Cordilleran-type orogens and plateaus: new views from a quantitative re-evaluation of mountain-building in the western Central Andes.

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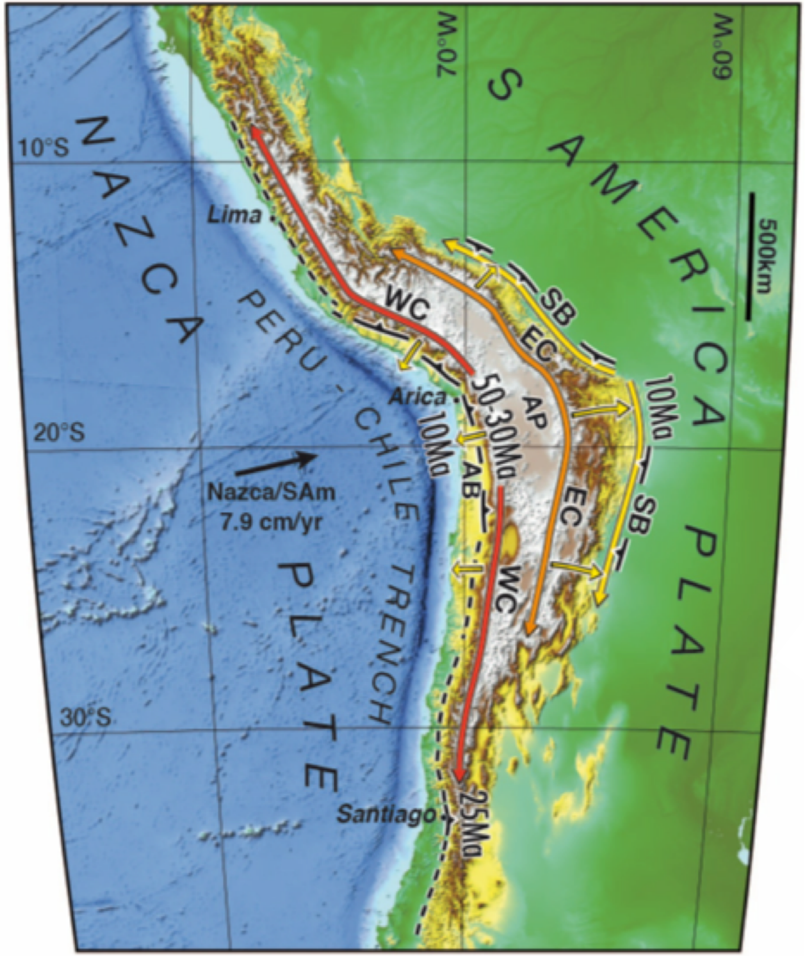
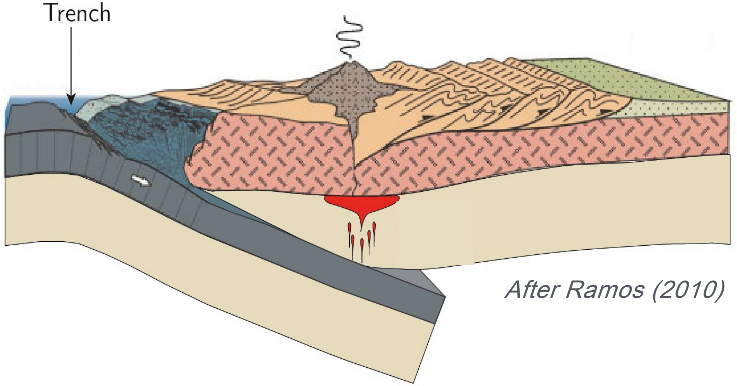
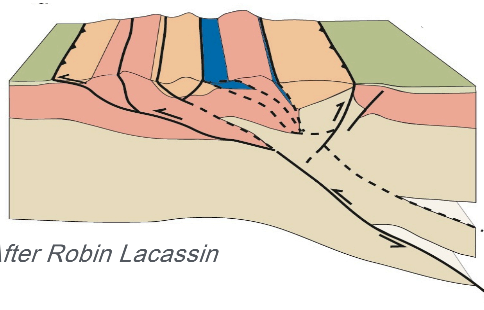


The Andes: a case example for an active cordilleran-type orogen



After Ramos (2010)

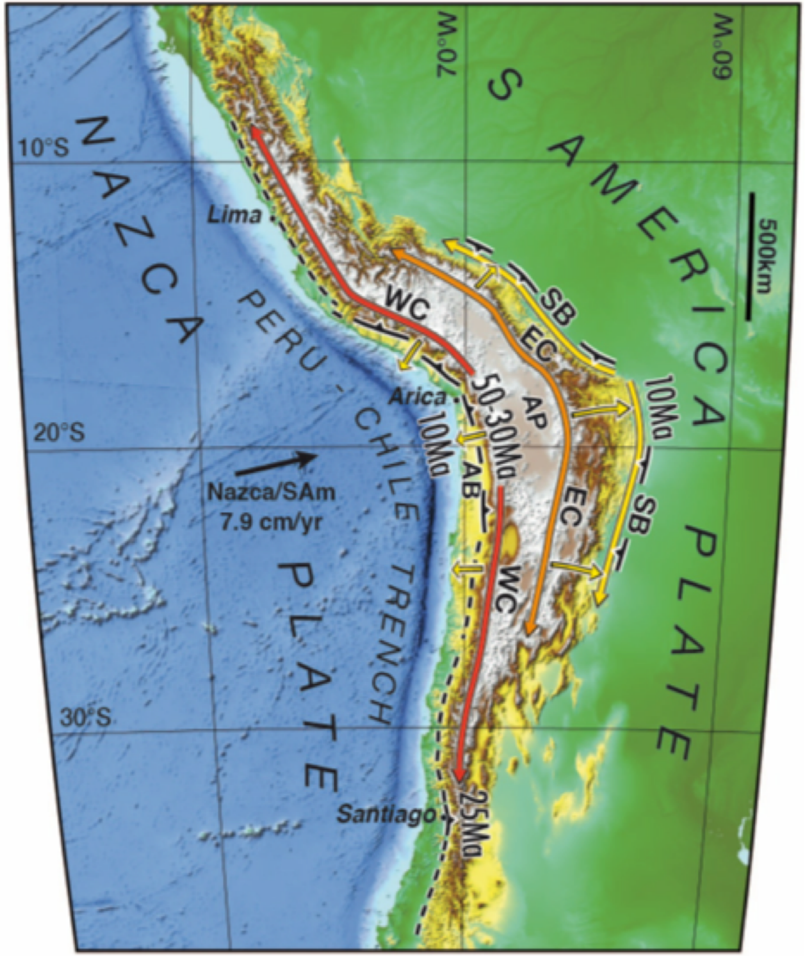
- Major basement thrusts antithetic to the subduction
- Magmatism
- Crustal thickening misunderstood…



