Himalaya-Tibet system: GPS



R. Bousquet

Himalaya-Tibet system: geology

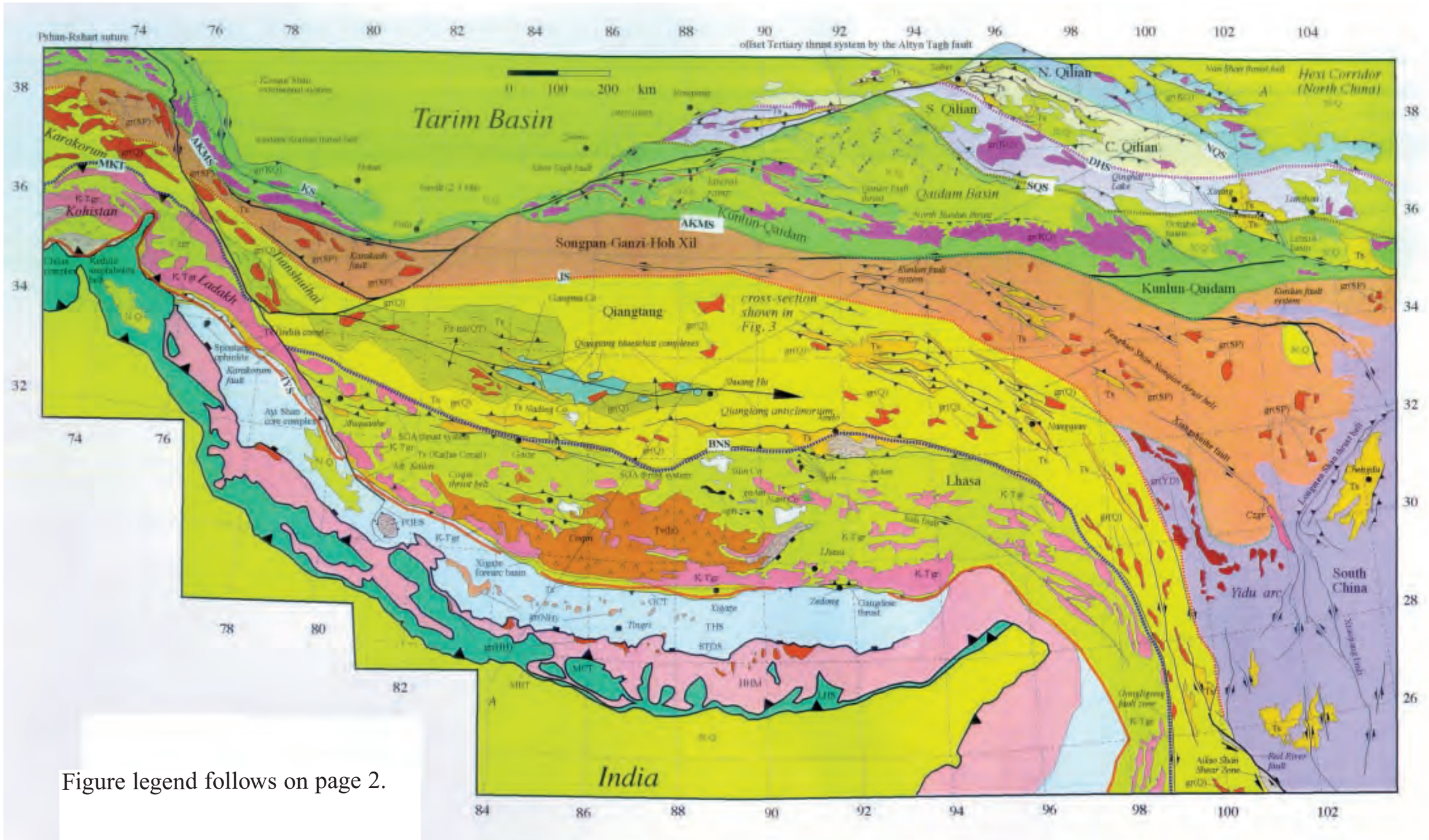


Figure legend follows on page 2.

Himalaya-Tibet system: geology

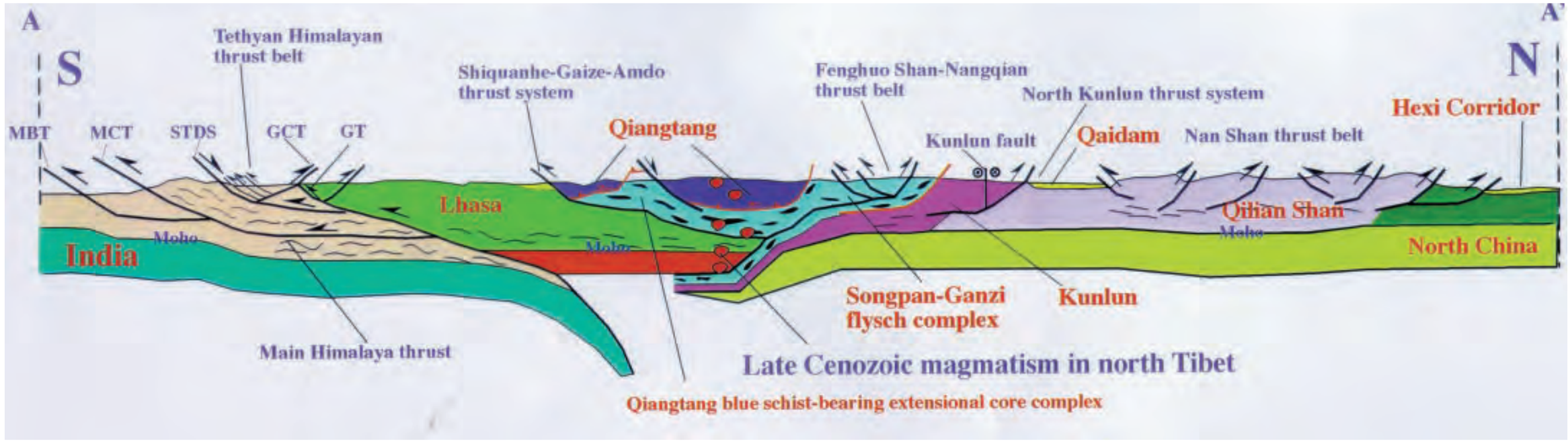
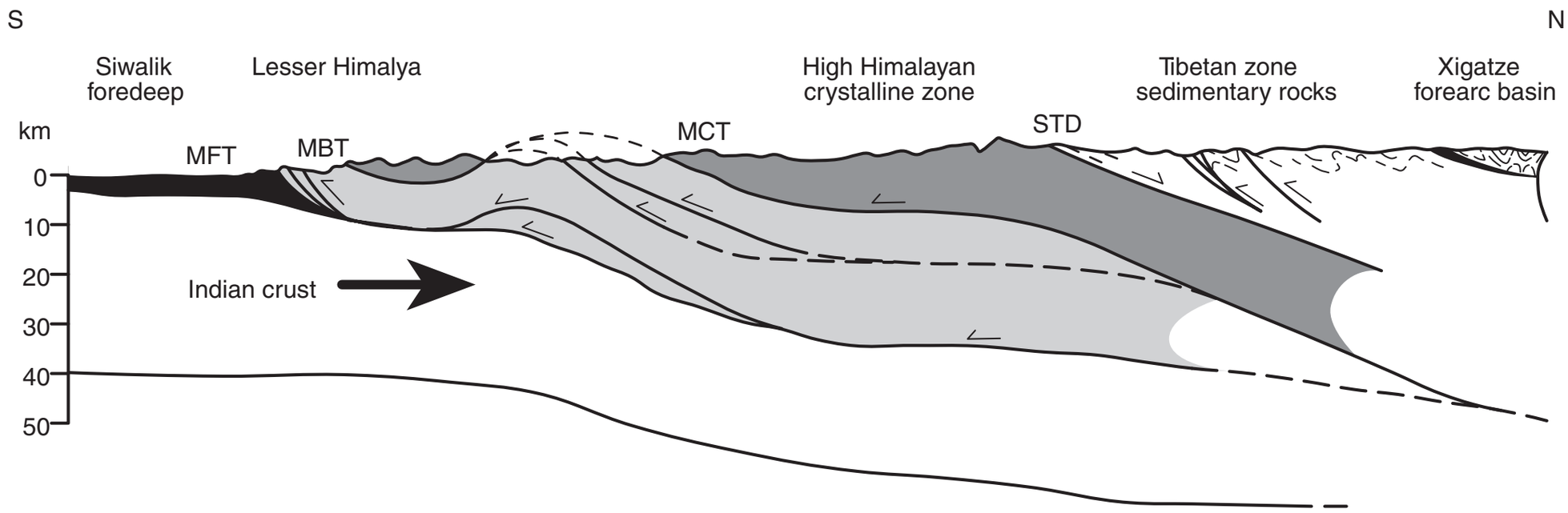
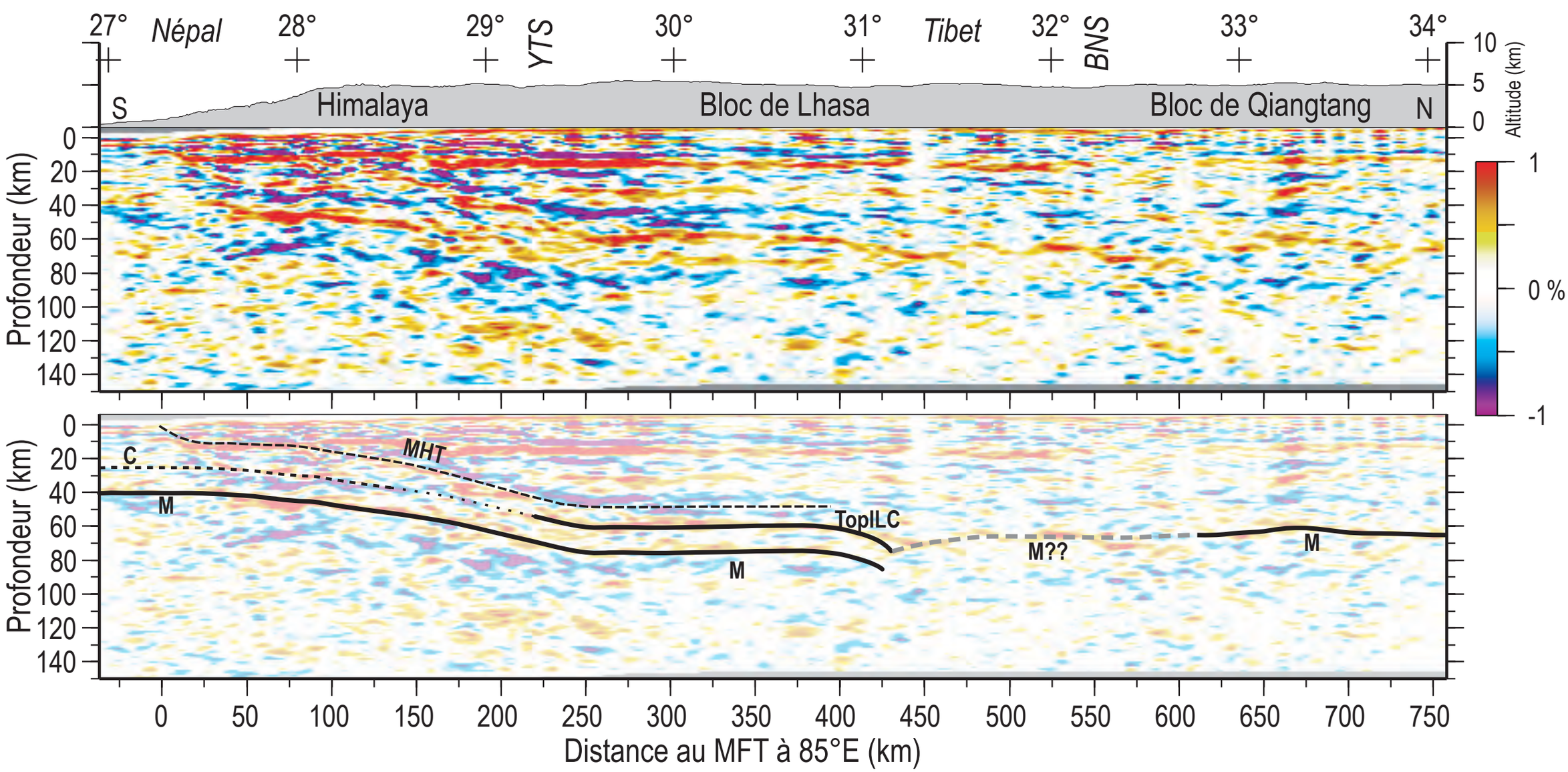


Figure 3 Schematic geologic cross-section across the Himalayan-Tibetan orogen. See Figure 2 for the location of the cross-section.

