Structural styles and tectonic inheritance in the Andean fold-thrust belt and foreland basin

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THEMES:

- Andean structural styles
- Controls on structural style
- Tectonic Inheritance

Chapter 1: Horton & Folguera 2022

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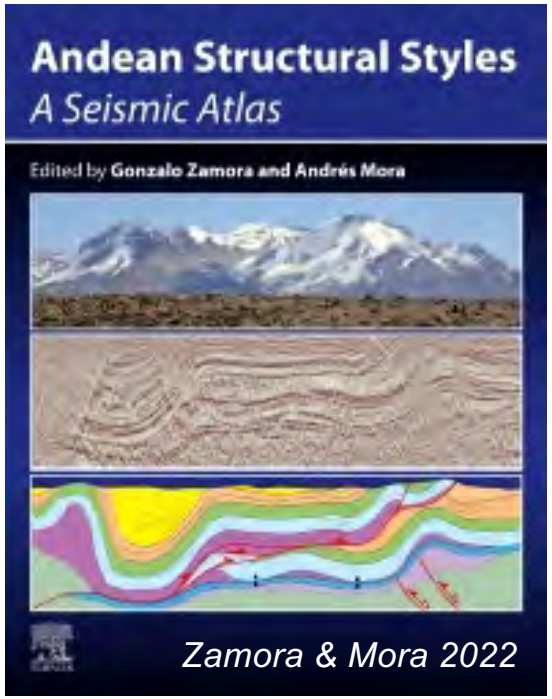
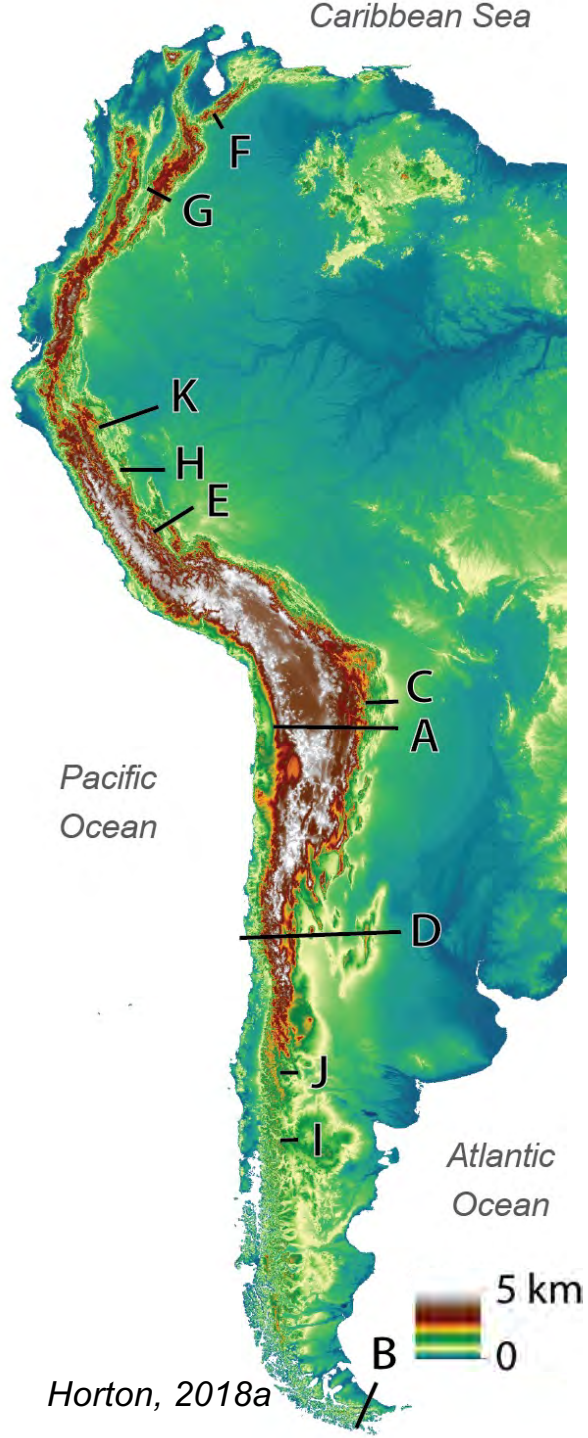
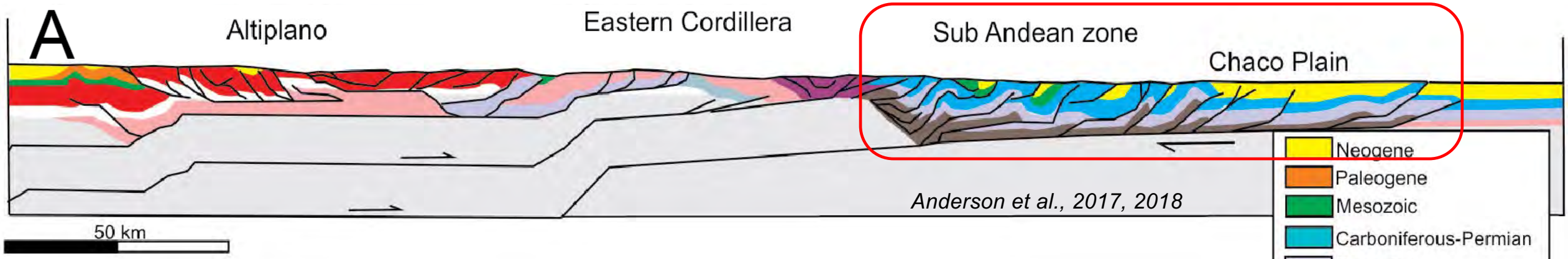
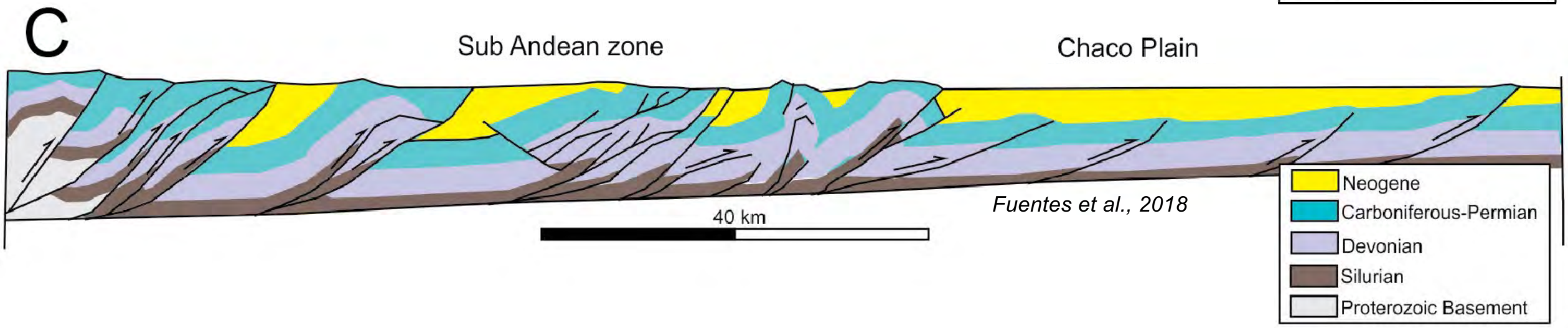