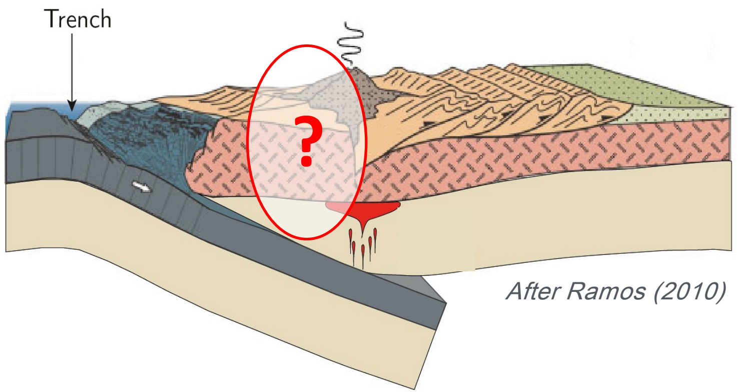
After Robin Lacassin

…when compared to alpine-type orogens:

- Major basement thrusts synthetic to the former subduction
- Crustal thickening explained by tectonic stacking



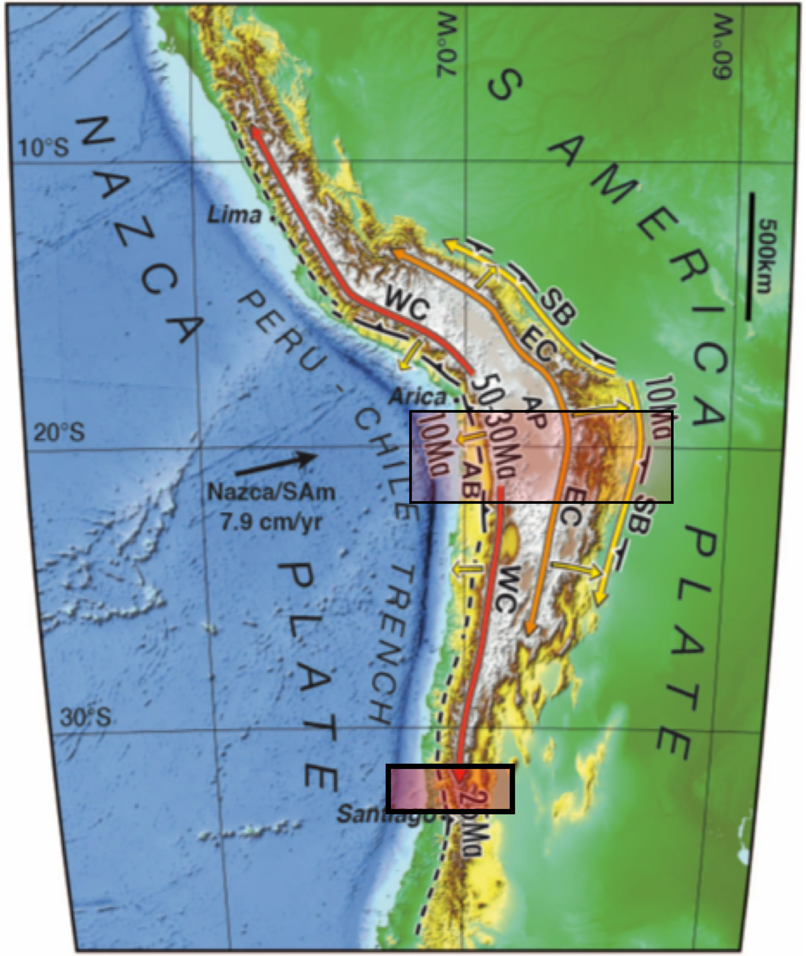
The Andes: a case example for an active cordilleran-type orogen



- Major basement thrusts antithetic to the subduction
- Magmatism
- Crustal thickening misunderstood…

Structures in the forearc ?

What contribution to crustal thickening ?



The Andes: a case example for an active cordilleran-type orogen

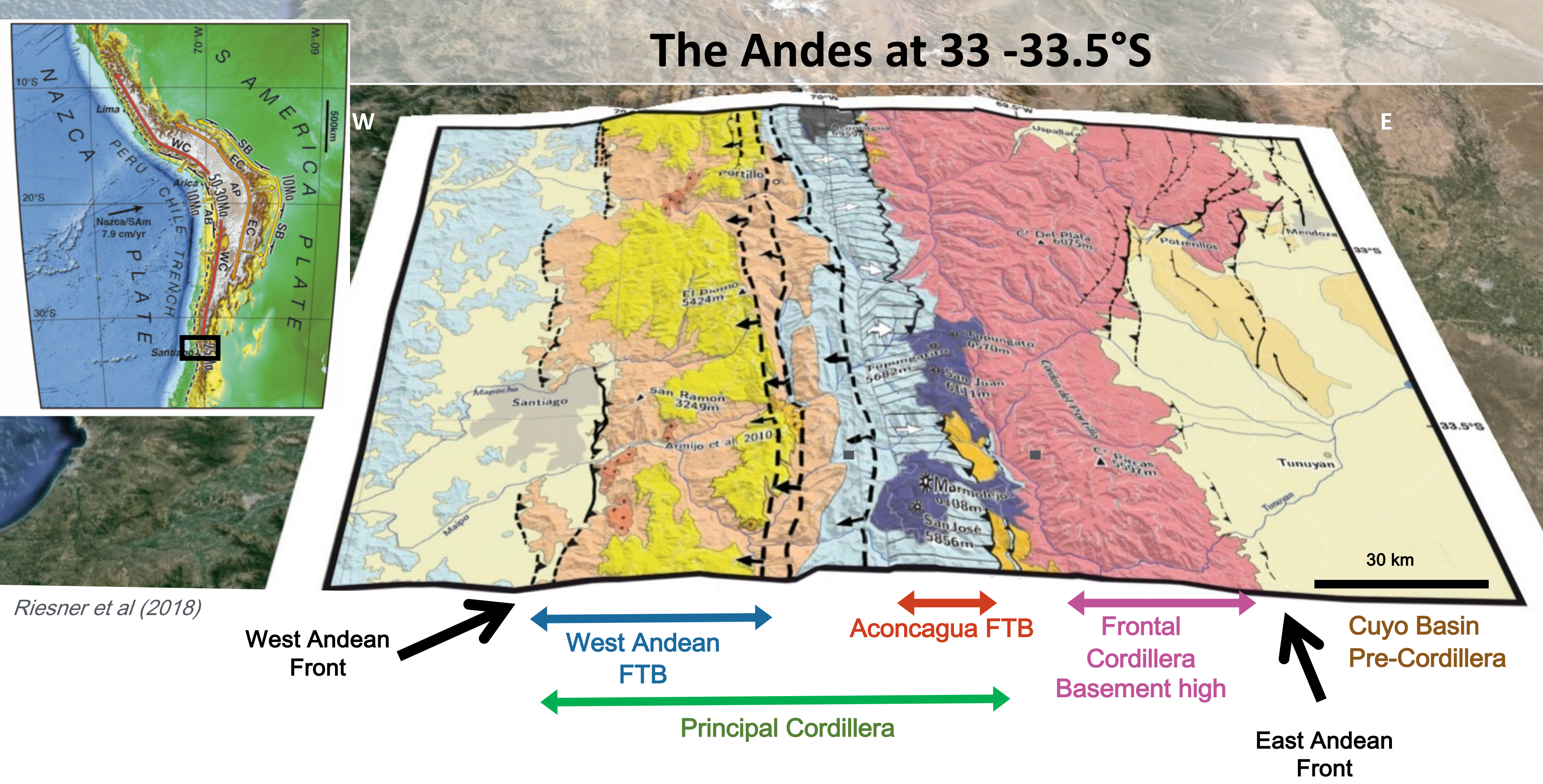
Structures in the forearc ?