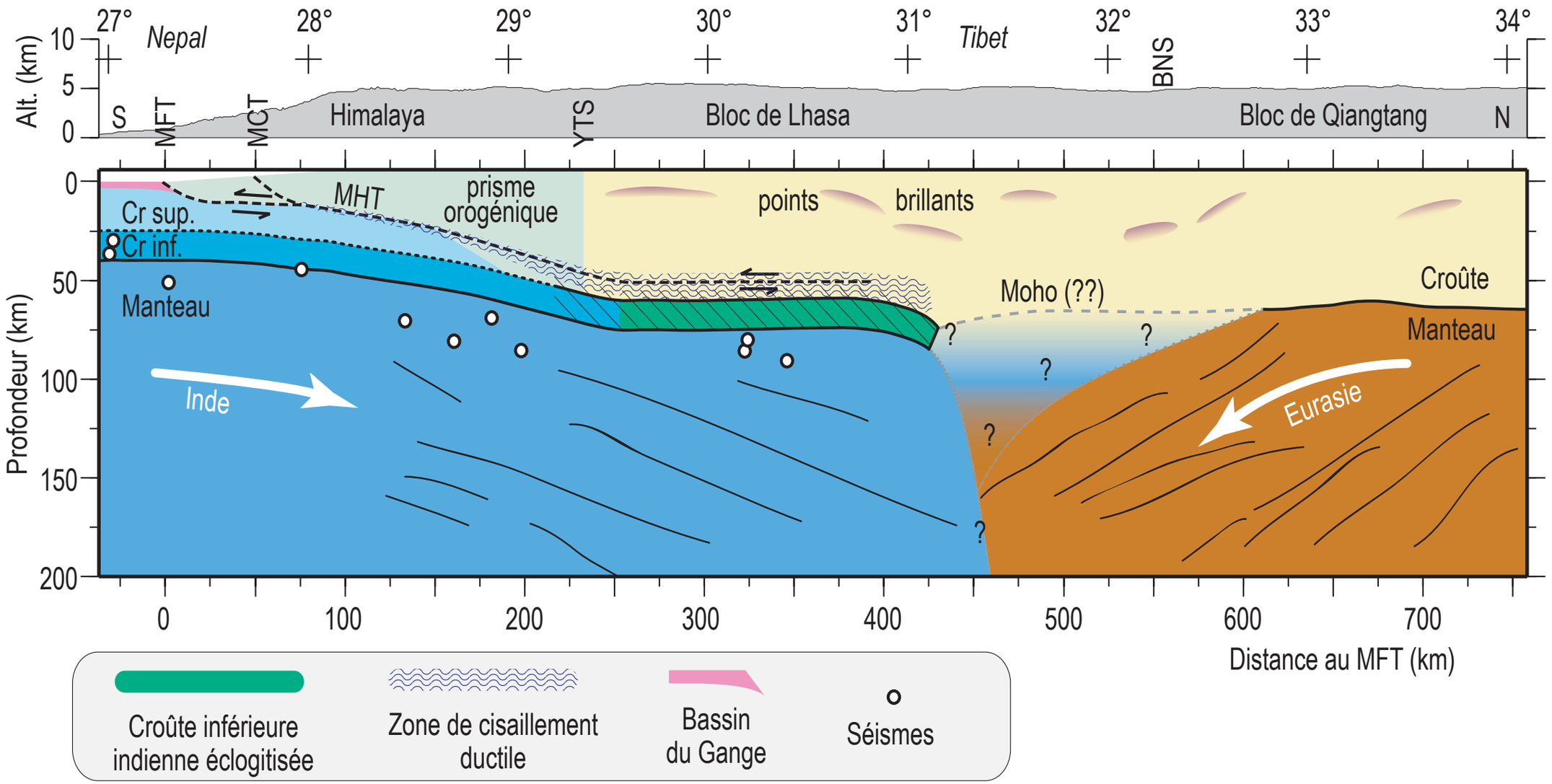


Himalaya-Tibet system: deep structure



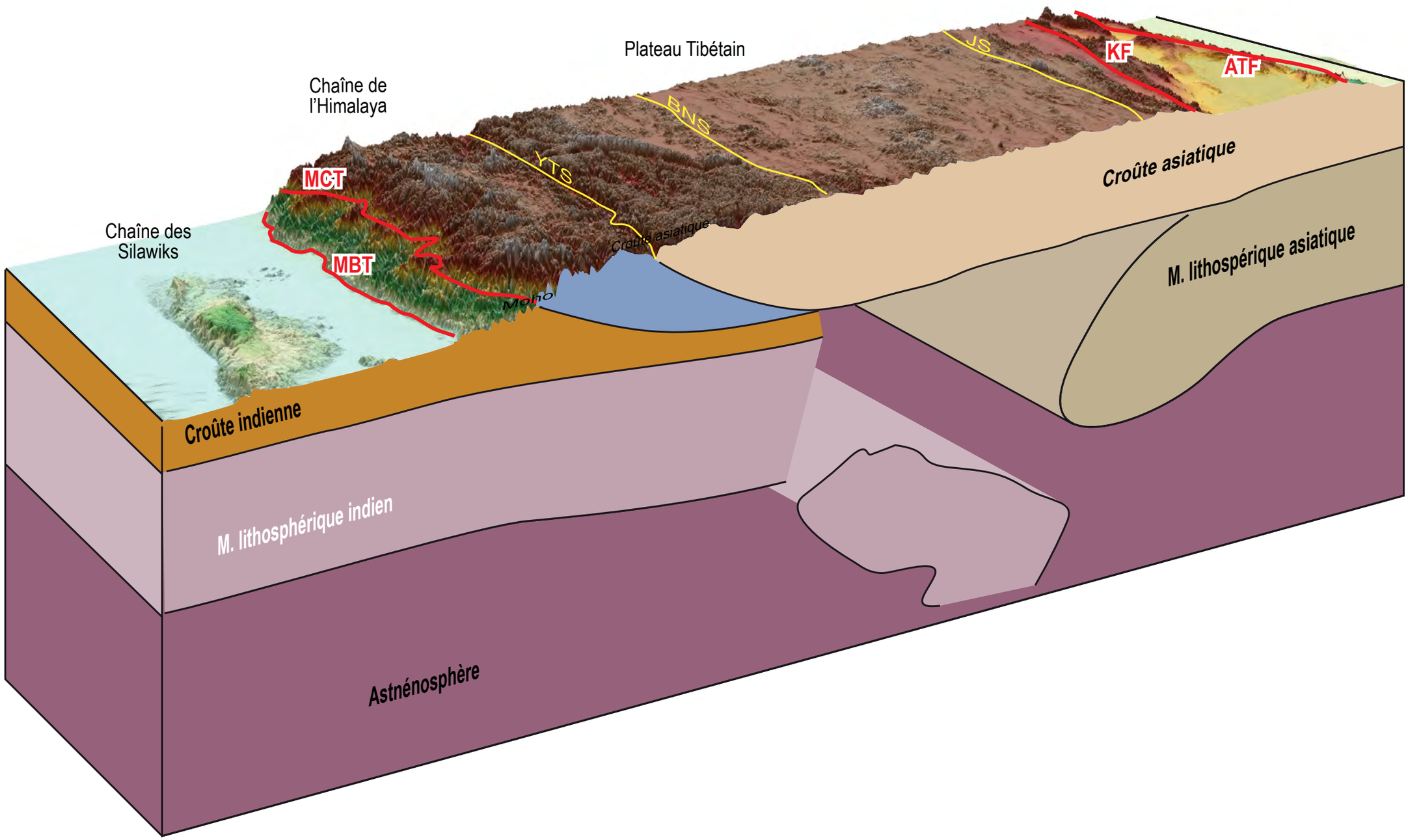
R. Bousquet

Himalaya-Tibet system: deep structure



R. Bousquet

Himalaya-Tibet system: deep structure



Himalaya-Tibet system: geology

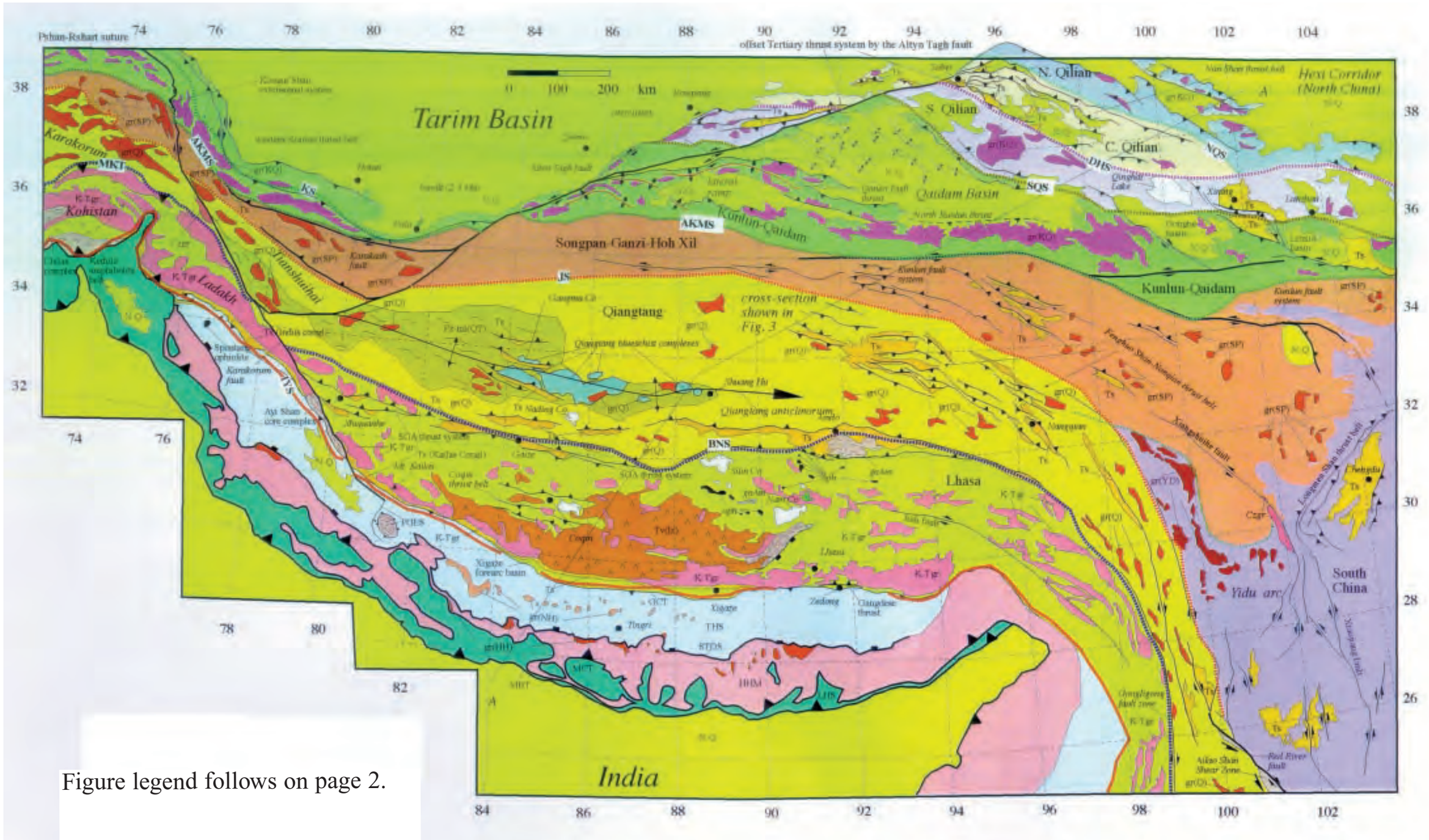
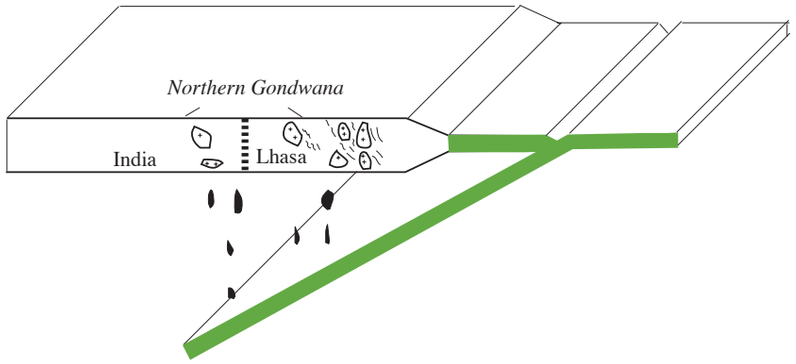


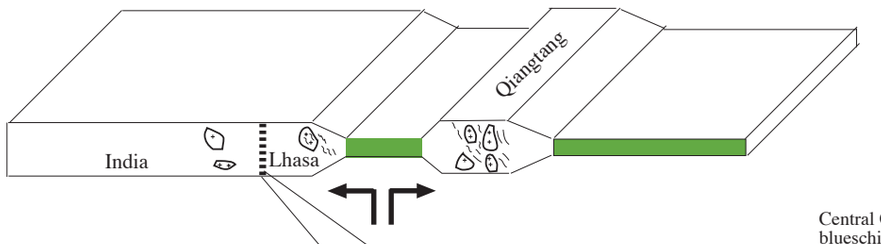
Figure legend follows on page 2.