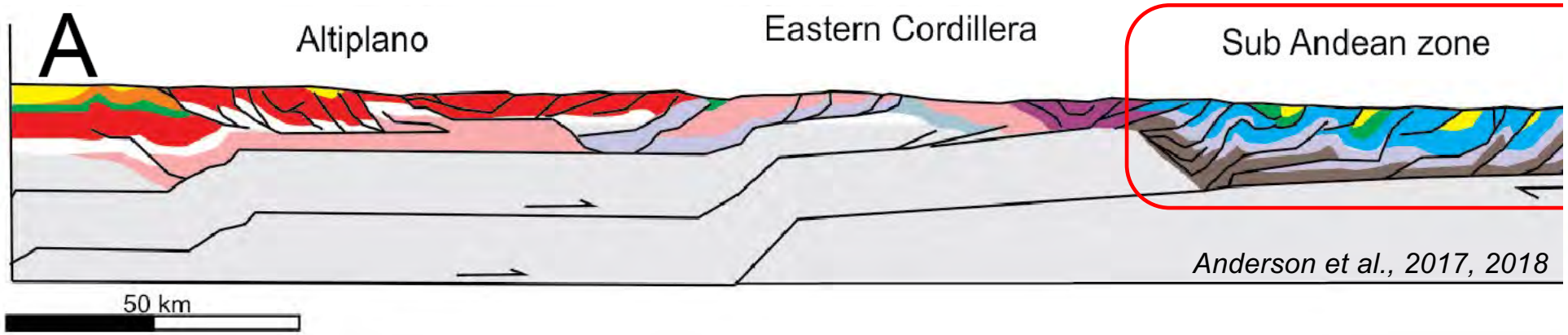




(1) thin-skinned fold-thrust systems affecting principally cover strata with ramp-flat structures above regional décollements that ultimately root in middle to upper crustal levels