What contribution to crustal thickening ?

Two sections investigated:

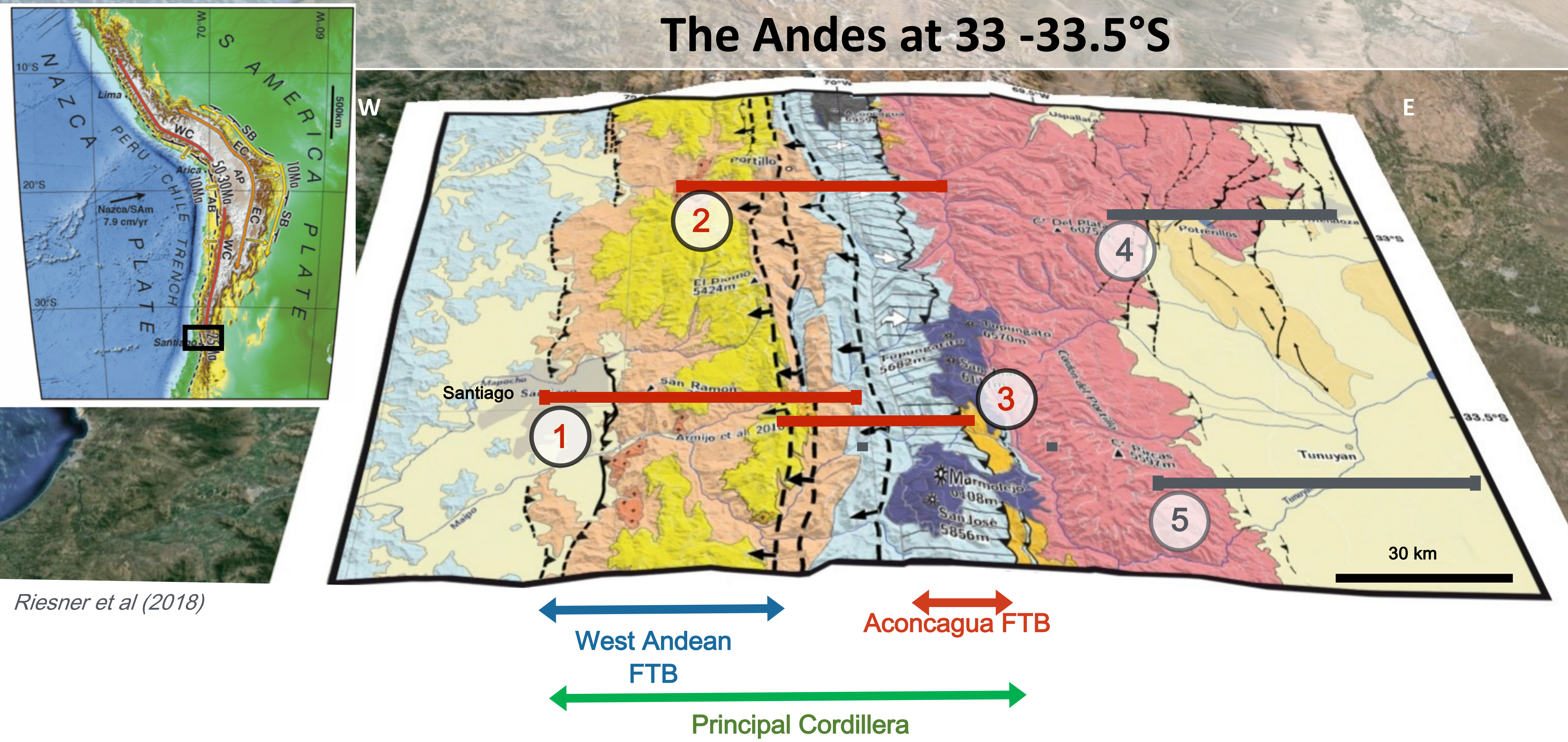
- First at the latitude of Santiago (Chile)
- Then in Northern Chile (See EGU presentation by Habel et al in the same session)

The Andes at 33 -33.5°S



Riesner et al (2018)

The Andes at 33 -33.5°S



Riesner et al (2018)

1 = *e.g. Armijo et al. (2010), Riesner et al. (2017)*

2 = *e.g. Ramos et al. (1996, 2004), Riesner et al. (2018)*

3 = *e.g. Giambiagi et al. (2001, 2003), Riesner et al, 2018*

Re-investigated sections

4 = *e.g. Giambiagi et al. (2011)*

5 = *e.g. García and Casa (2015)*

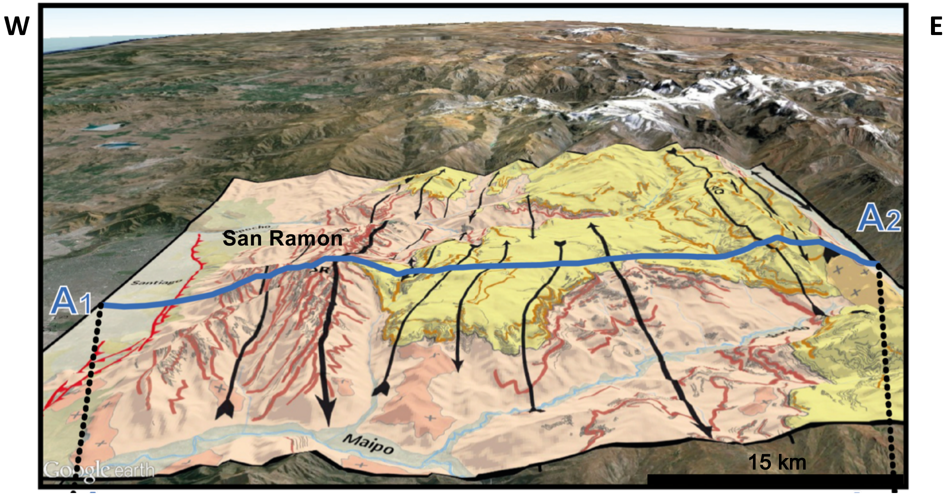
Mapping structures within the forearc of the Andes