Himalaya-Tibet system: evolution

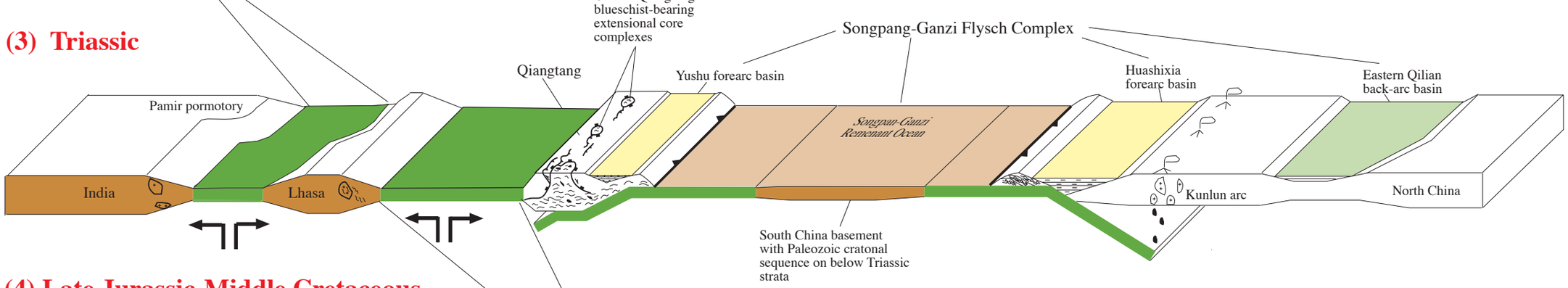
(1) Cambrian-Early Ordovician



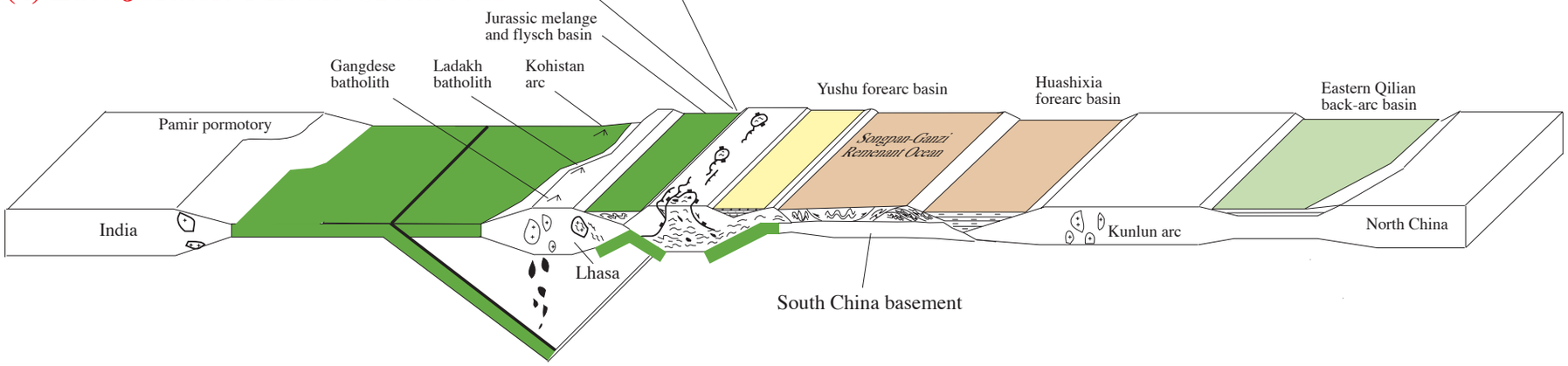
(2) Early Ordovician-Carboniferous



(3) Triassic

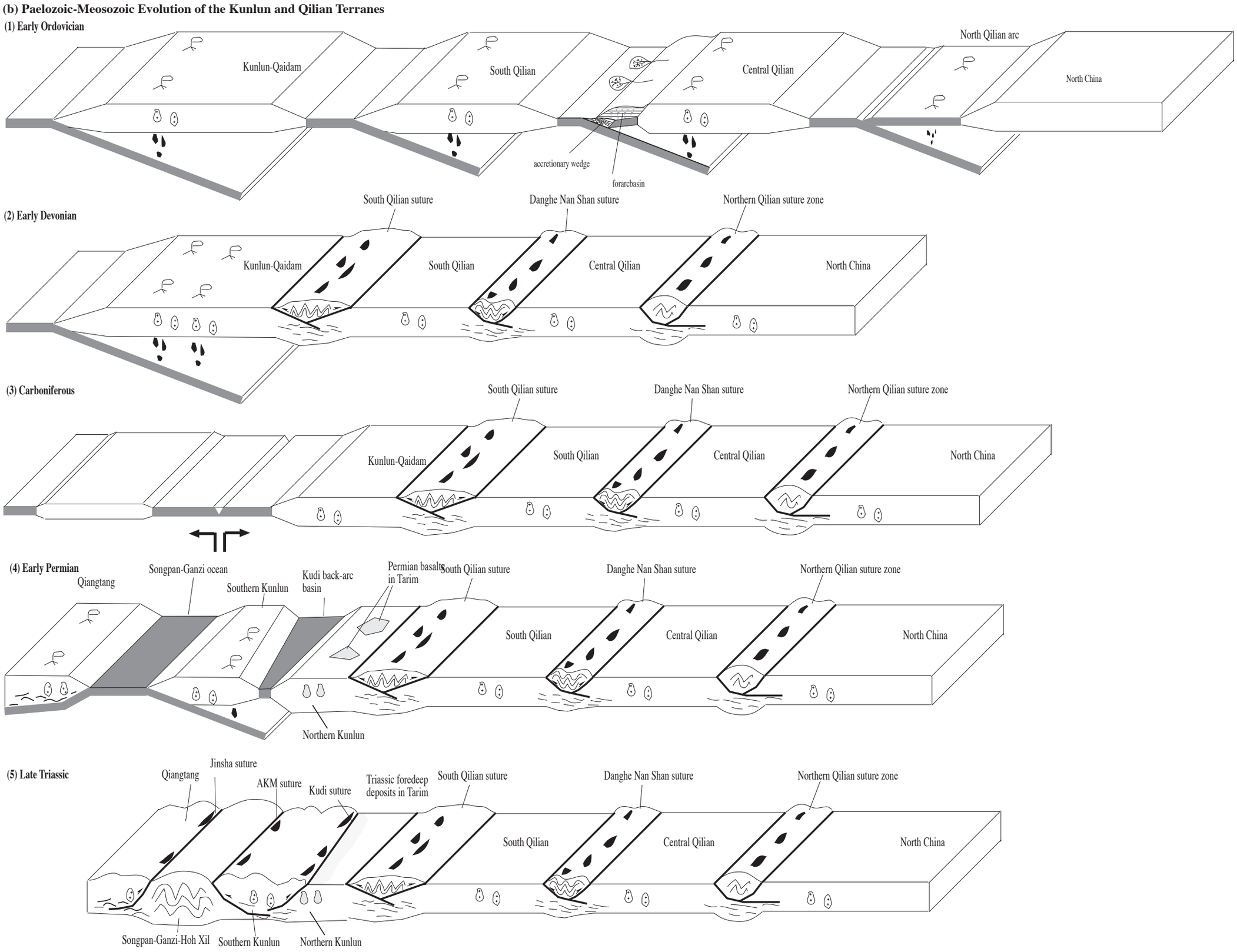


(4) Late Jurassic-Middle Cretaceous



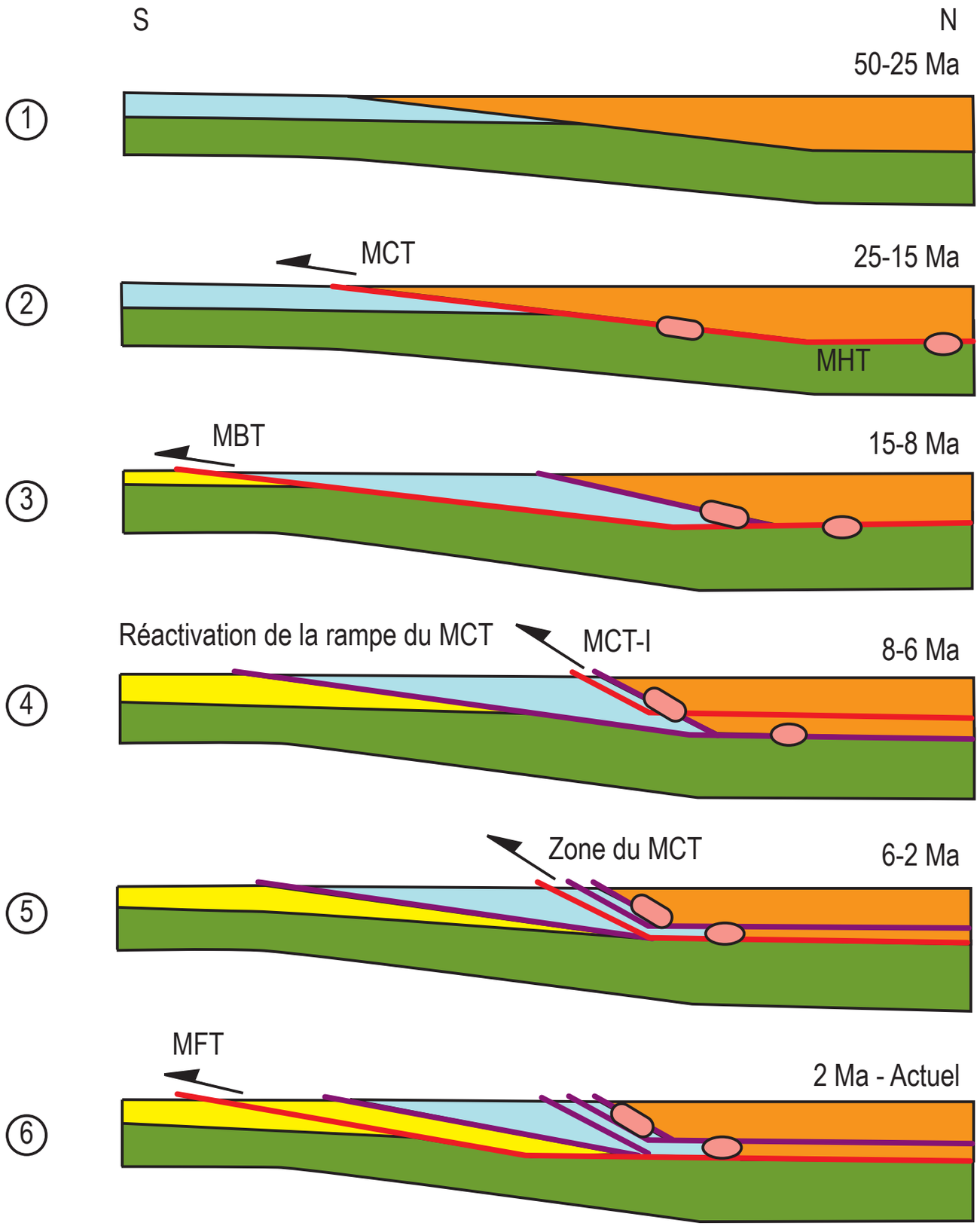
R. Bousquet

Himalaya-Tibet system: evolution



R. Bousquet

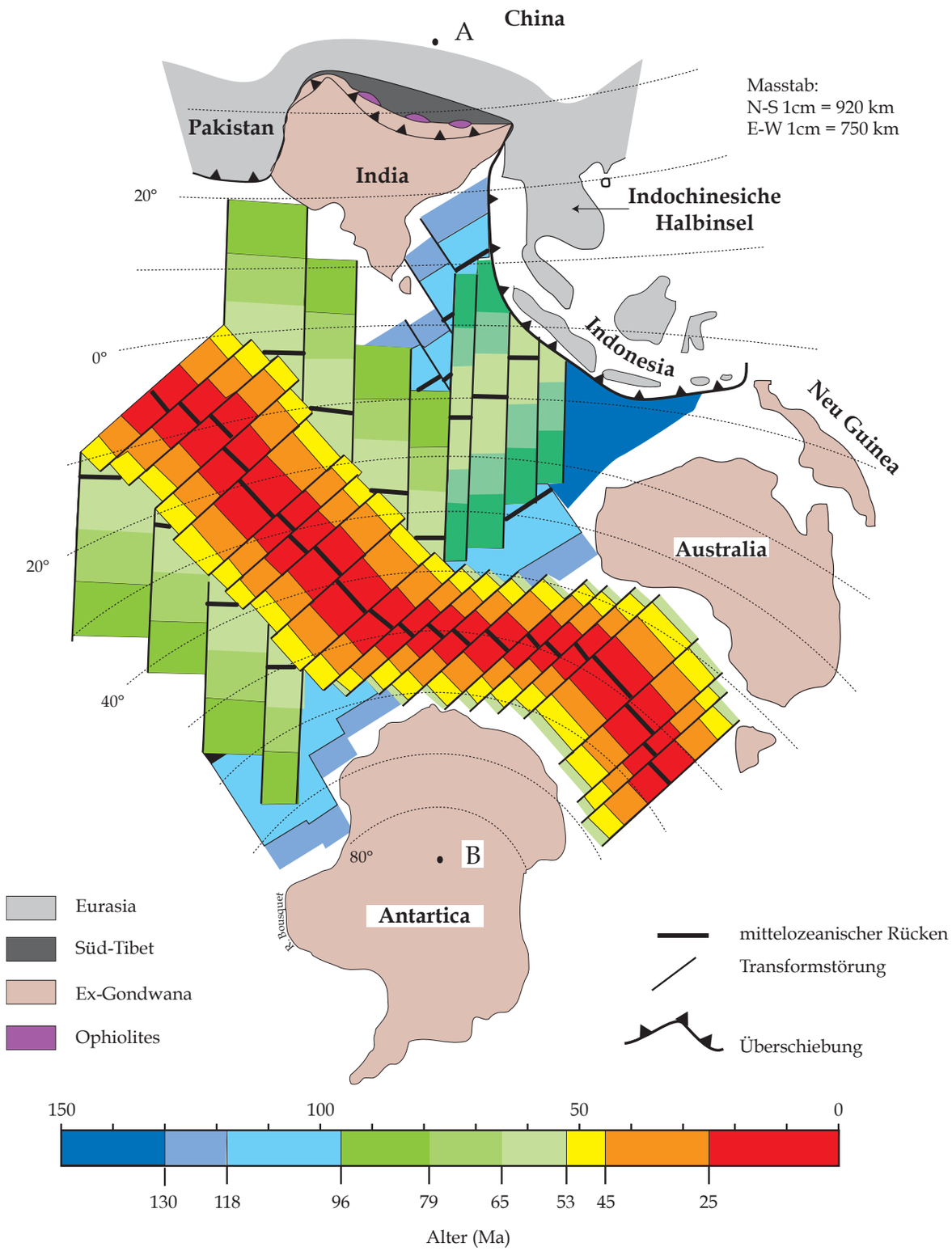
Himalaya-Tibet system: evolution



R. Bousquet

Himalaya-Tibet system: evolution

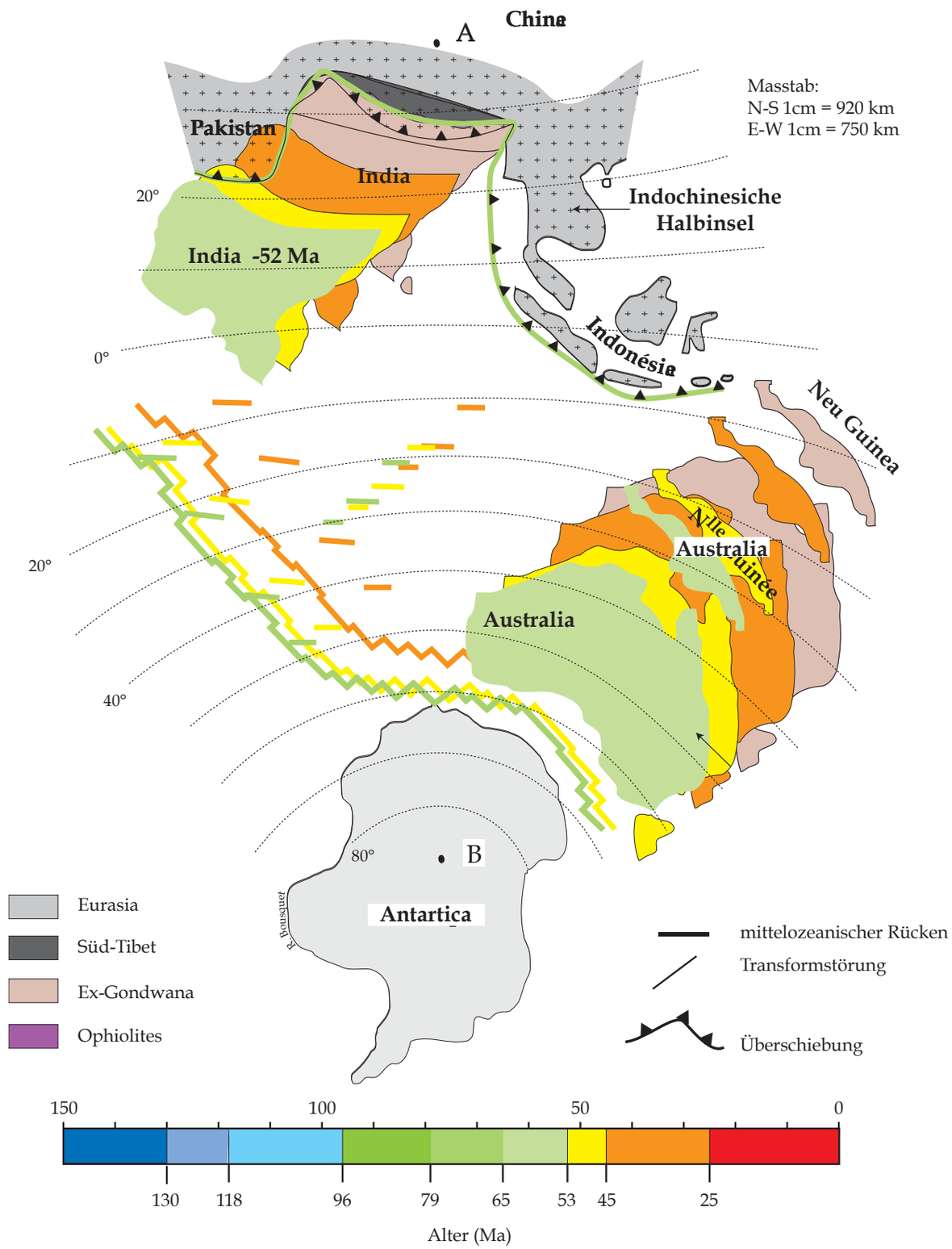
Vereinfache Karte des indische Ozean



R. Bousquet 2009-2010

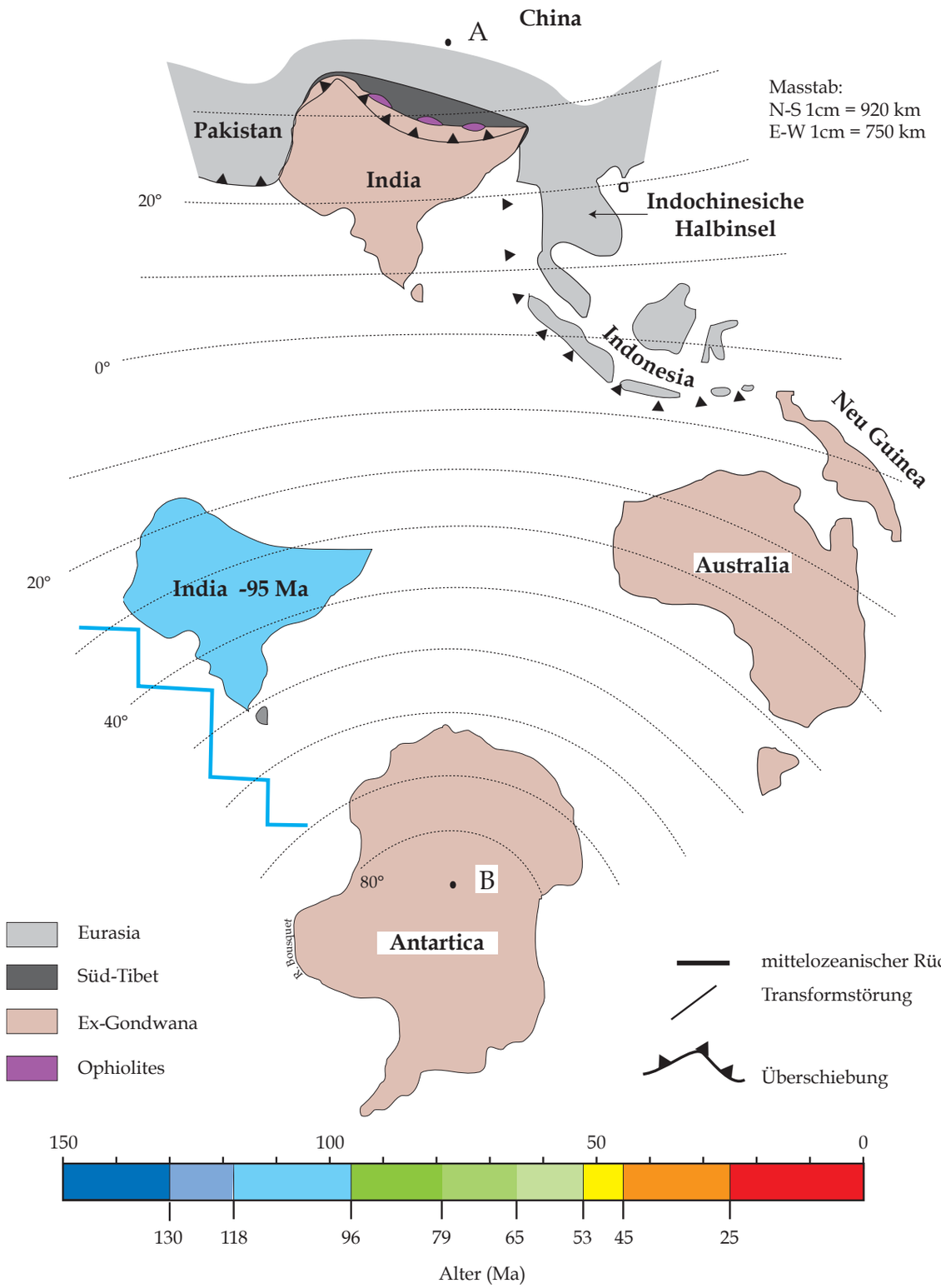
Himalaya-Tibet system: evolution