Structures not easy to map and document from classical field measurements:

- Magmatic intrusions in the forearc
- Initial depositional environment of volcano-sedimentary formations

=> Mapping structures from 3D data at larger scale

West andean fold-and-thrust belt

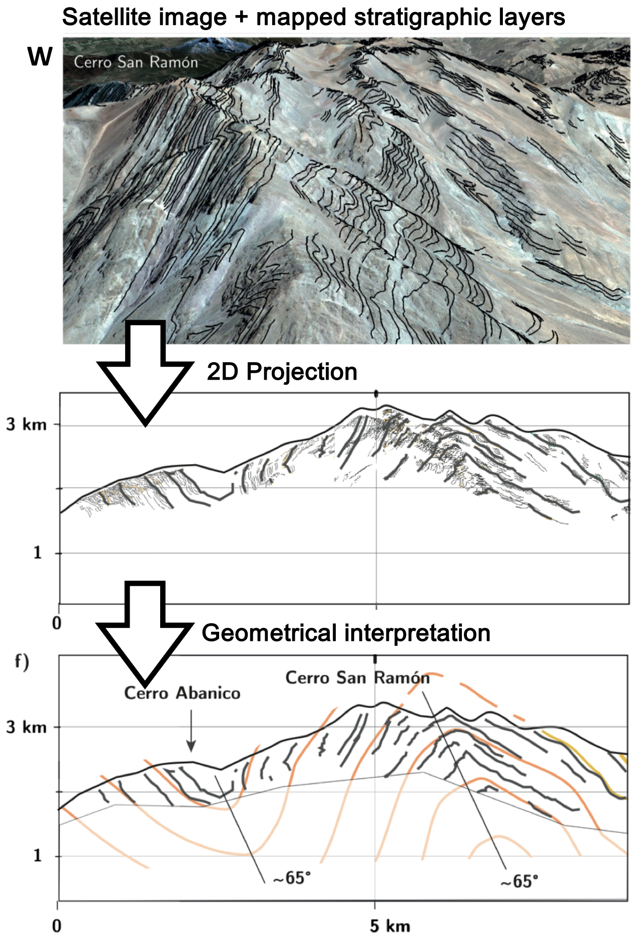


Data available

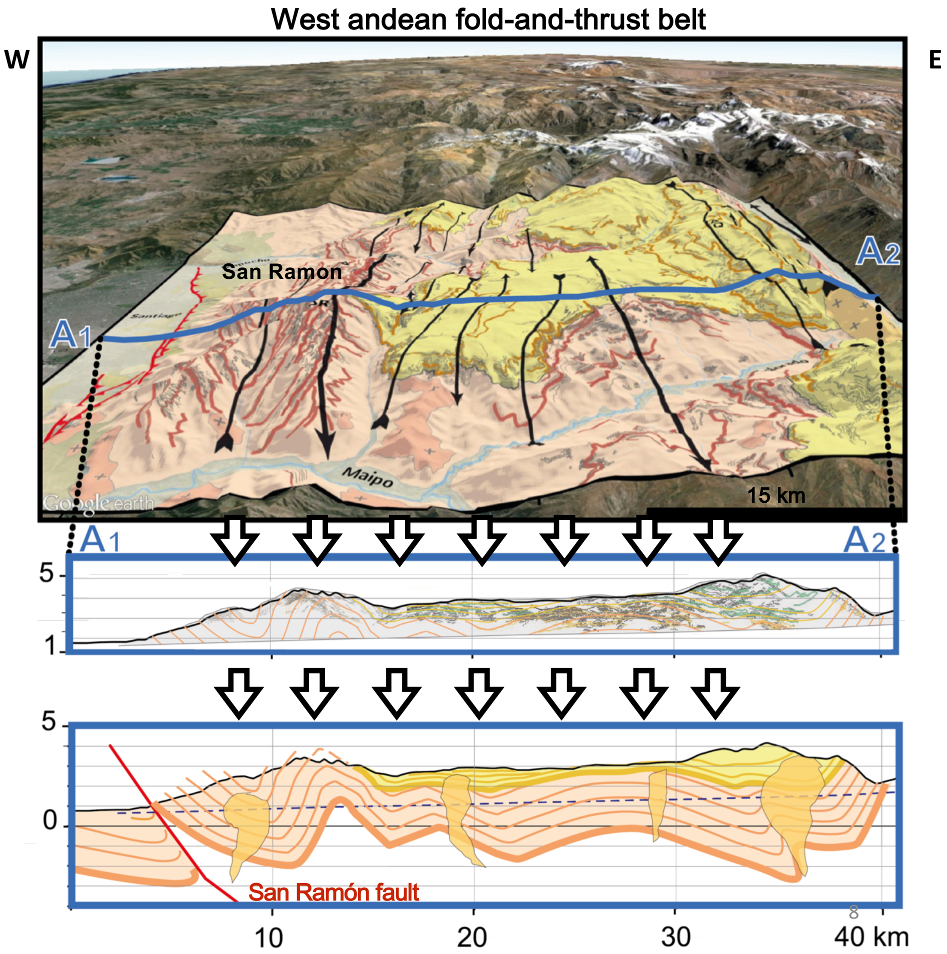
- Geological maps
- Satellite imagery
- High resolution aerial pictures
- Digital Elevation Model
- Field observations
- Structural maps

Riesner et al (2017), Riesner et al (2018)