Vereinfache Karte des indische Ozean

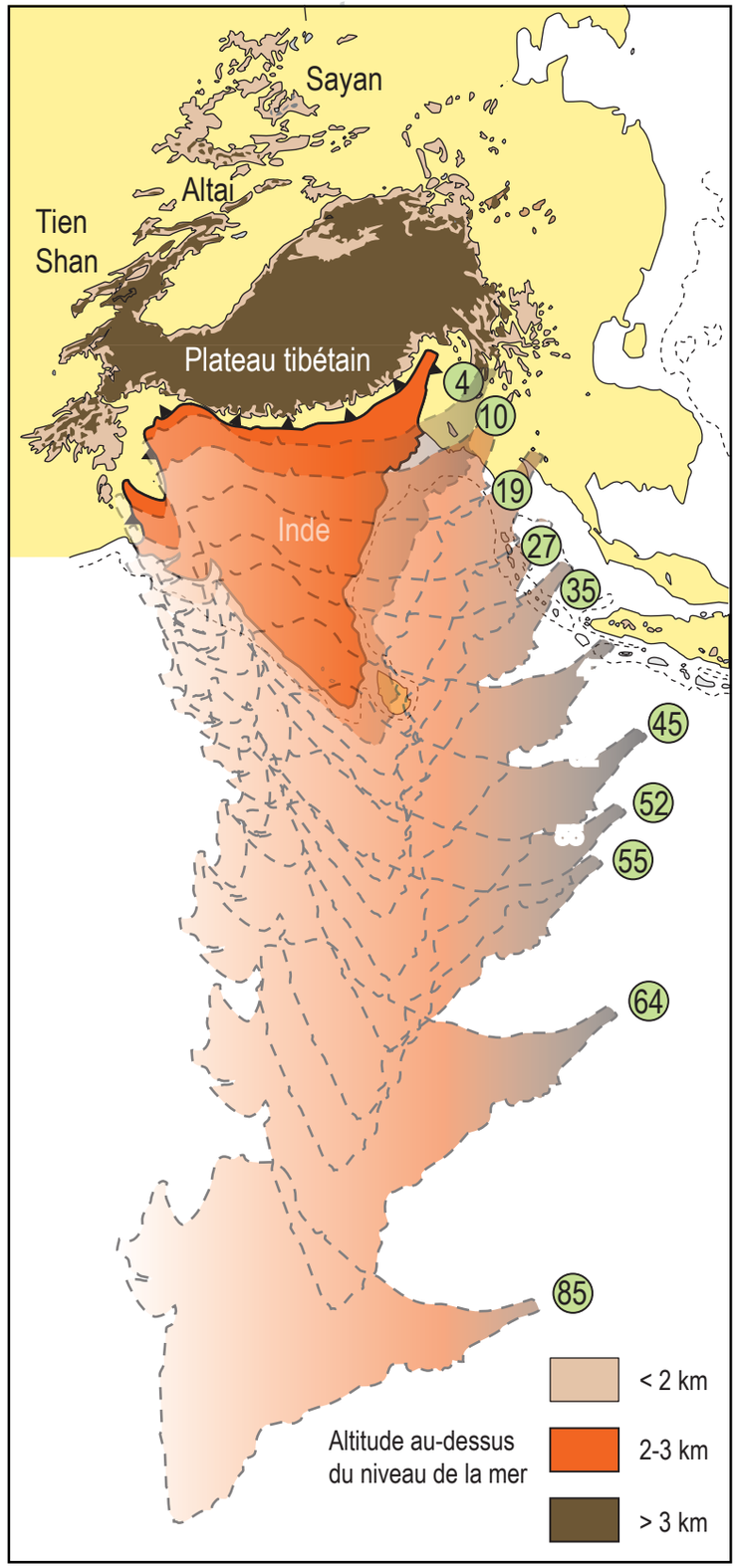


Himalaya-Tibet system: evolution

Vereinfache Karte des indische Ozean

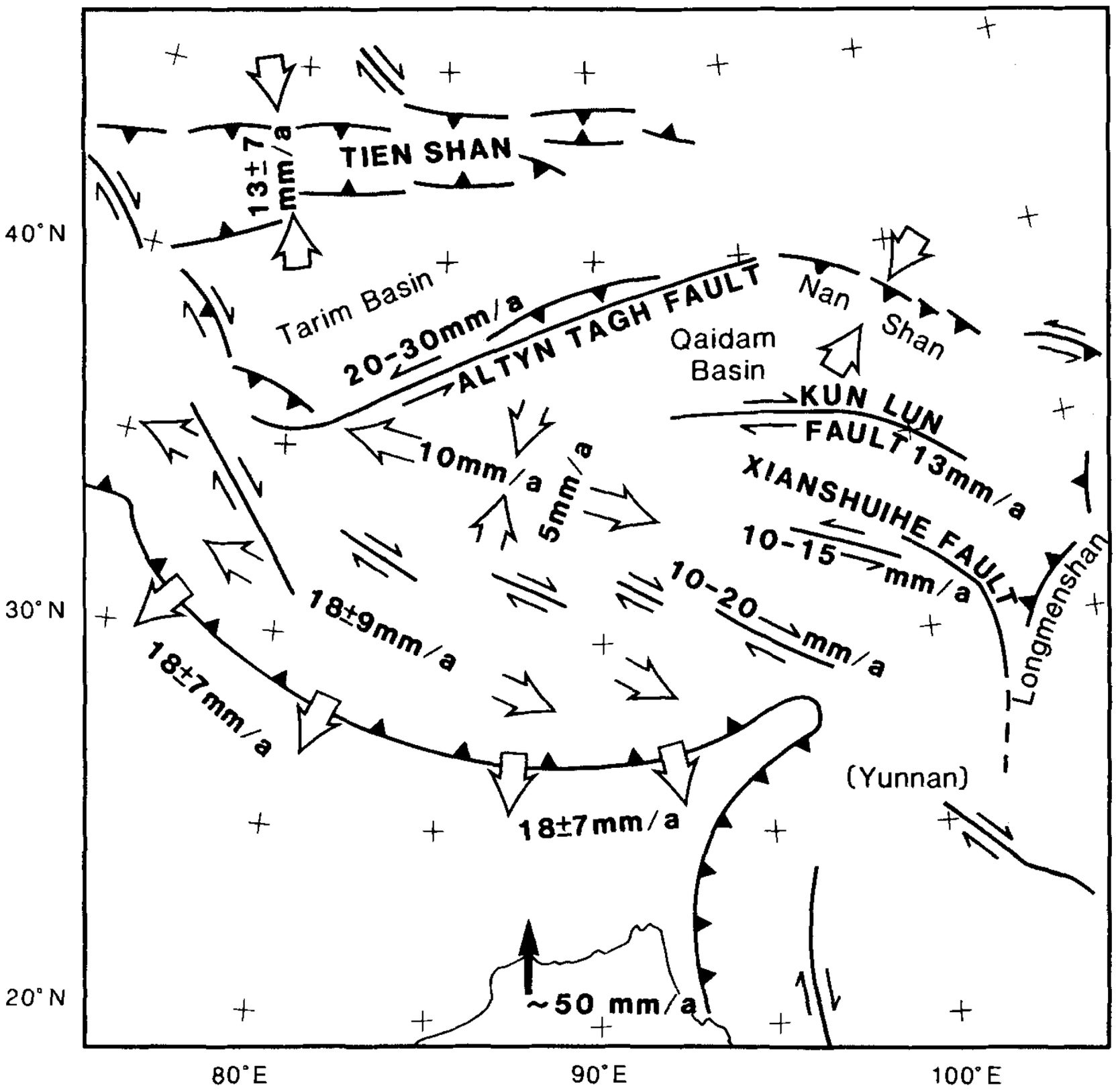


Himalaya-Tibet system: evolution



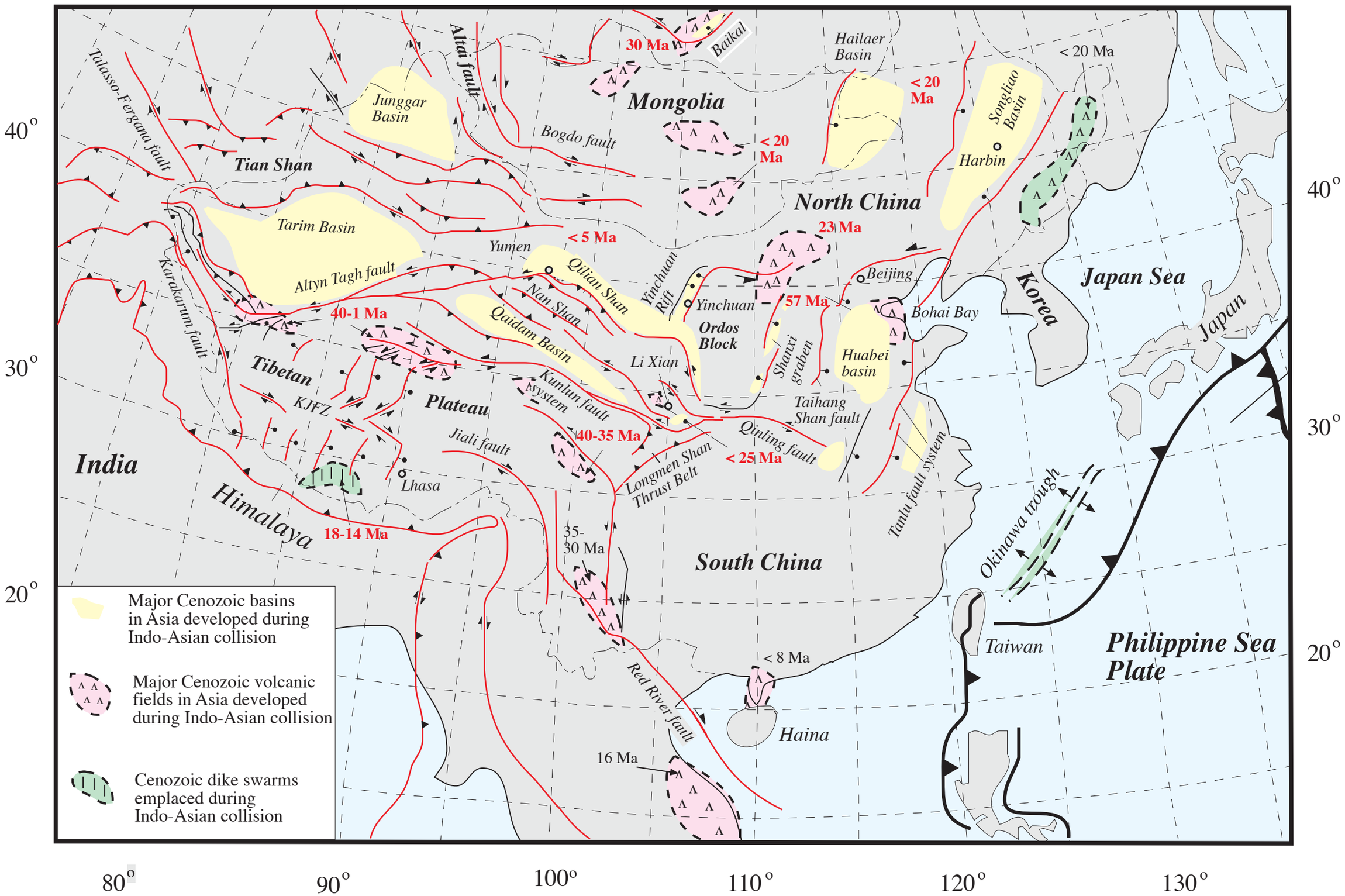
R. Bousquet 2009-2010

Himalaya-Tibet system: Neotectonics



R. Bousquet

Himalaya-Tibet system: deformation of Asia

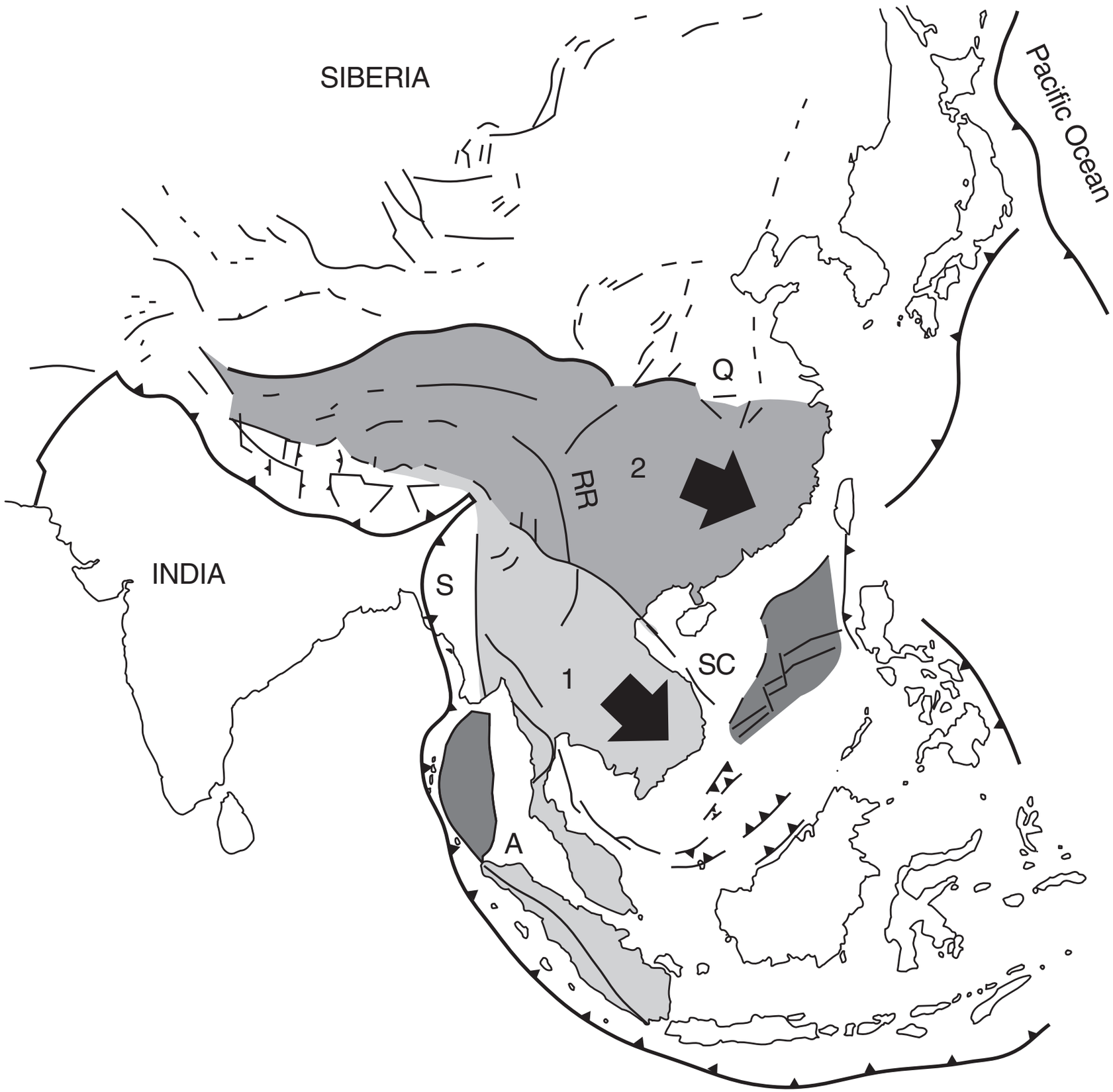


Cenozoic tectonic map of the Indo-Asian collision zone and major active fault systems in Asia.

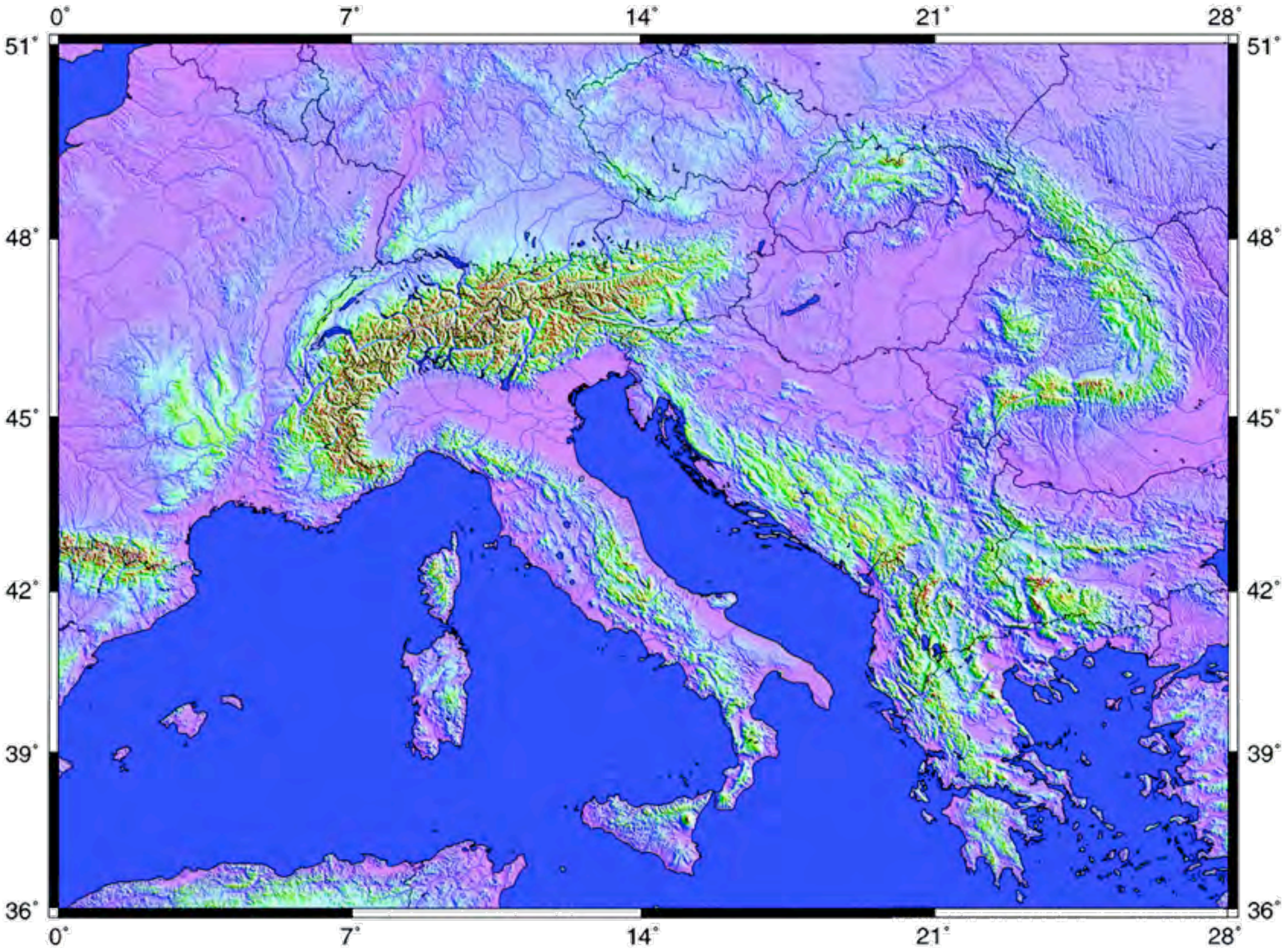
Yin & Harrison 2000

R. Bousquet

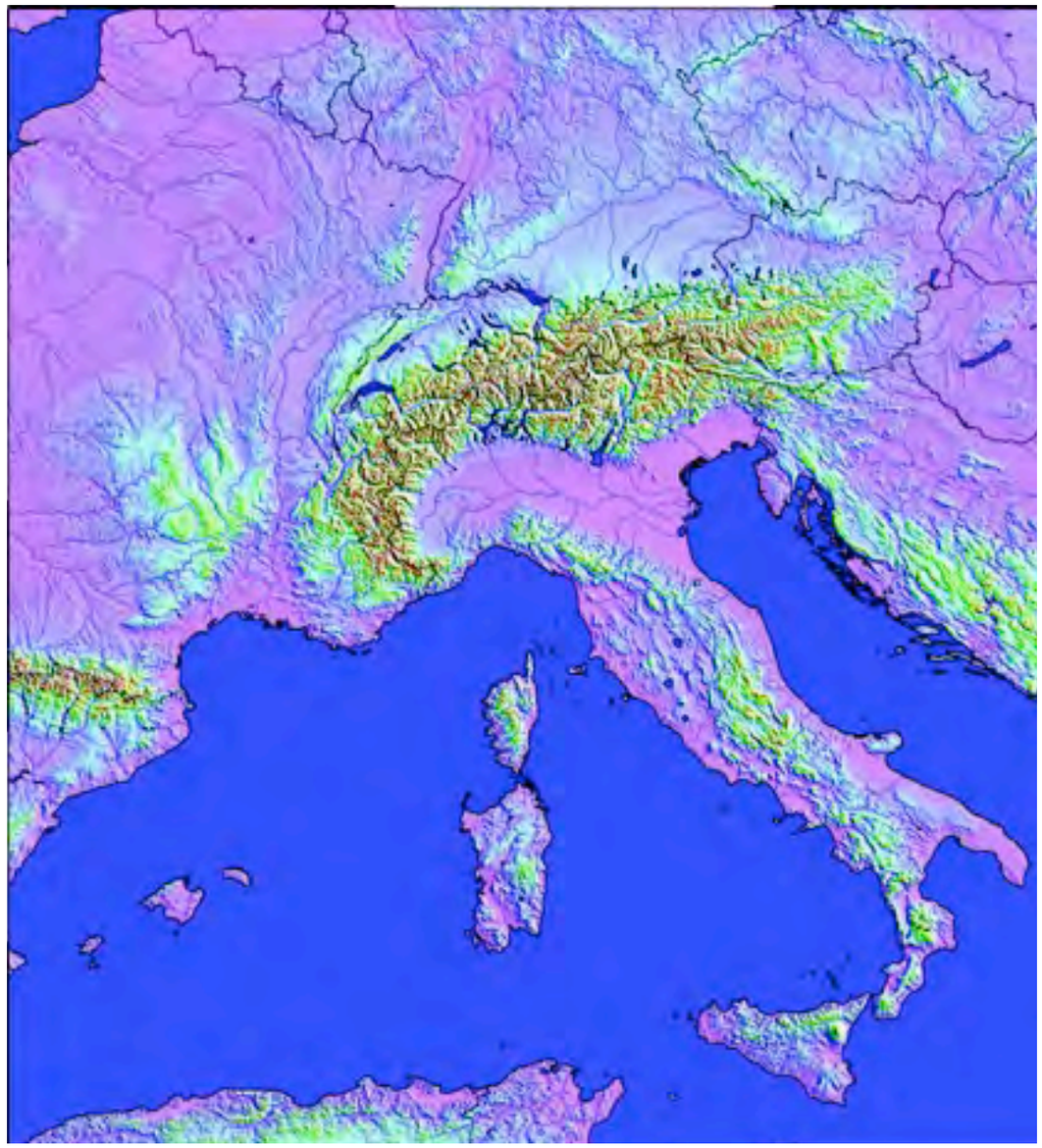
Himalaya-Tibet system: deformation of Asia

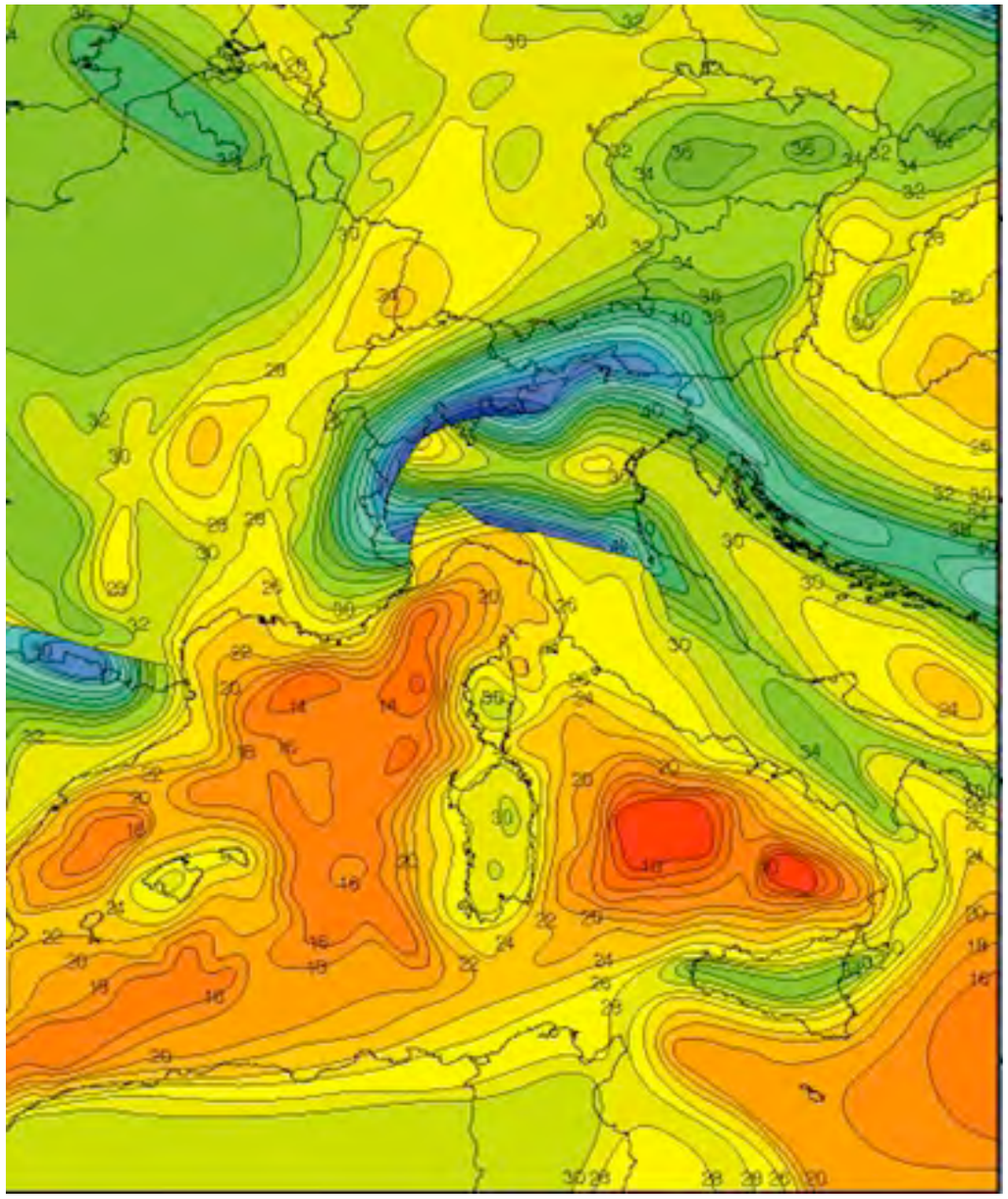


Around the Alps

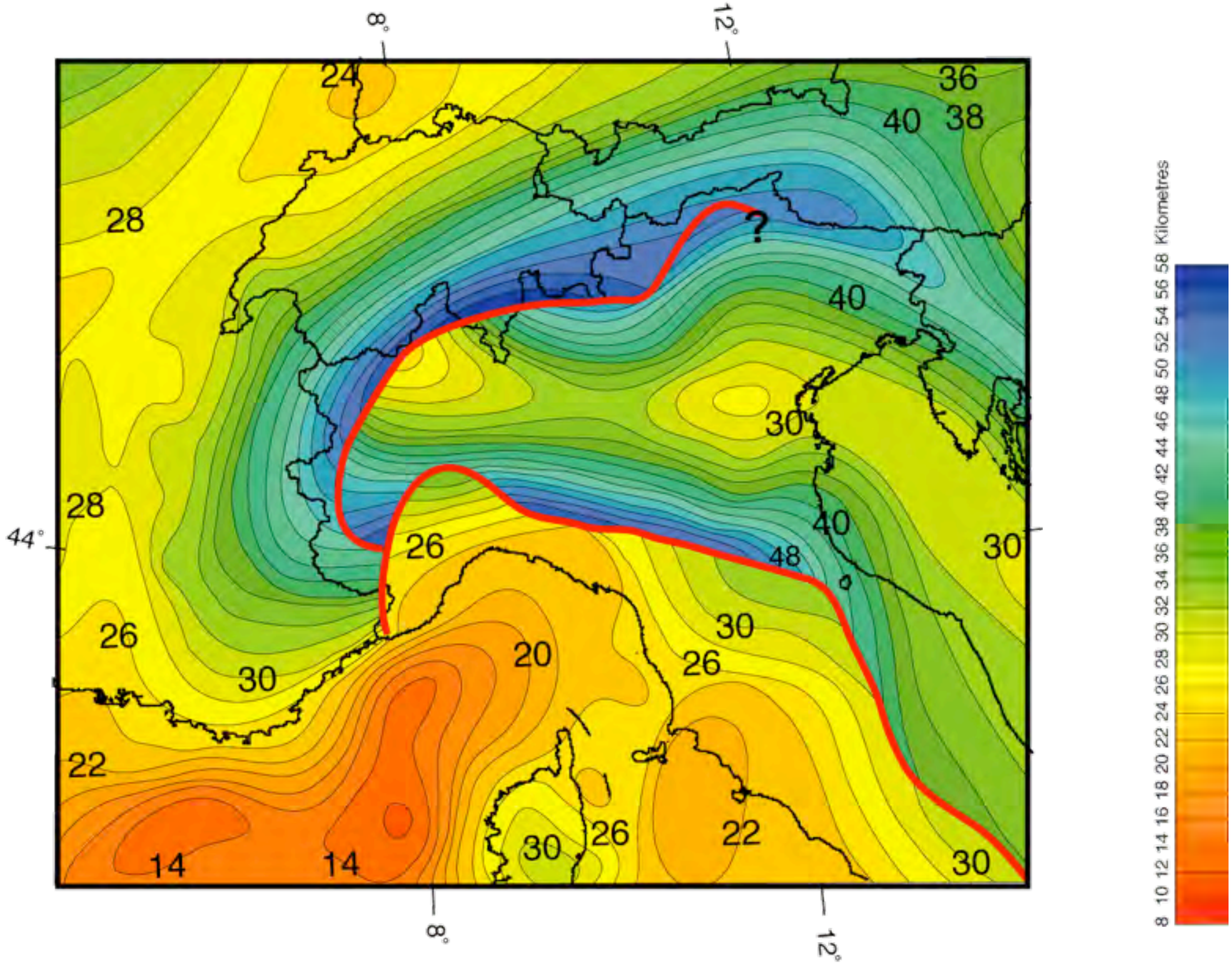


Topography vs. Moho



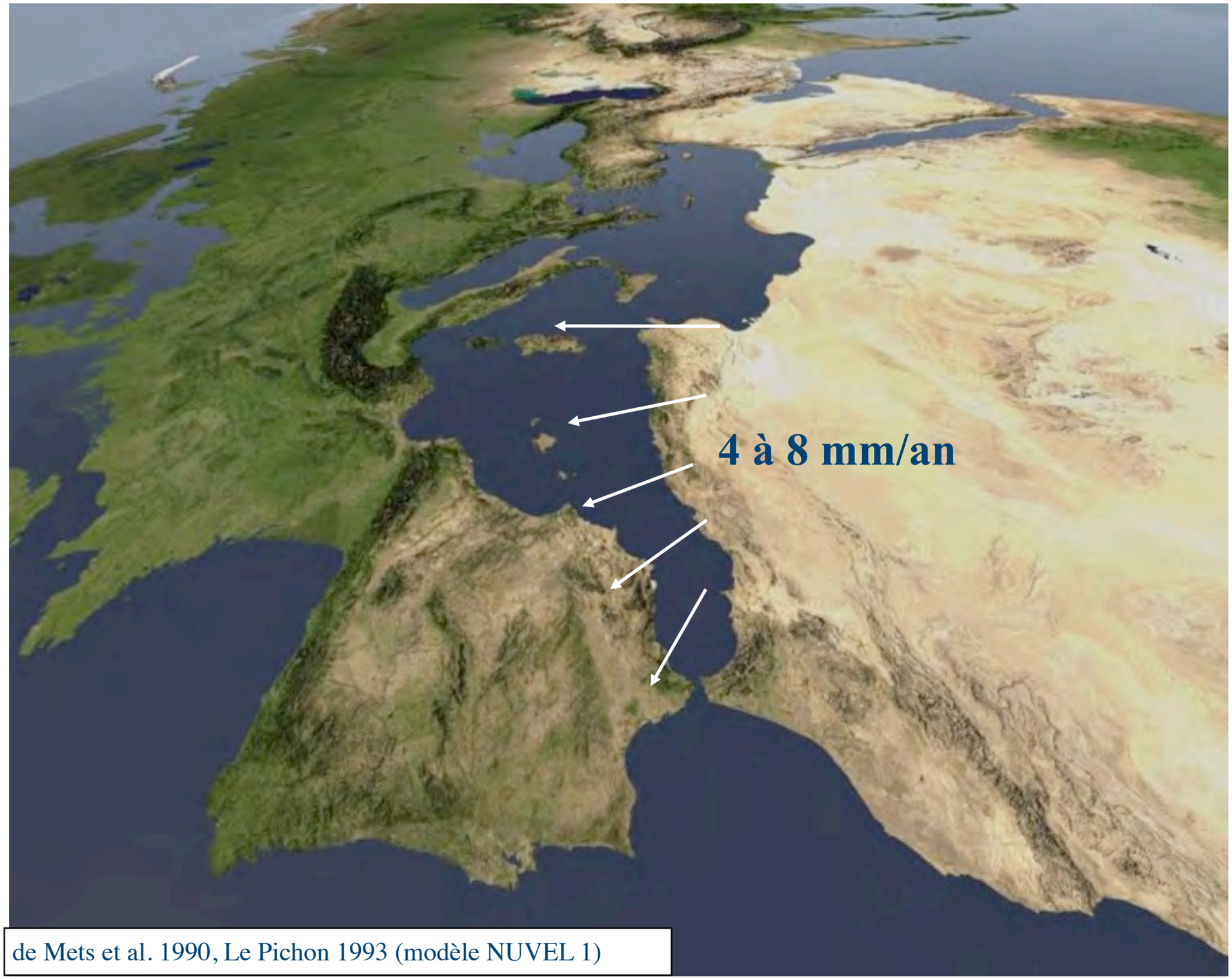


Moho unten den Alpen



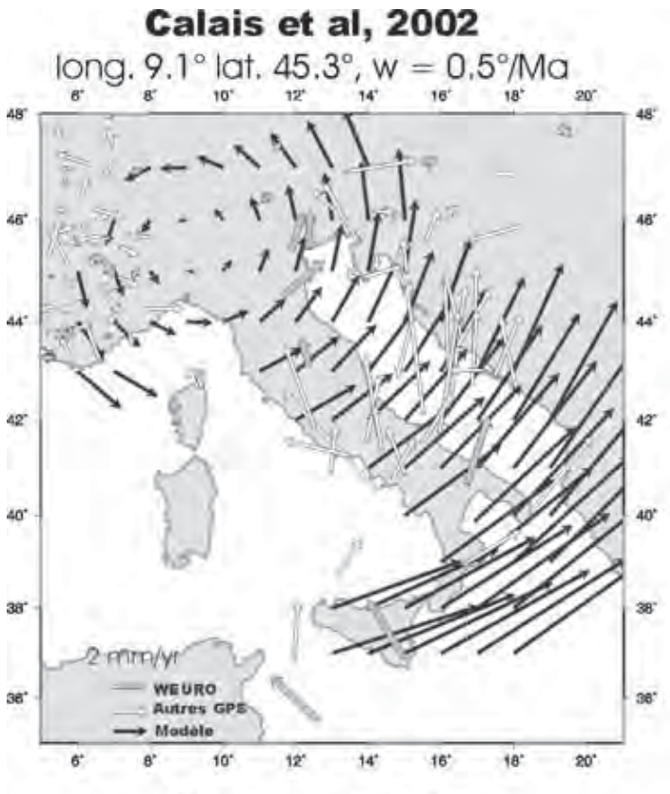
R. Bousquet 2009-2010

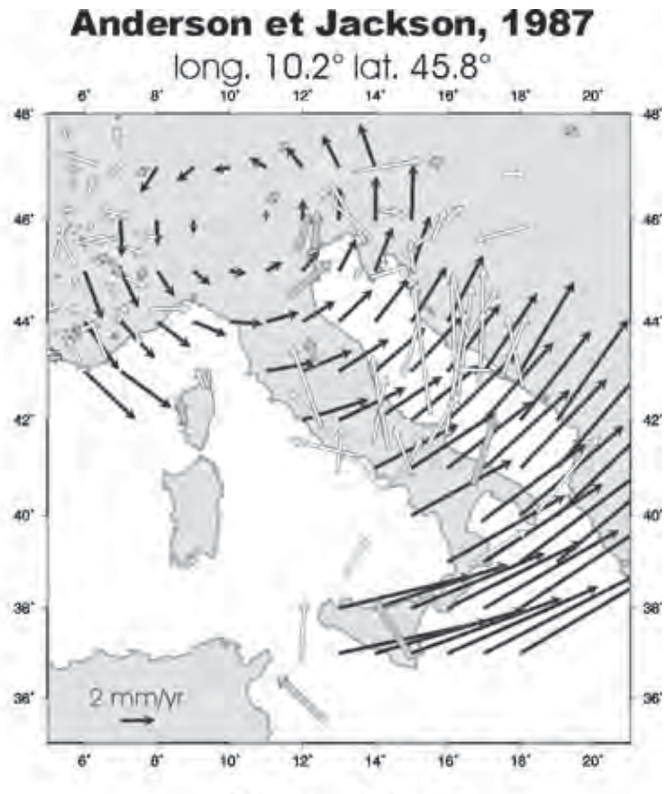
Plate tectonic: Africa-Europa convergence

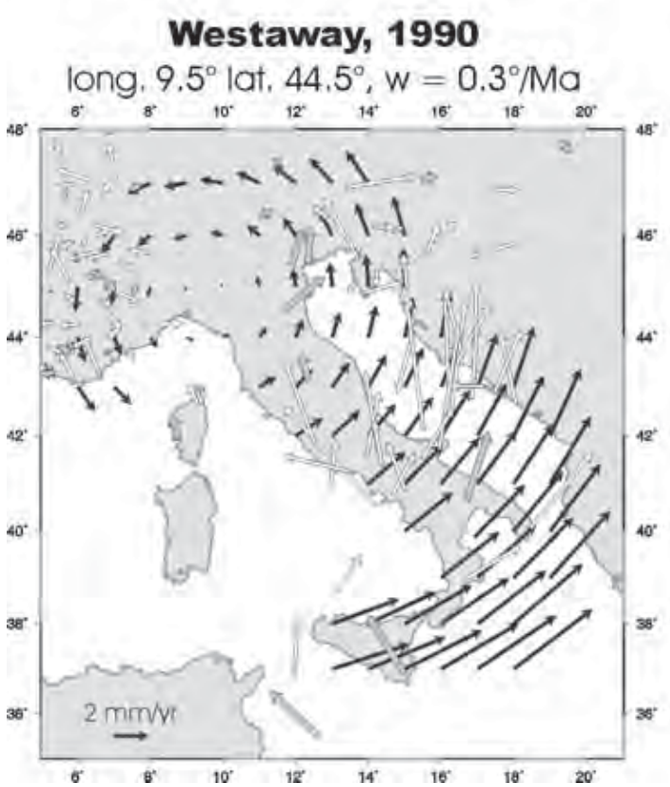


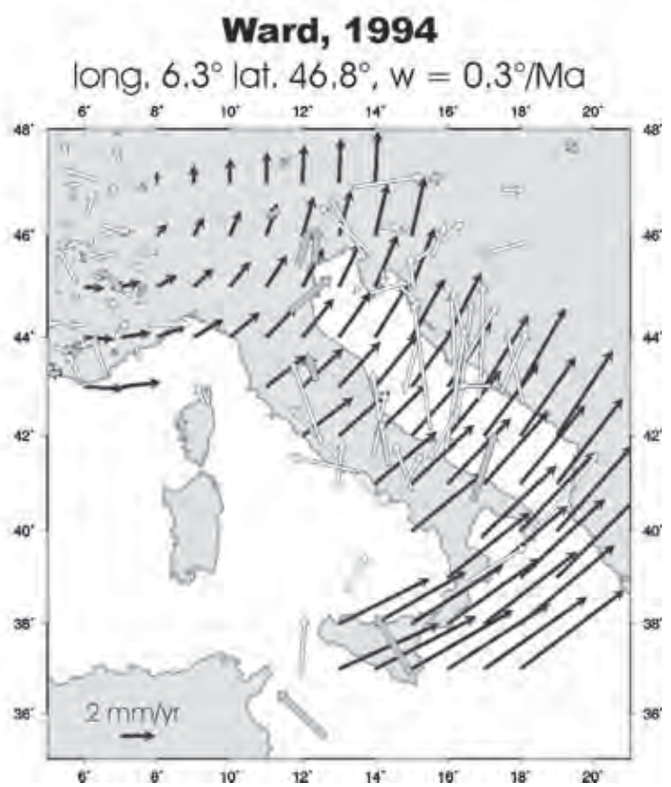
de Mets et al. 1990, Le Pichon 1993 (modèle NUVEL 1)