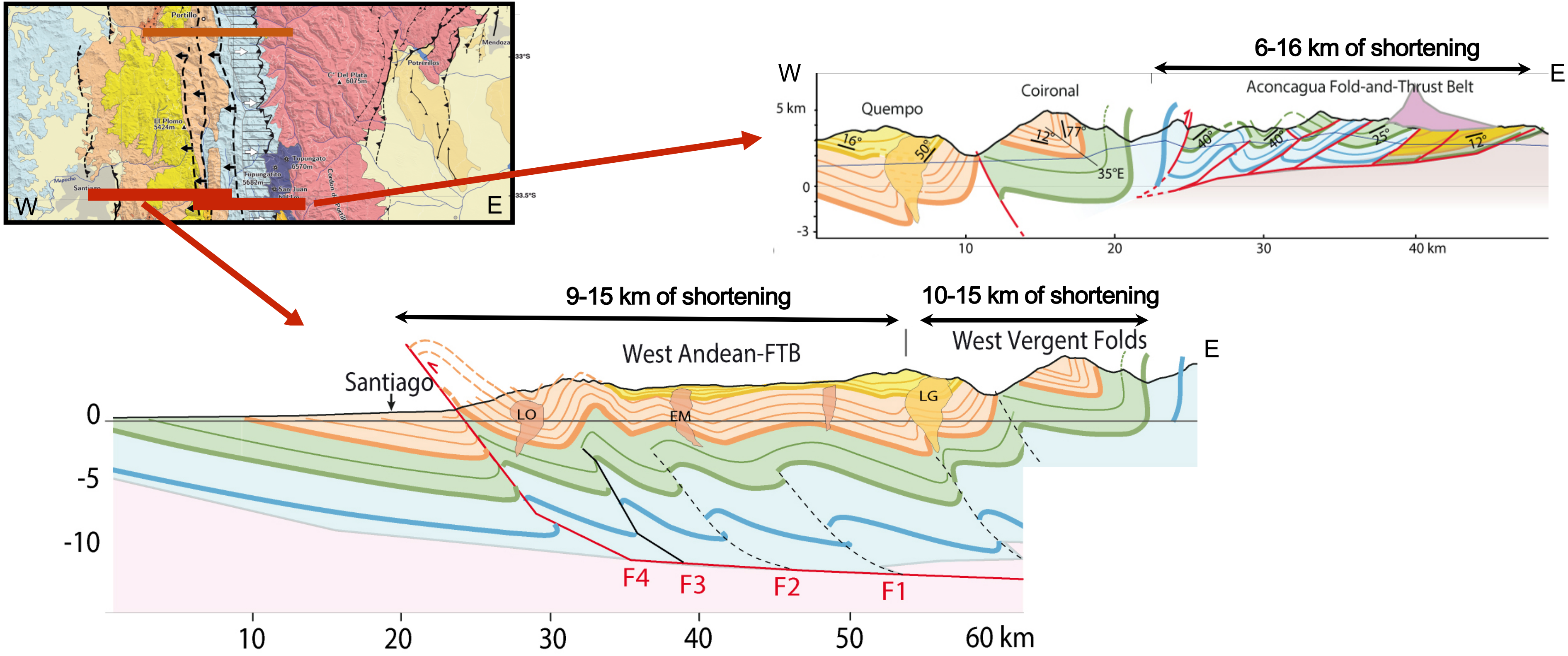
Mapping structures within the forearc of the Andes



Riesner et al (2017), Riesner et al (2018)



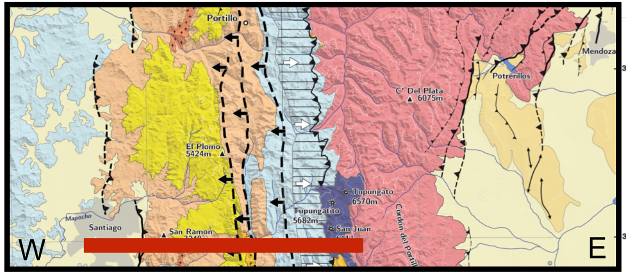
Building a cross-section of the Principal Cordillera (~33.5°S)

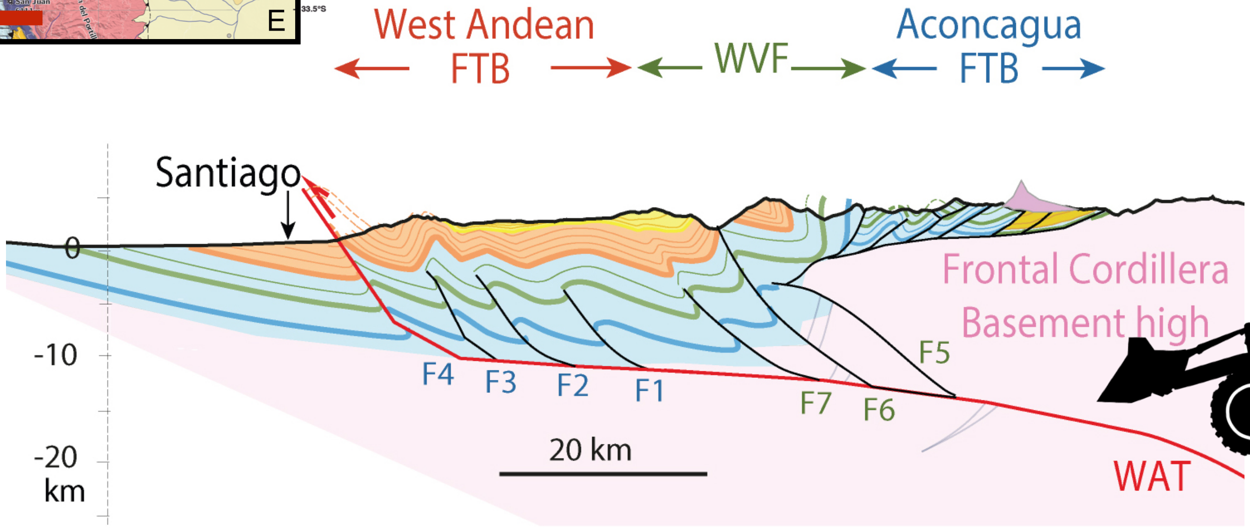


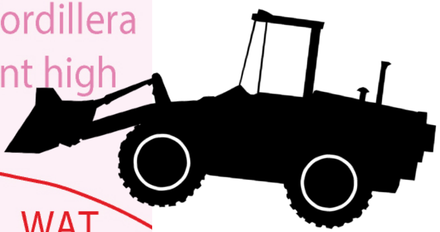
25-46 km of total shortening across the Principal Cordillera (forearc)

Riesner et al (2017), Riesner et al (2018)

Building a cross-section of the Principal Cordillera (~33.5°S)