Plate tectonic: Africa-Europa convergence



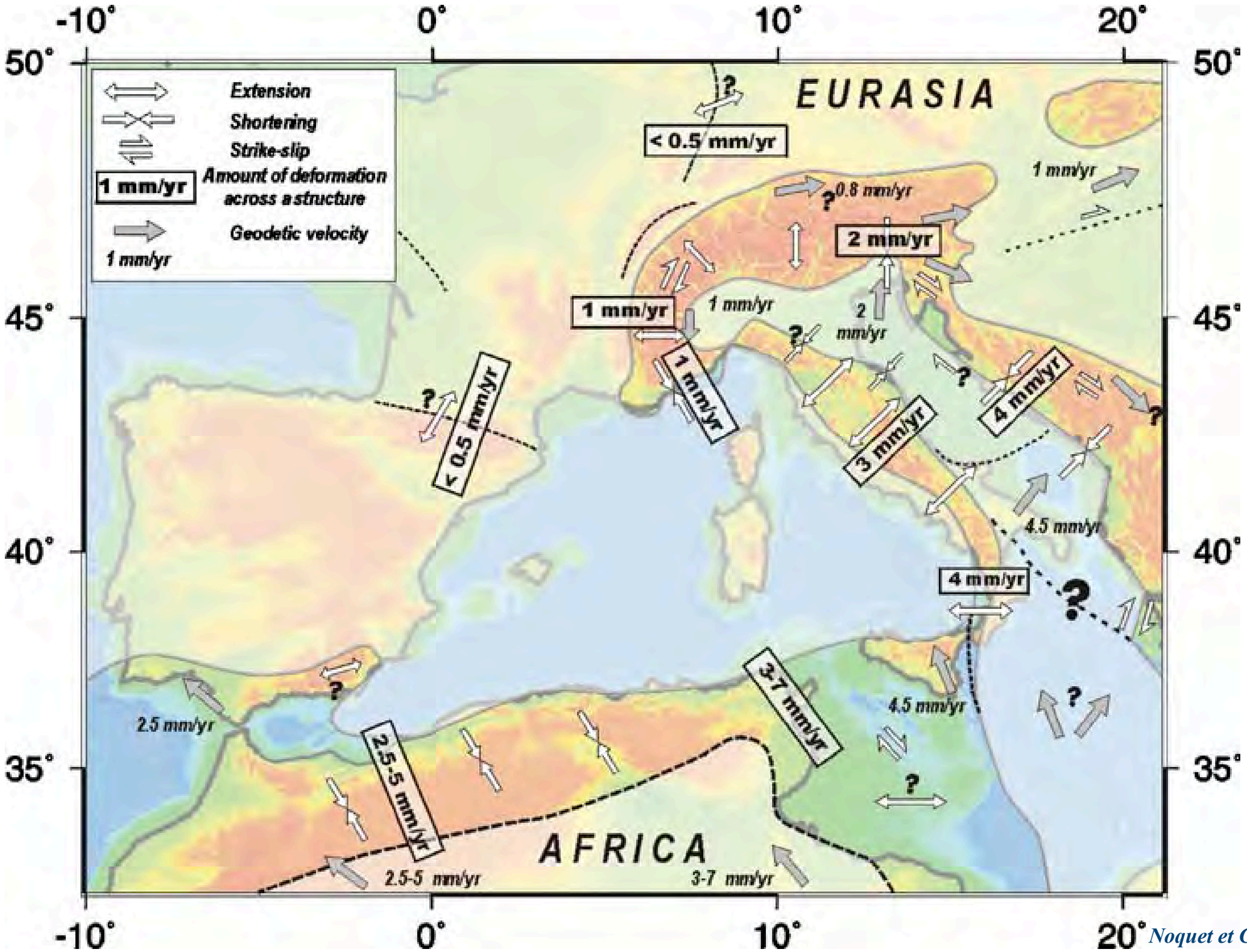






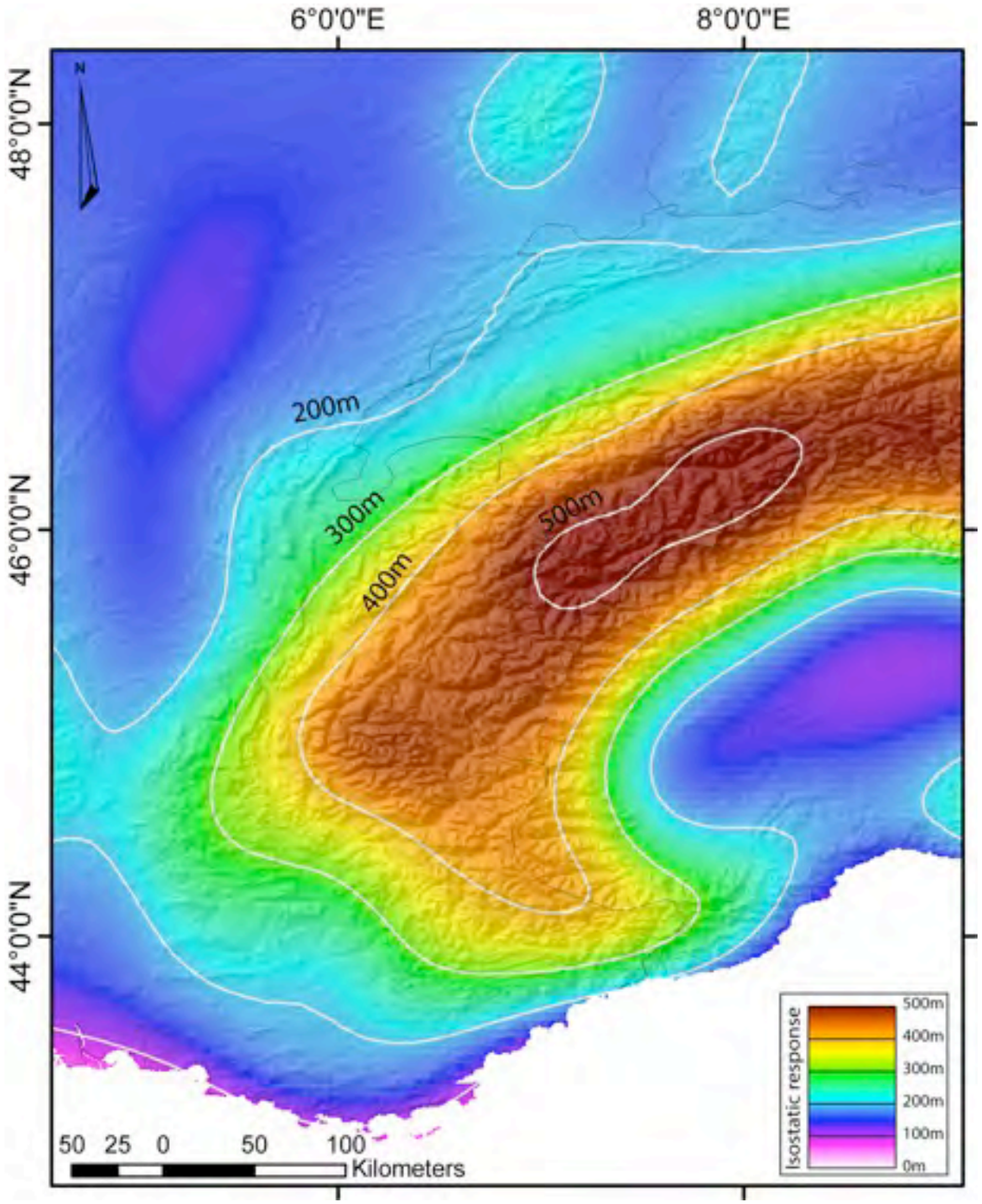
Noquet et Calais, 2004

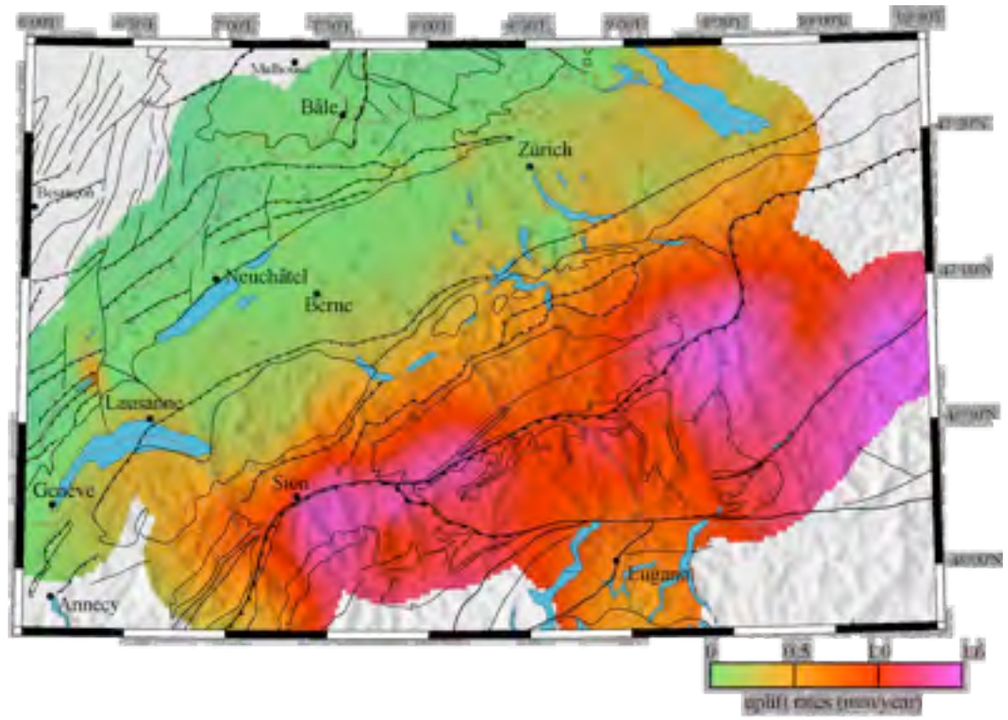
Plate tectonic: Africa-Europa convergence



Noquet et Calais, 2004

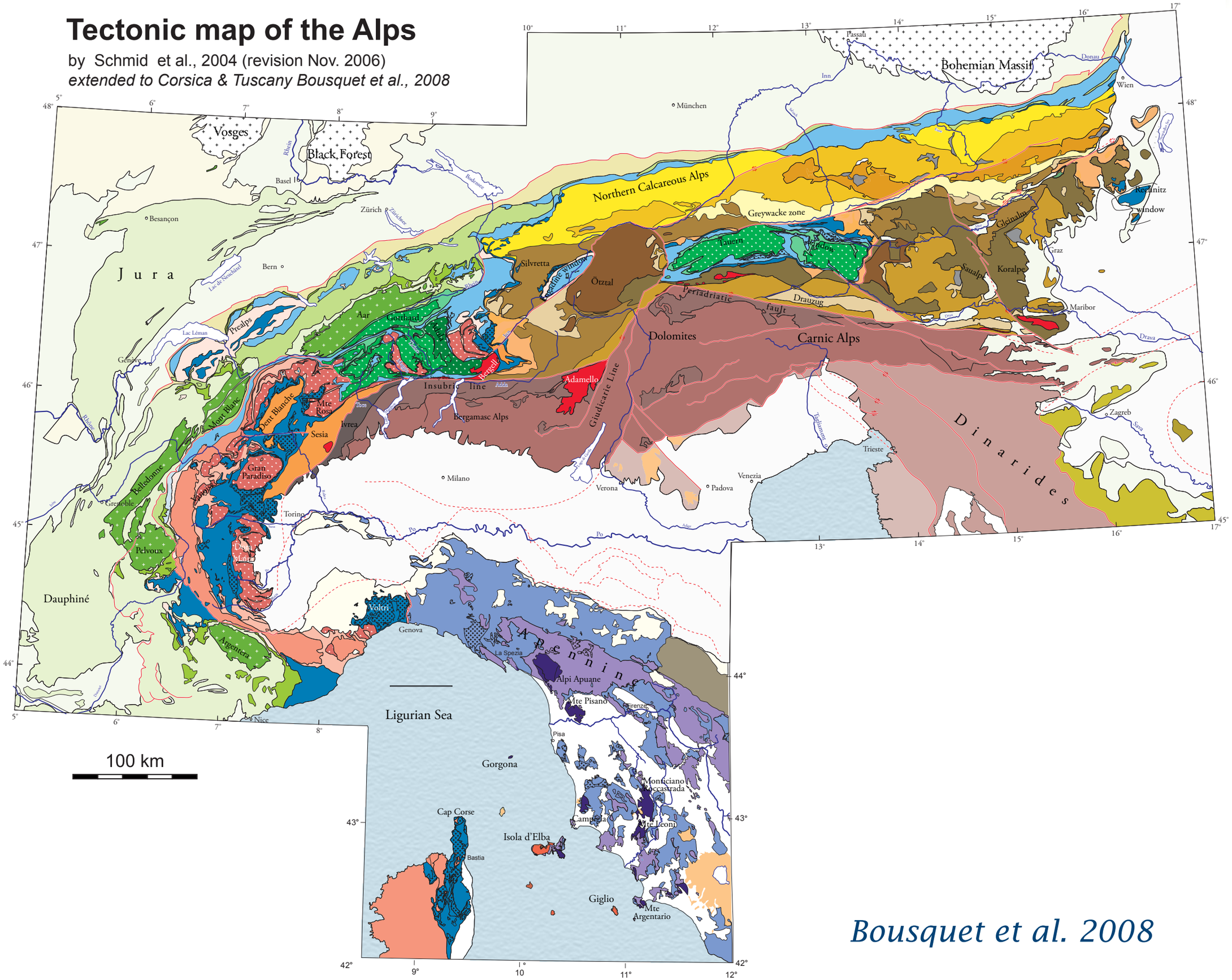
Today uplift of the Alps





Champagnac et al, 2007

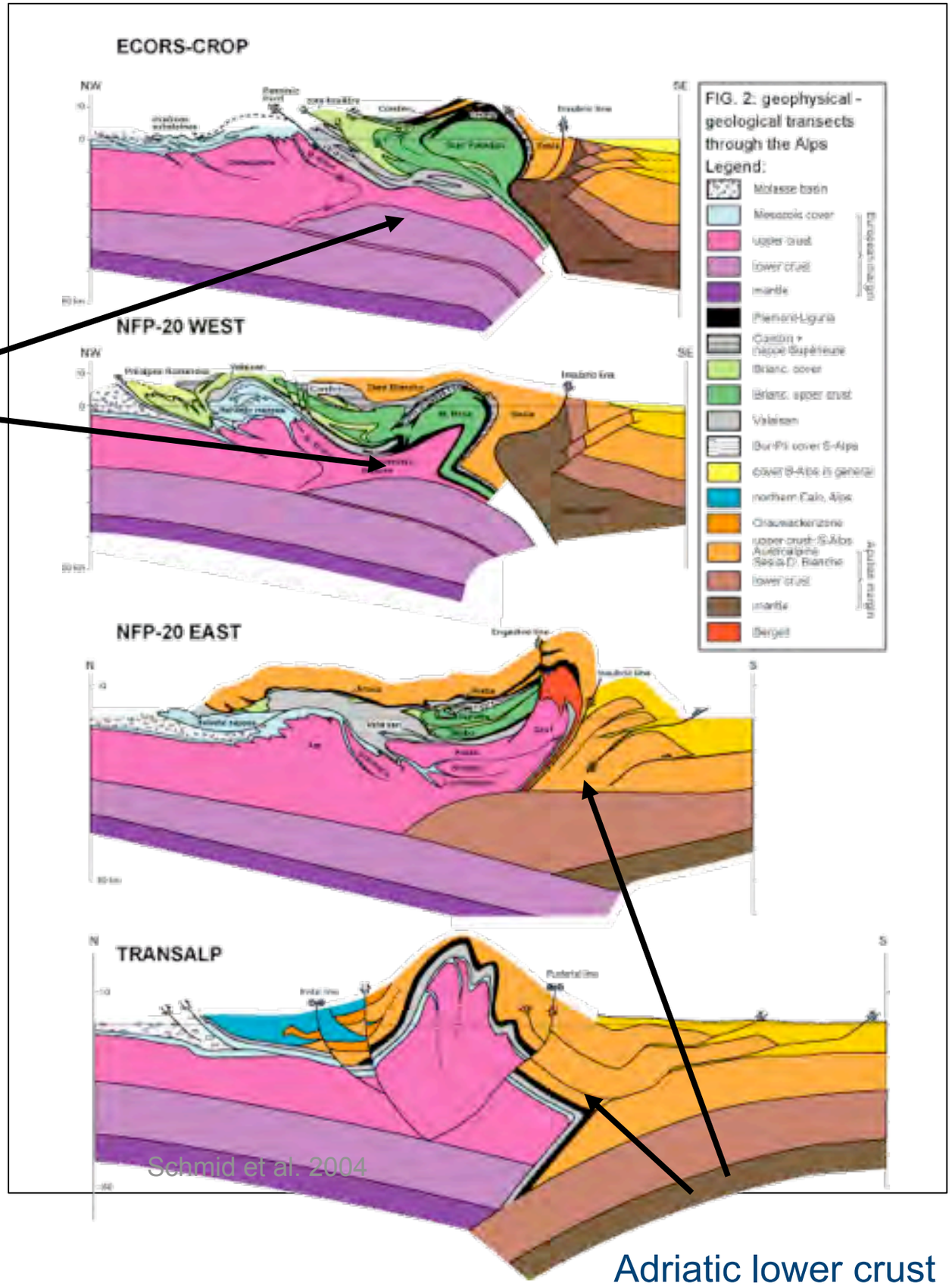
Tectonic map of the Alps



Bousquet et al. 2008

Profiles across the Alps

European lower crust

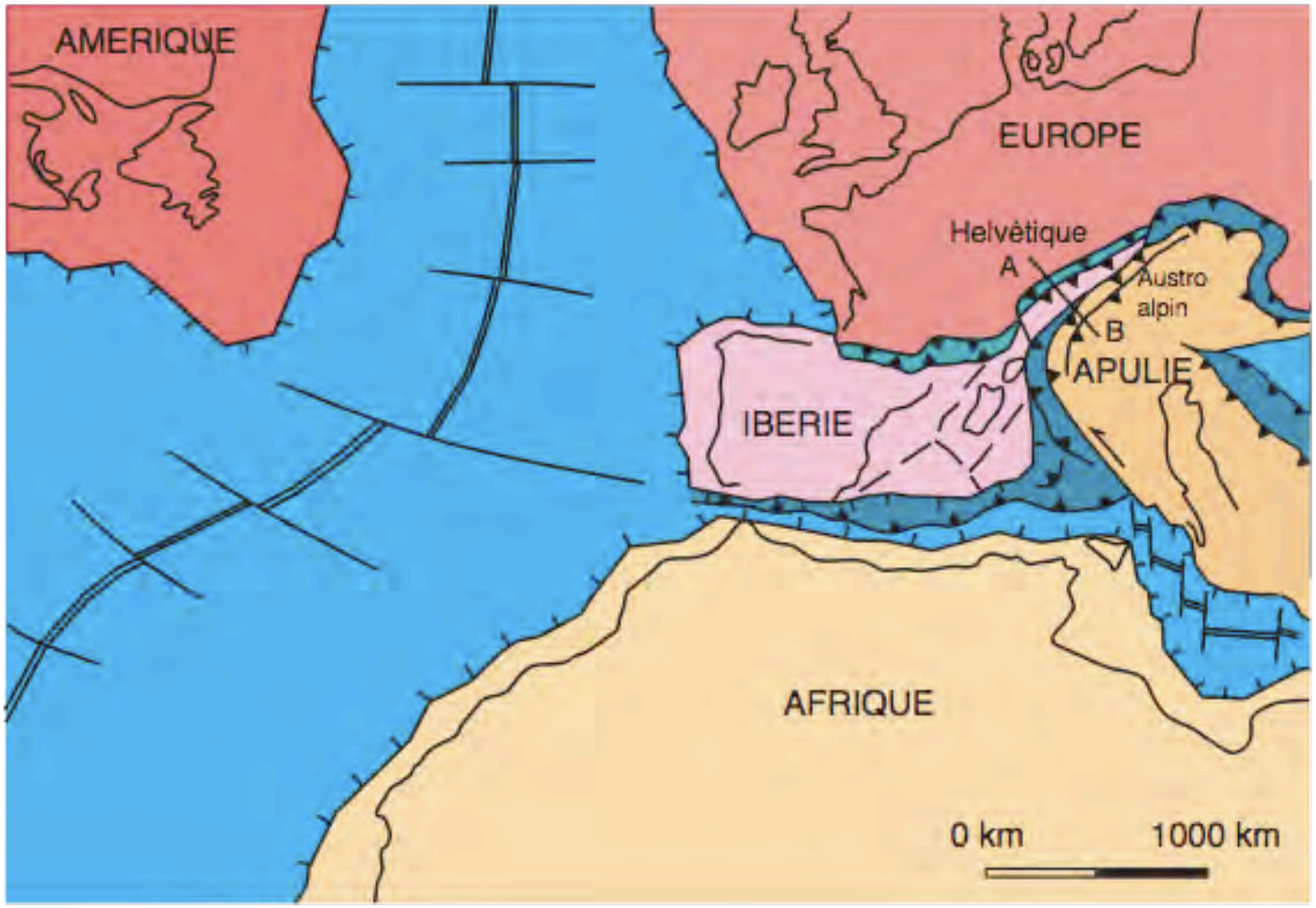


Adriatic lower crust

Schmid et al. 2004

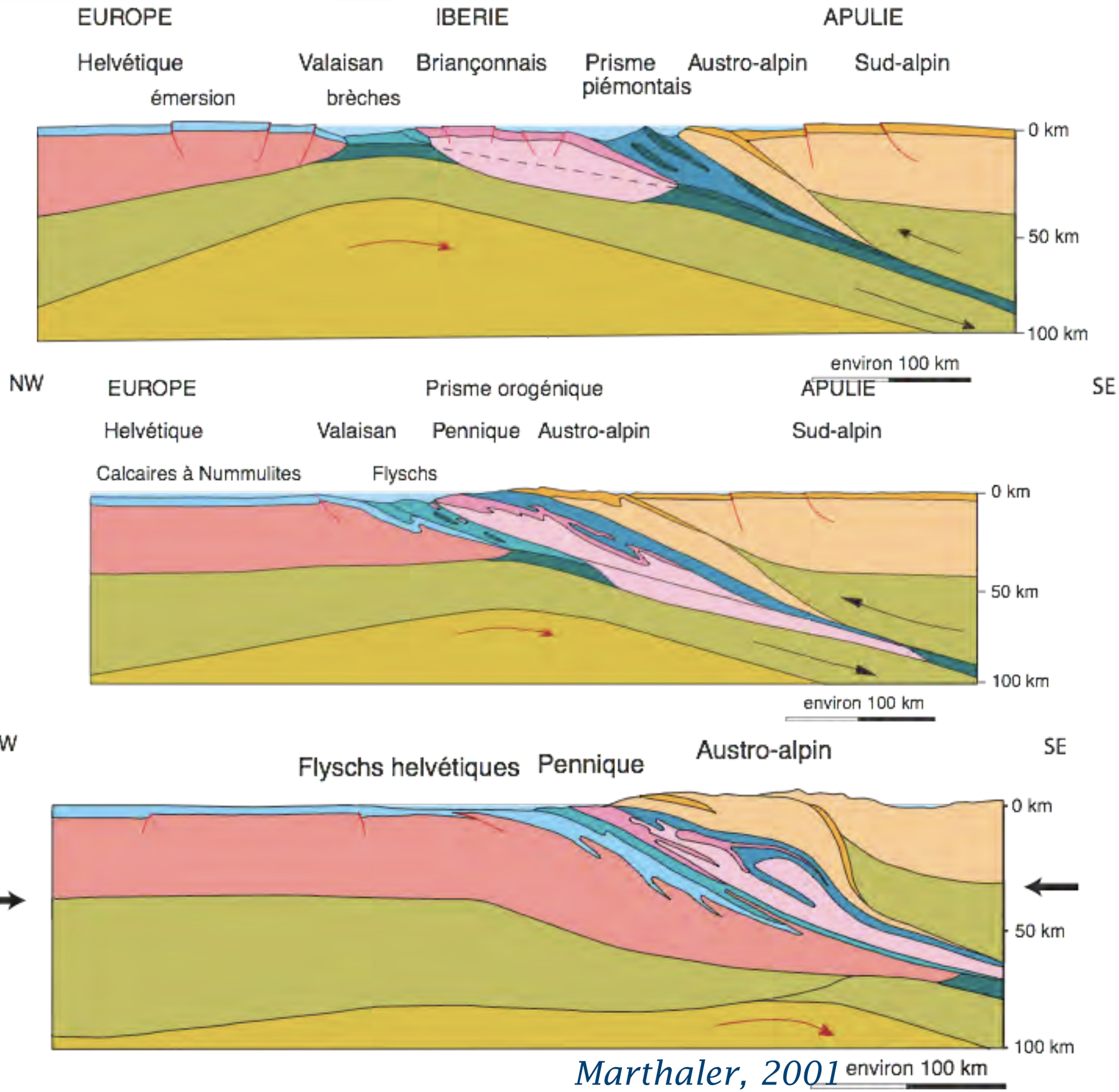
Plate tectonic reconstruction

60 Ma



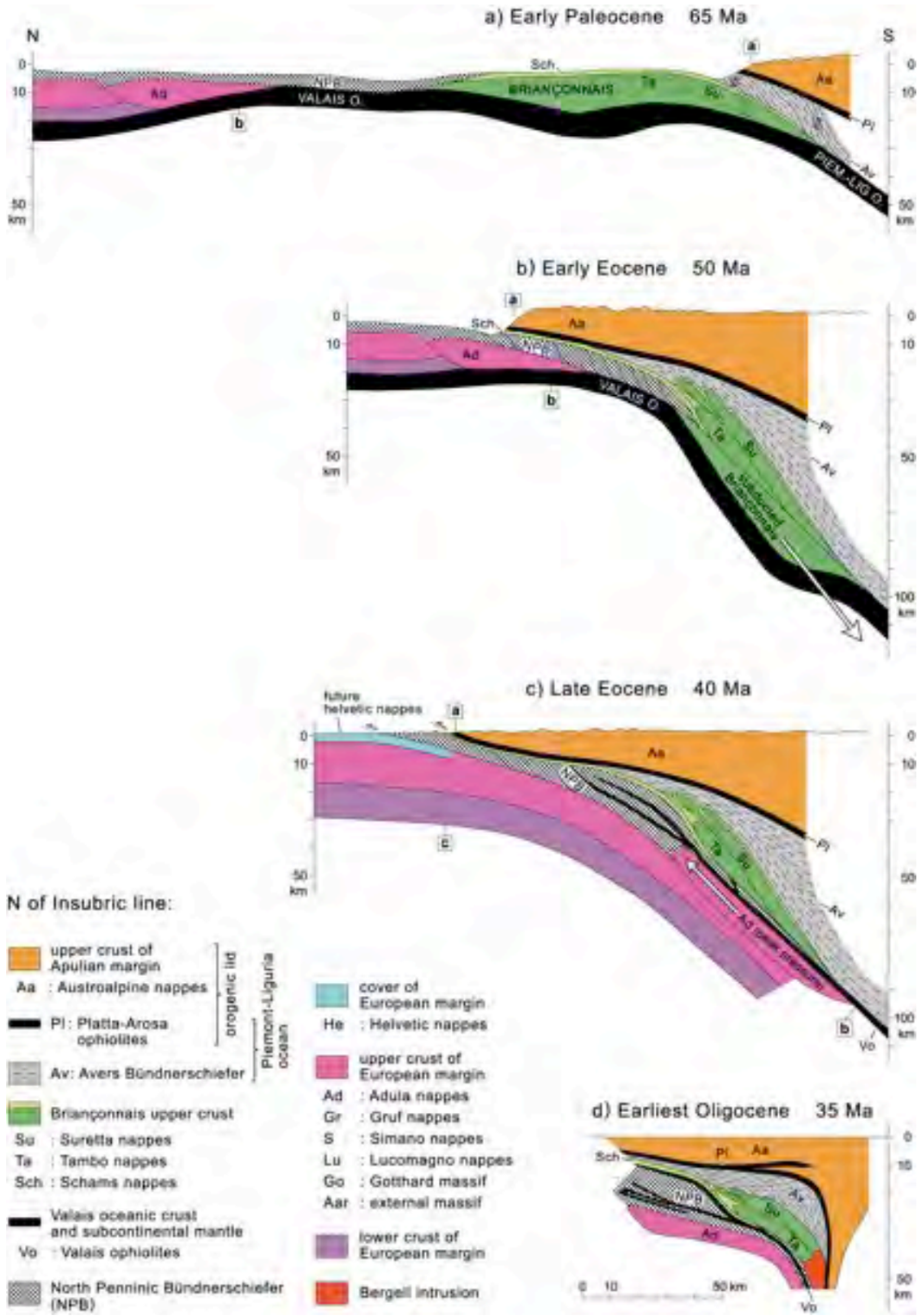
Marthaler, 2001

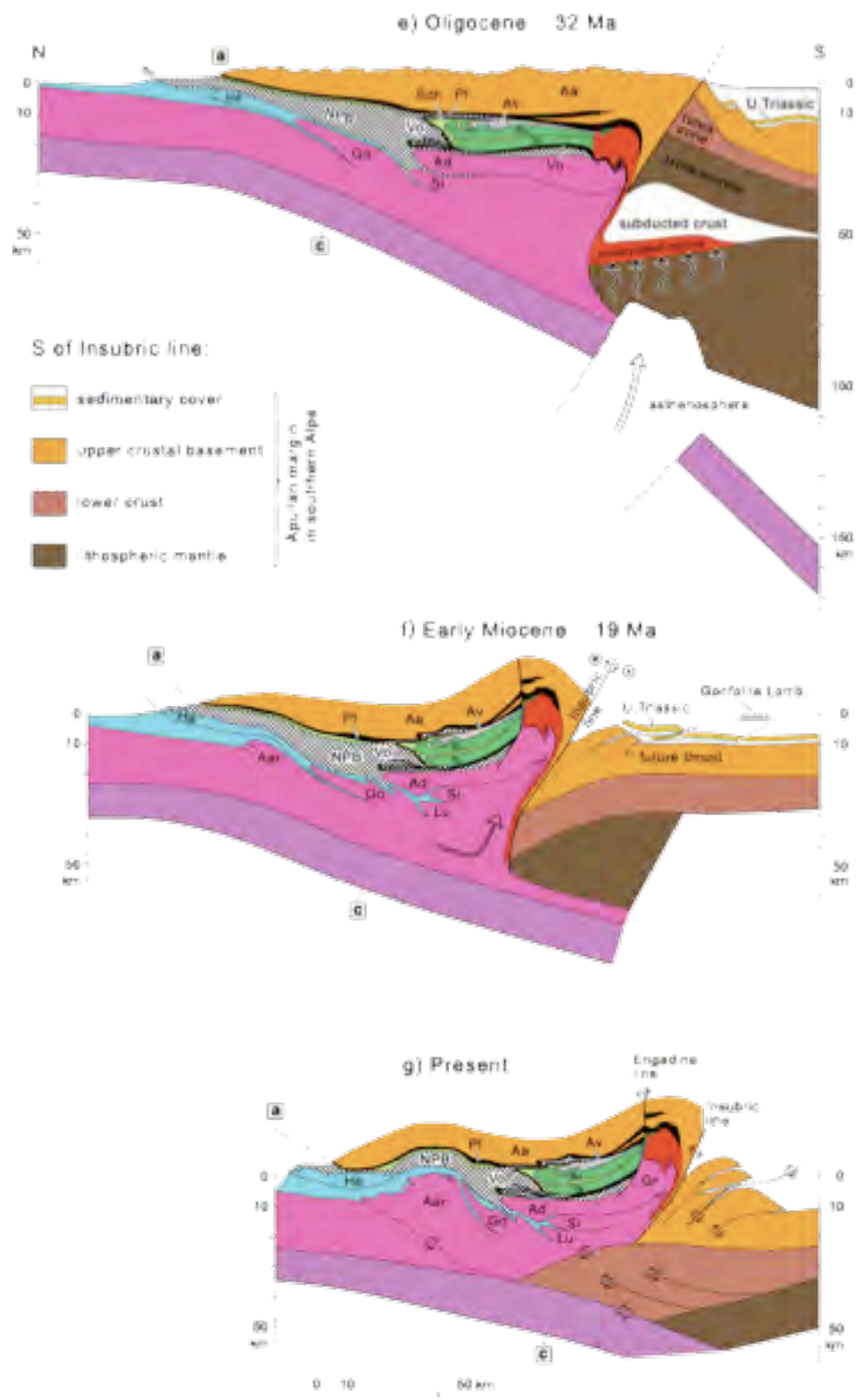
Schematic cross sections



Marthaler, 2001

Schematic cross sections



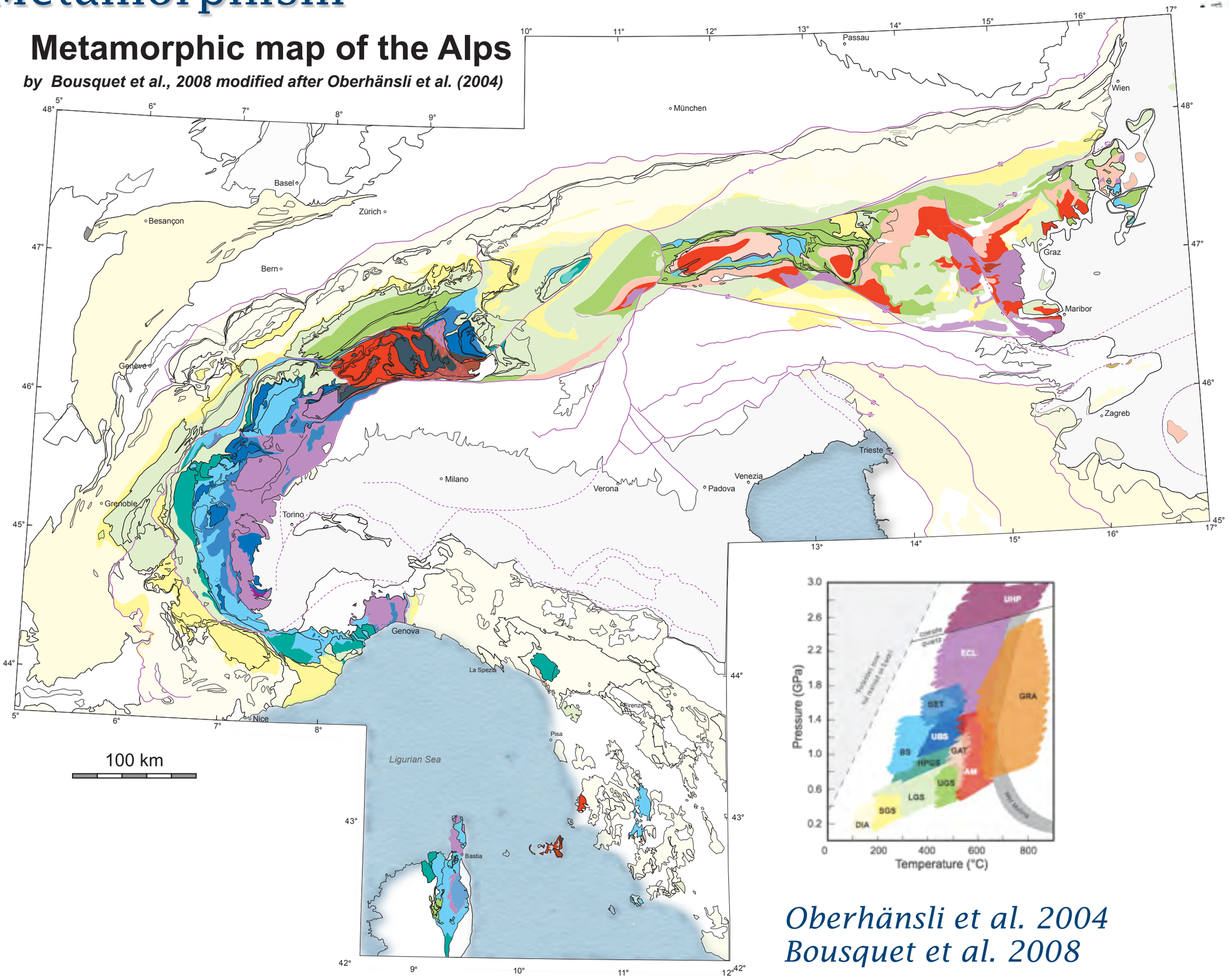


Schmid et al. 2004

Metamorphism

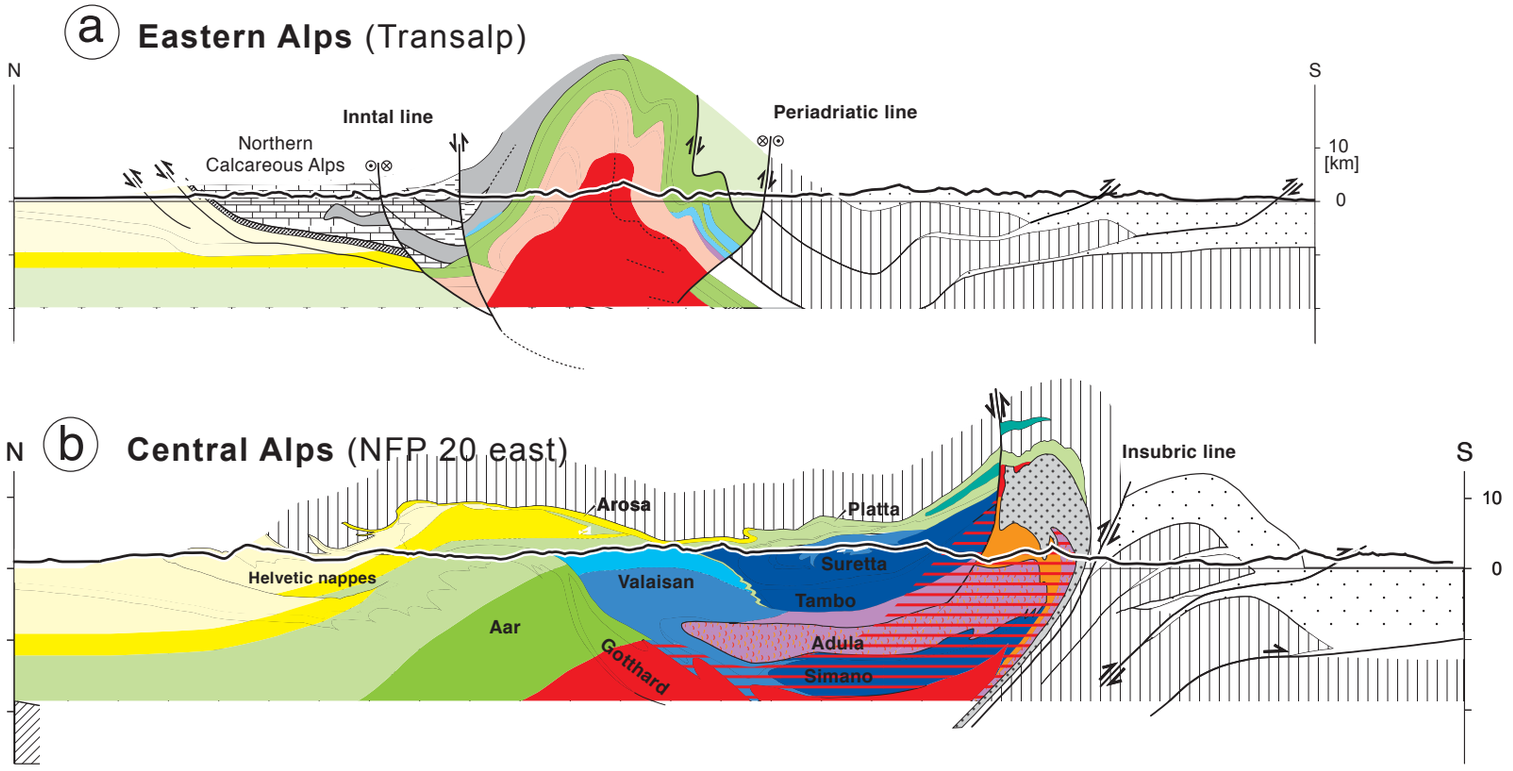
Metamorphic map of the Alps

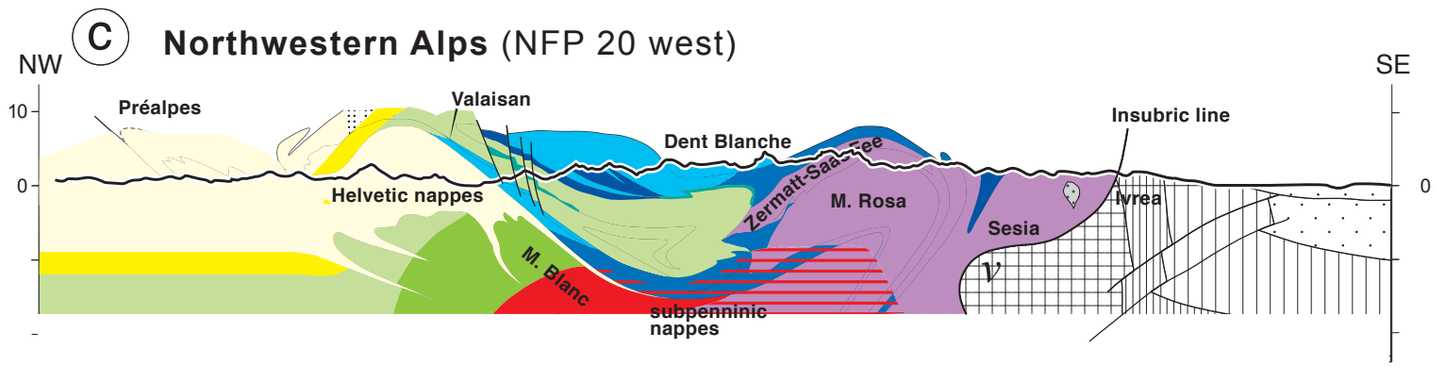
by Bousquet et al., 2008 modified after Oberhänsli et al. (2004)