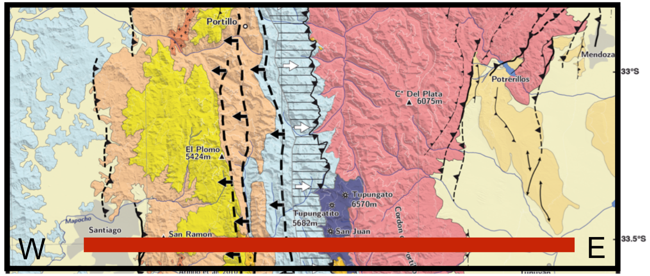


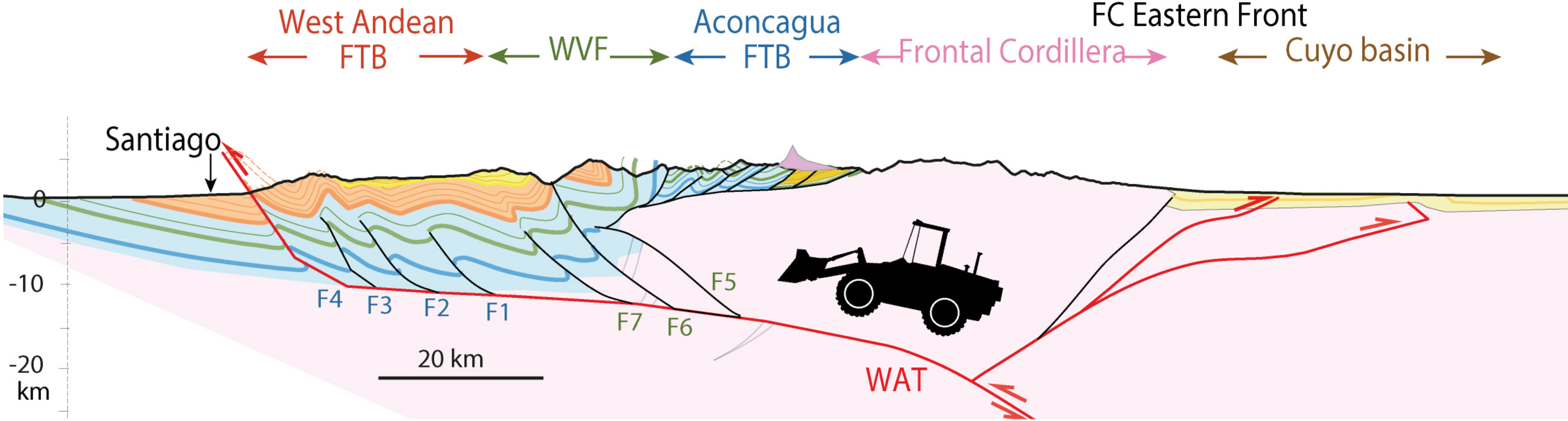


25-46 km of total shortening across the Principal Cordillera (forearc)

Riesner et al (2018), Riesner et al (in prep - Tectonics).

Building a cross-section of the Andes (~33.5°S)

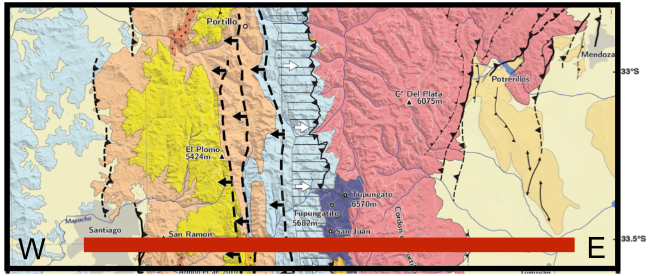




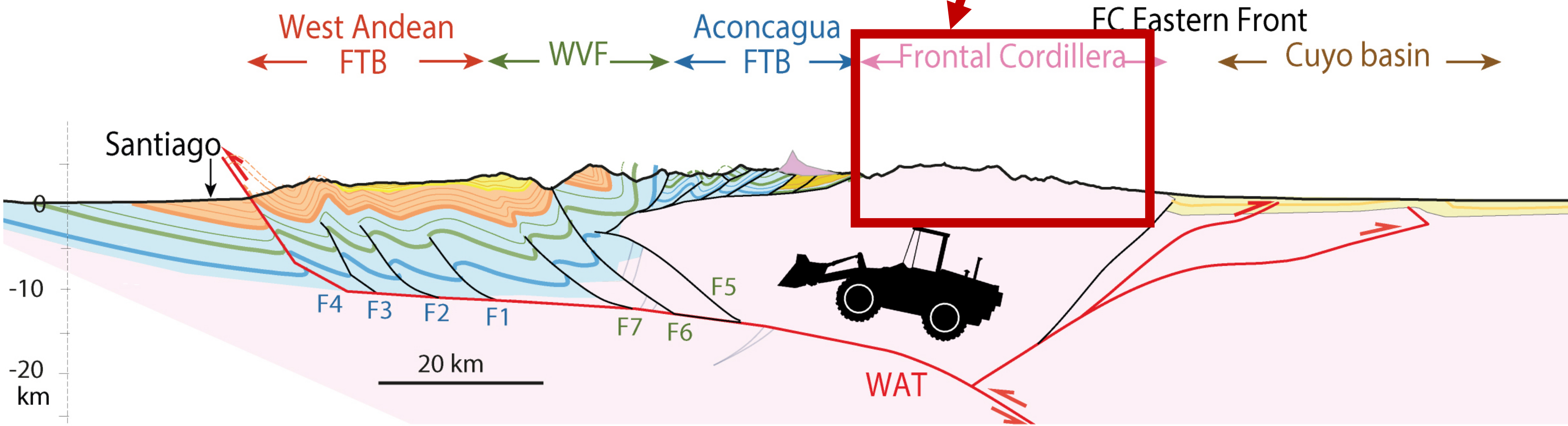
29-59 km of total shortening across the Andes (33.5°S)

García and Casa (2015)
Riesner et al (2018), Riesner et al (in prep - Tectonics).

Building a cross-section of the Andes (~33.5°S)



Exhumation of the Frontal Cordillera Basement: see work by Lacassin et al in the same session

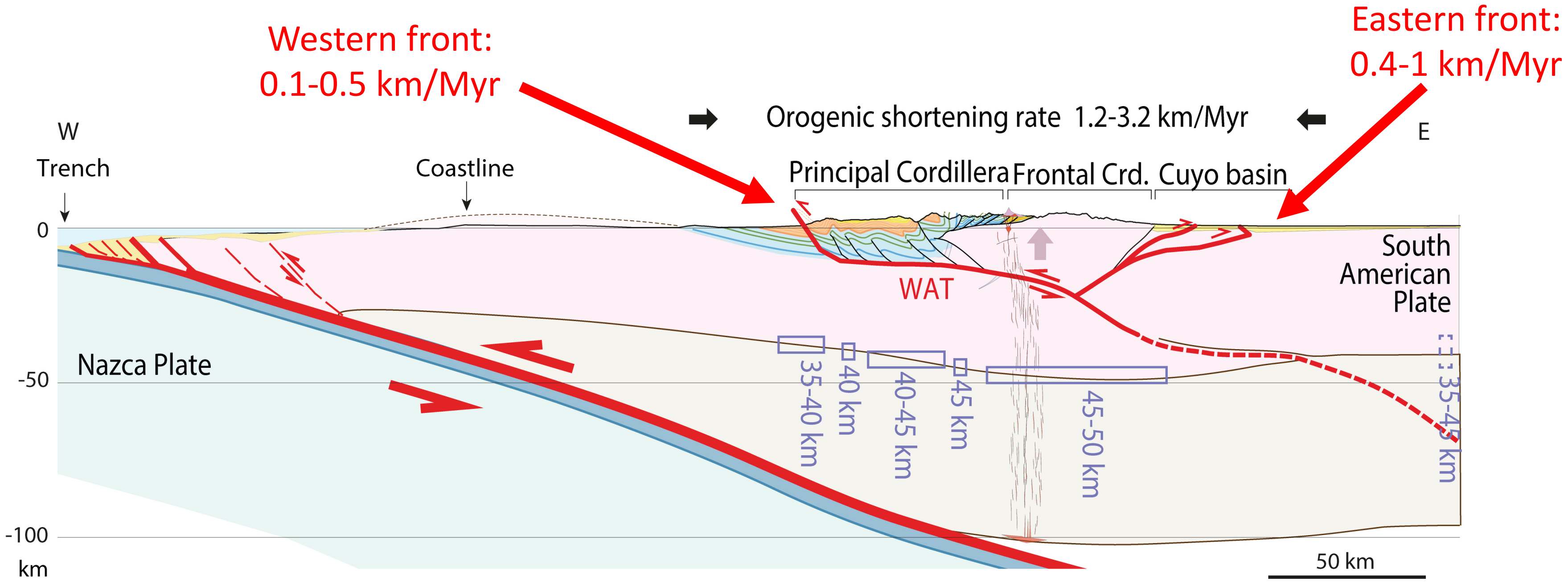


29-59 km of total shortening across the Andes (33.5°S)

García and Casa (2014)

Riesner et al (2018), Riesner et al (in prep - Tectonics)., Riesner et al, 2019

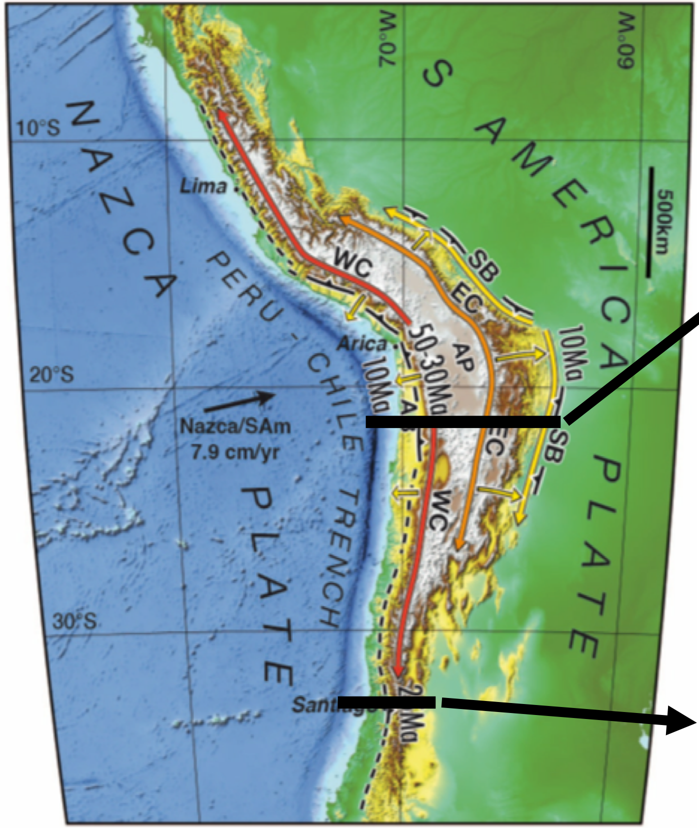
A revised crustal-scale section of the Andes at ~33.5°S

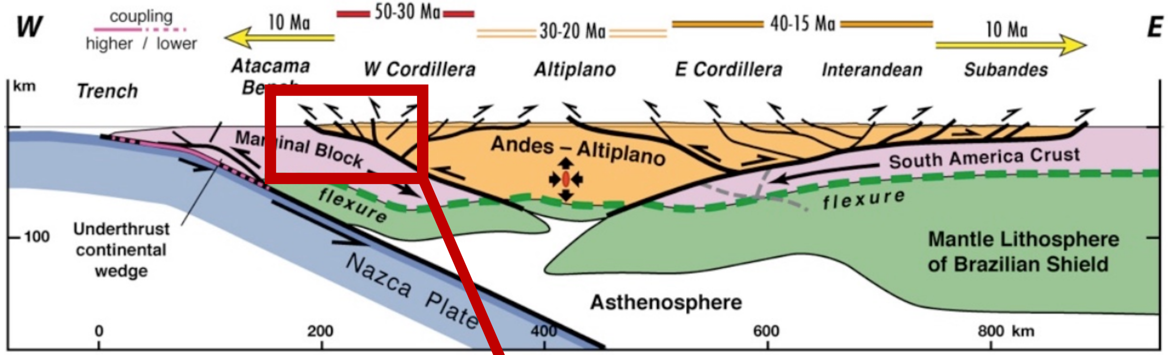


- Bi-vergent mountain belt with two active fronts
- Mountain building initiated synthetic to the subduction zone, and has been mostly sustained by west-vergent structures in the forearc.
- Late east-vergent structures presently accommodate most of the present Andean shortening rate

Riesner et al (2018), Riesner et al (in prep - Tectonics).

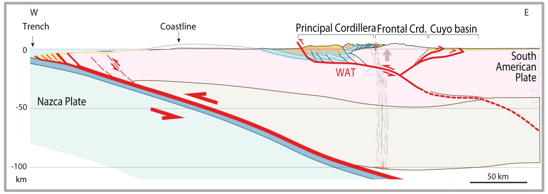
A larger scale perspective….





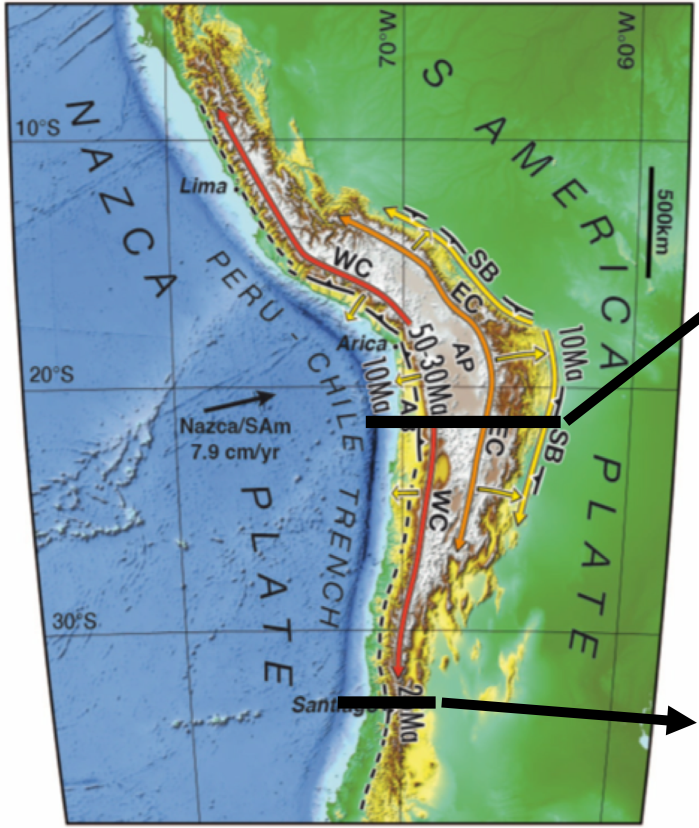
Armijo et al (2015)