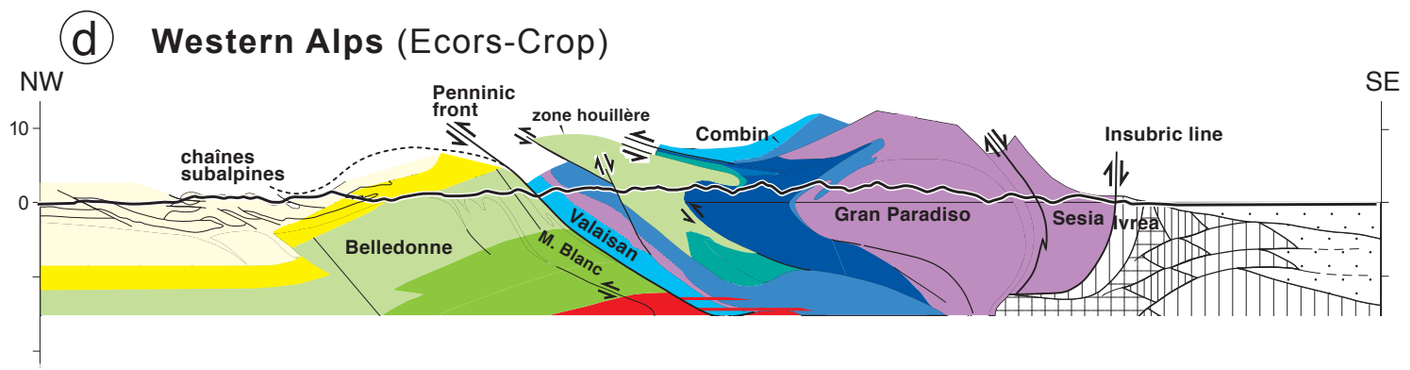


Oberhänsli et al. 2004
Bousquet et al. 2008

Metamorphic cross-sections

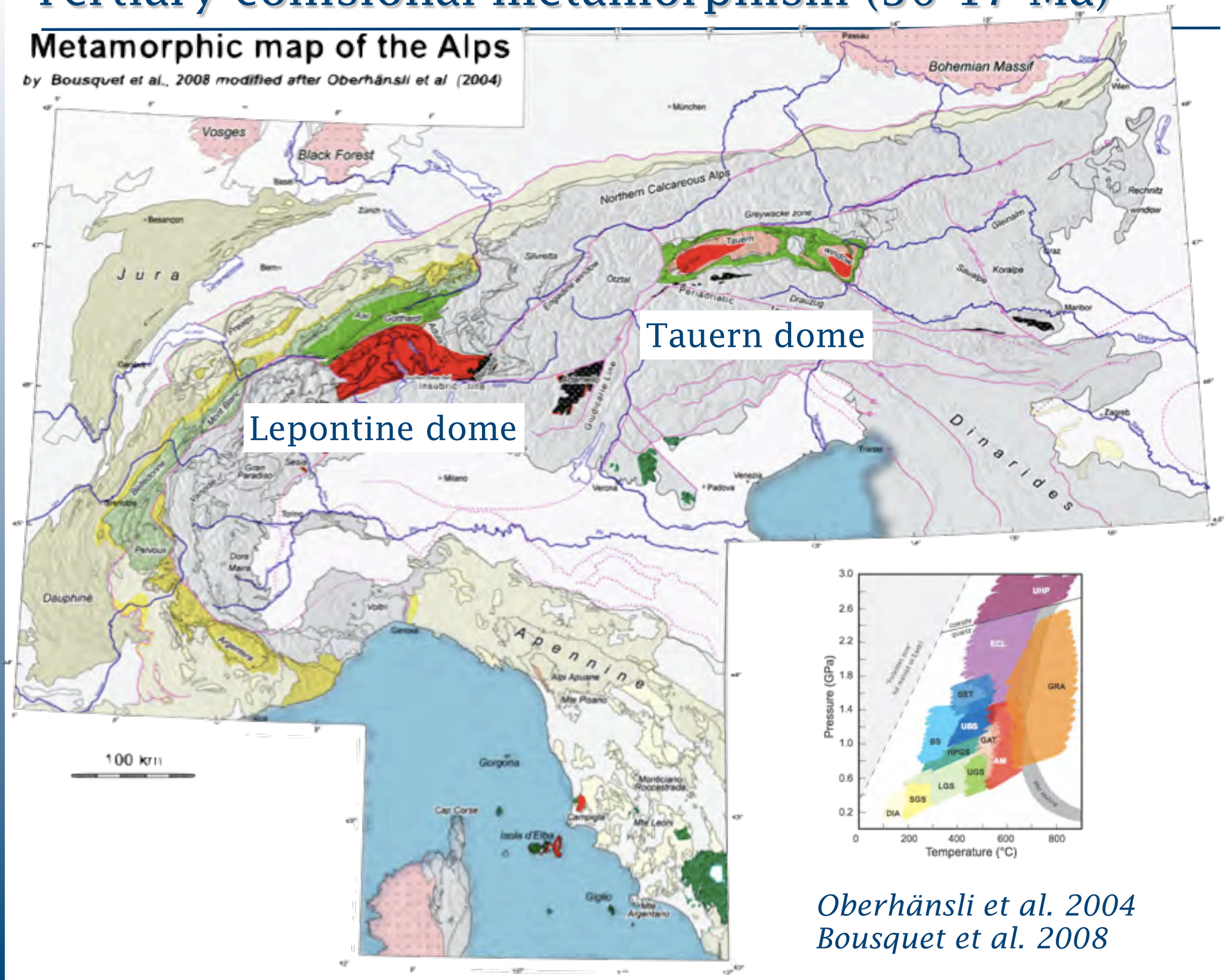






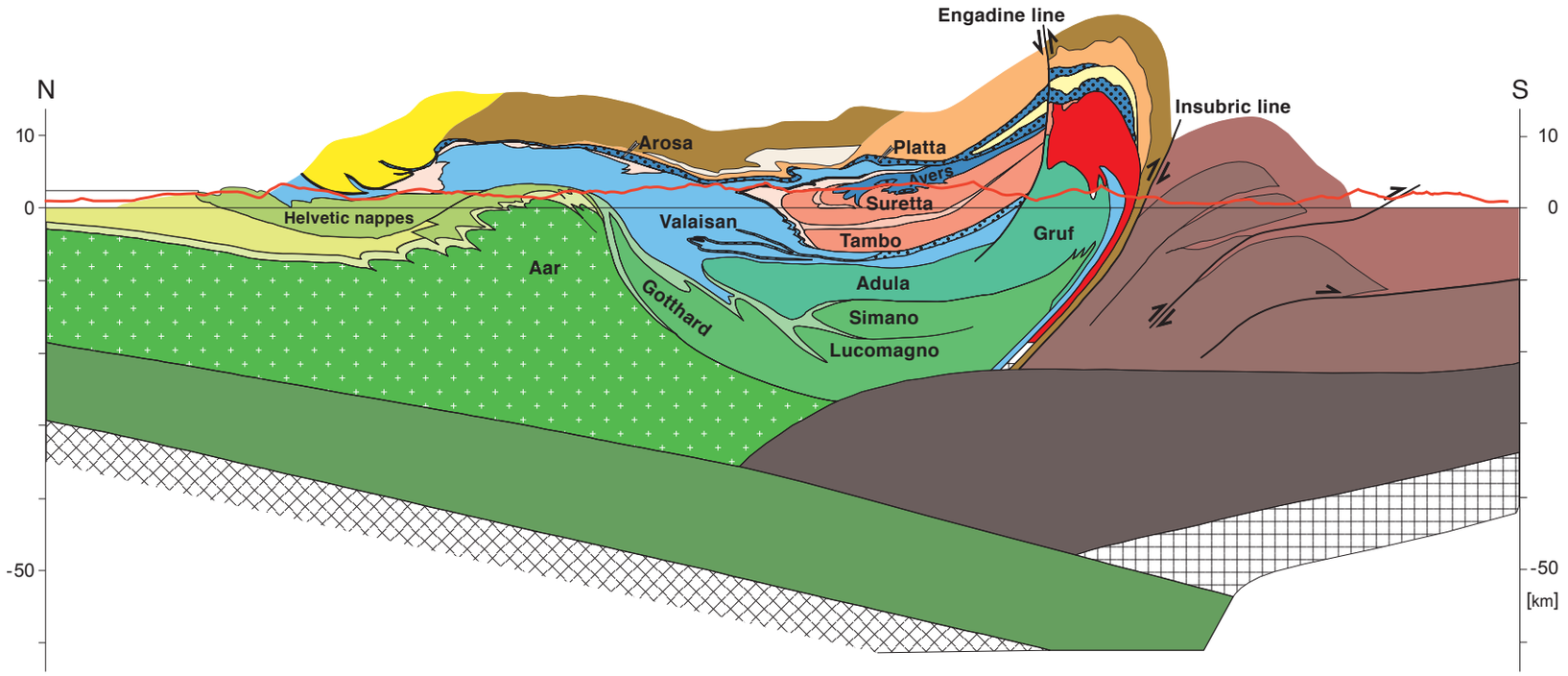
Bousquet et al. 2008

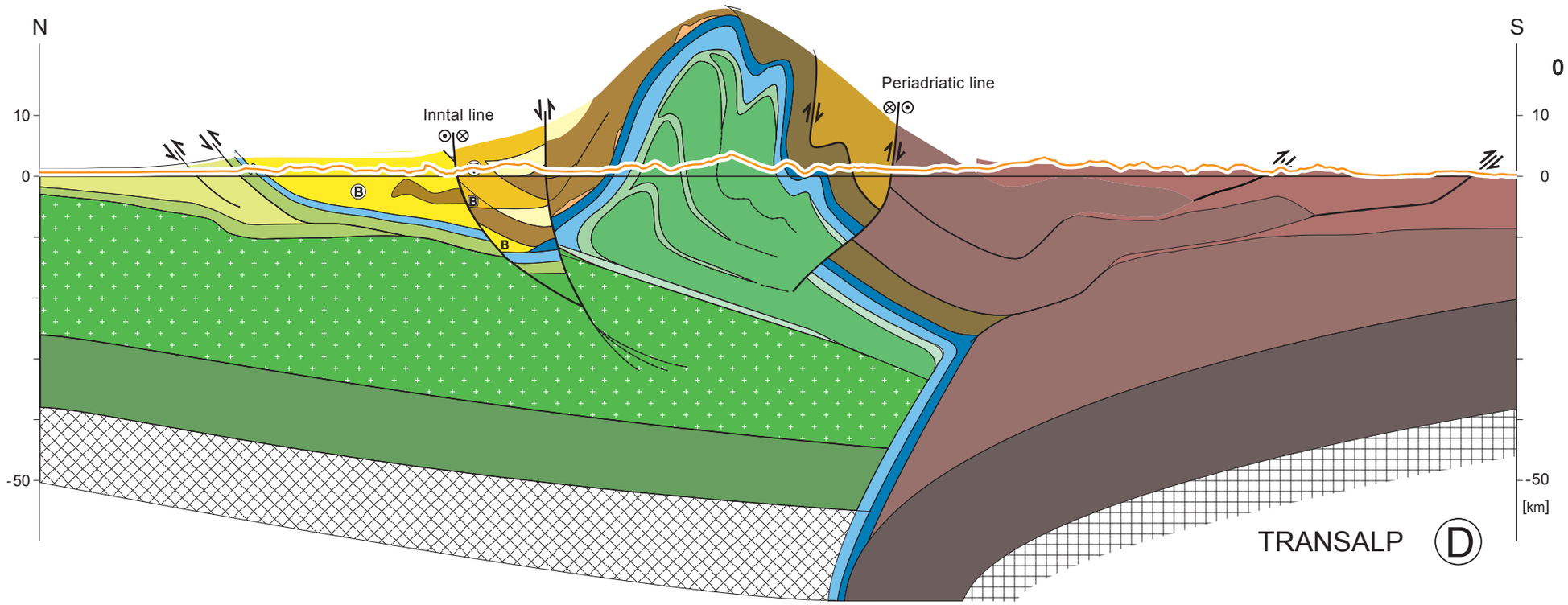
Tertiary collisional metamorphism (30-17 Ma)



Oberhänsli et al. 2004
Bousquet et al. 2008

Relation high T metamorphism & crustal accretion

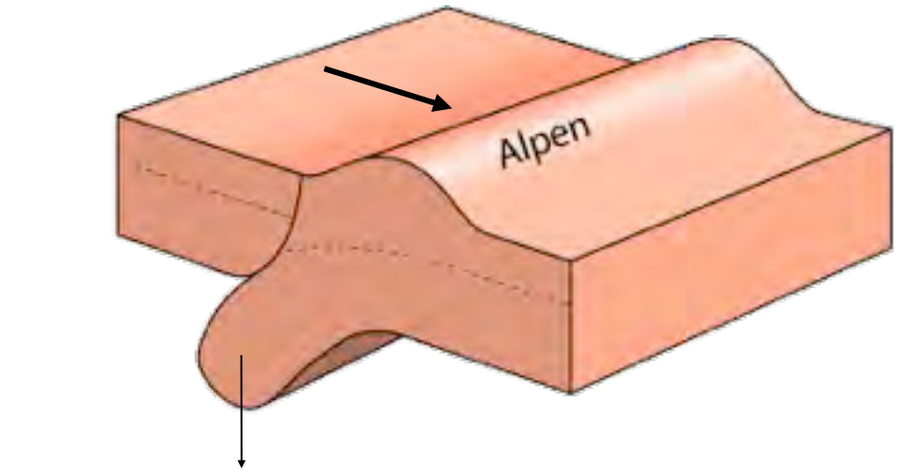




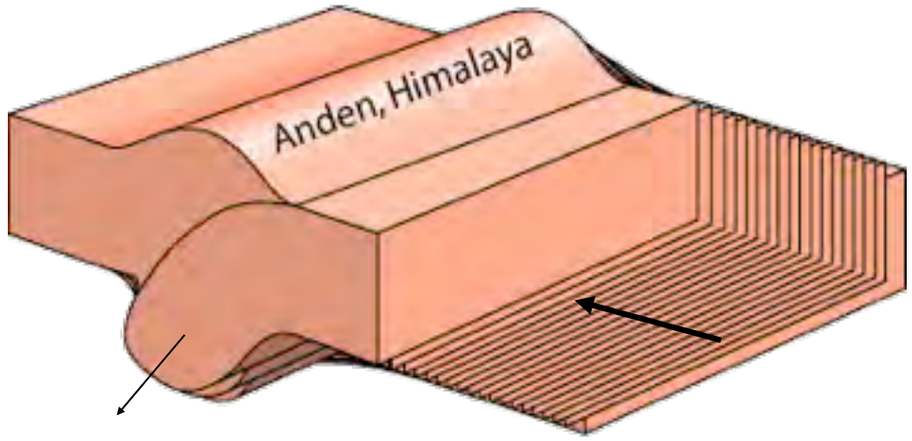
Schmid et al., 2004

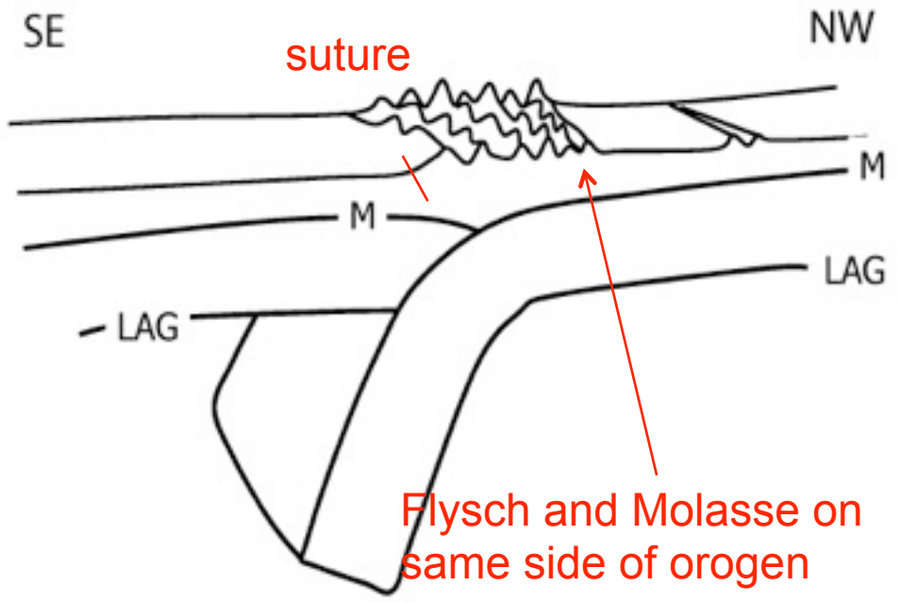
Different types of collision

Unlike Himalayan type orogens, the Western and Central Alps ride on the subducting plate



Adria is following rolling back European slab





Europe has not moved S
=> roll back and slab retreat