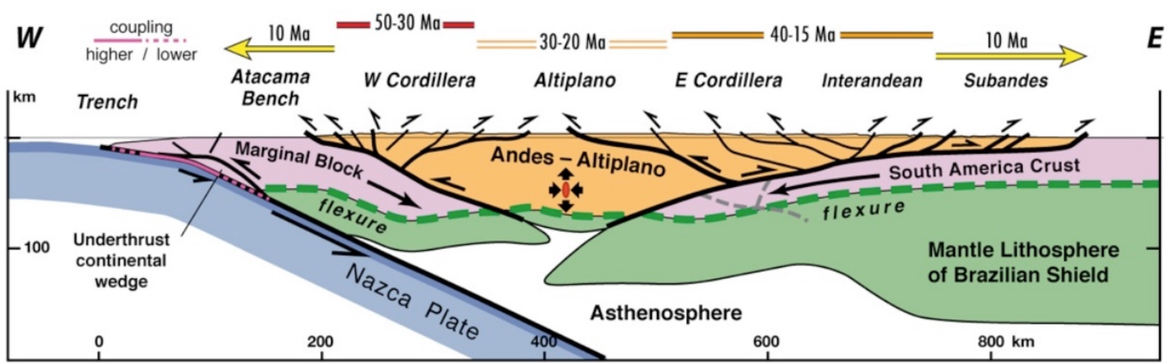
See work by Habel et al in the same session



Riesner et al (2018)

A larger scale perspective….

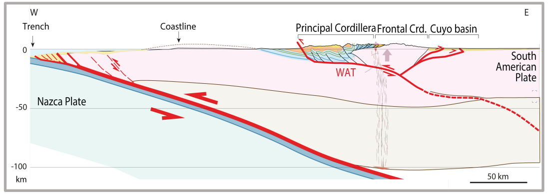




Armijo et al (2015)

The building of the Andean Plateau:

⇒ Major contribution of forearc structures, synthetic to the subduction zone, during the initial stages of Andean mountain-building ?

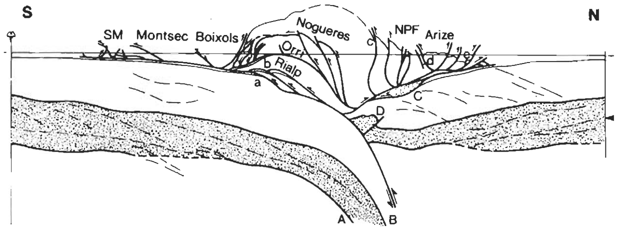


Riesner et al (2018)

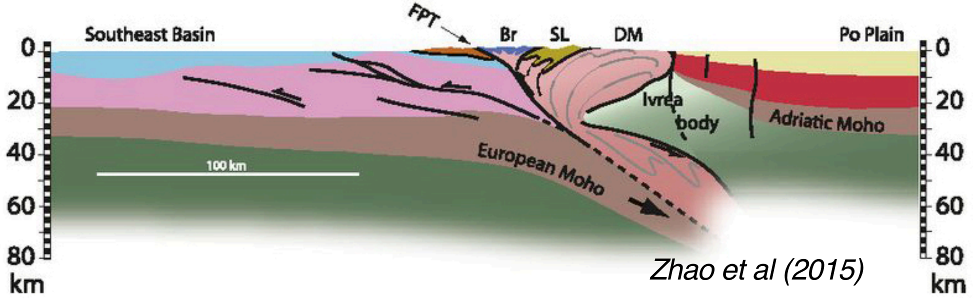
⇒ Limited flexure of Marginal Block results in later propagation of eastward deformation, antithetic to the subduction zone ?

Comparison to collisional orogens

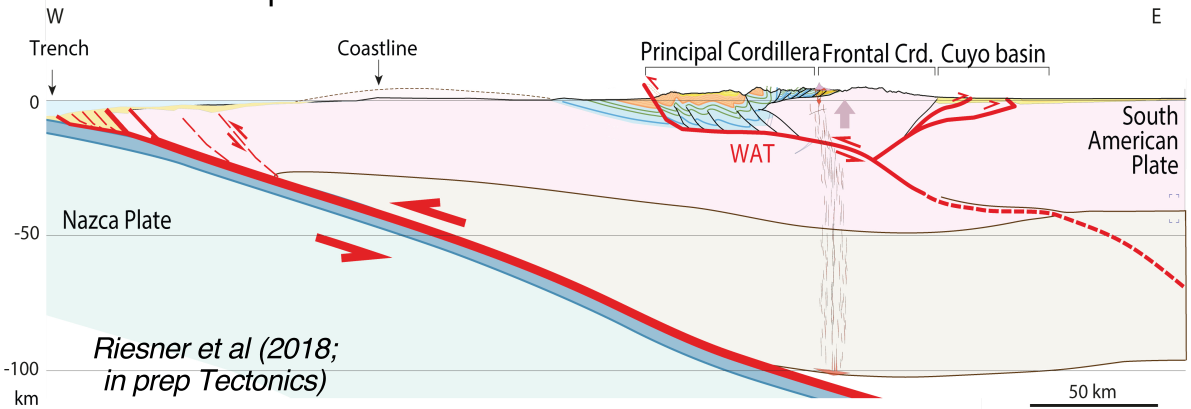
The Pyrenees



The Western Alps



The Principal Cordillera of the Andes at 33.5°S



⇒ **Similarities in structural style:**

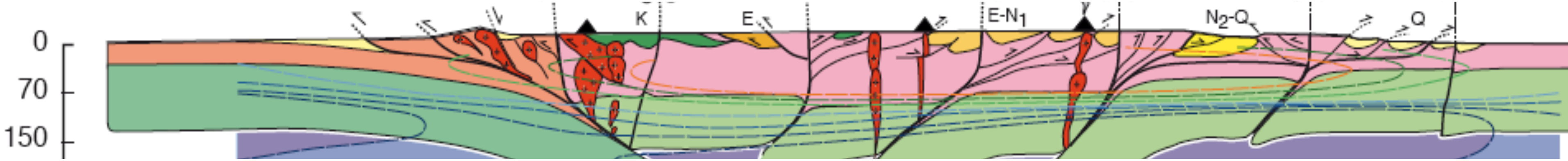
- Deformation of basement high and fold-and-thrust belt sustained by crustal structures synthetic to subduction
- Backthrusts within the retro-wedge/back-arc.

⇒ **Differences of Andes (33.5°S):**

- Limited flexure of forearc block
- Deformation within the upper plate of the subduction zone

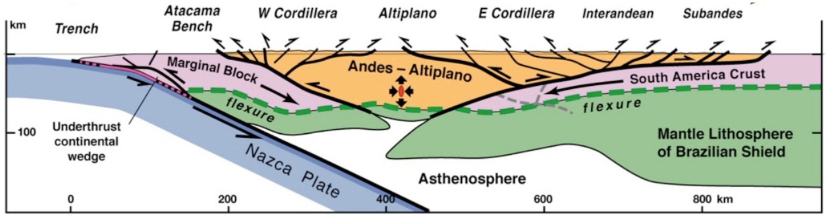
Comparison to collisional orogens

Himalaya - Tibet



Tapponnier et al (2001)

The Andes - Altiplano at 20°S



Armijo et al. 2015

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