Andean structural styles





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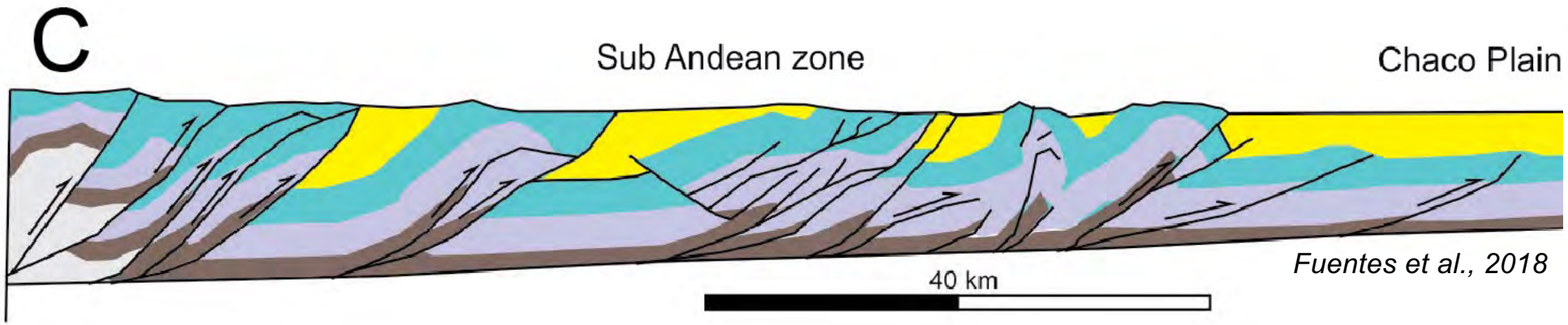
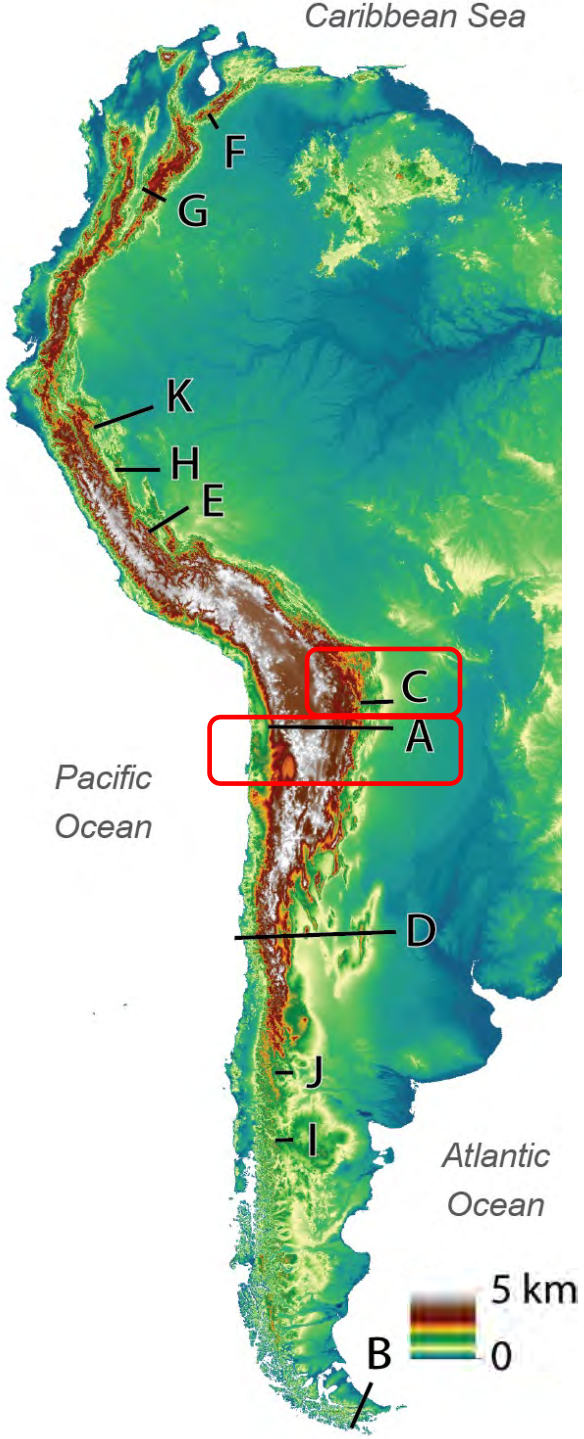
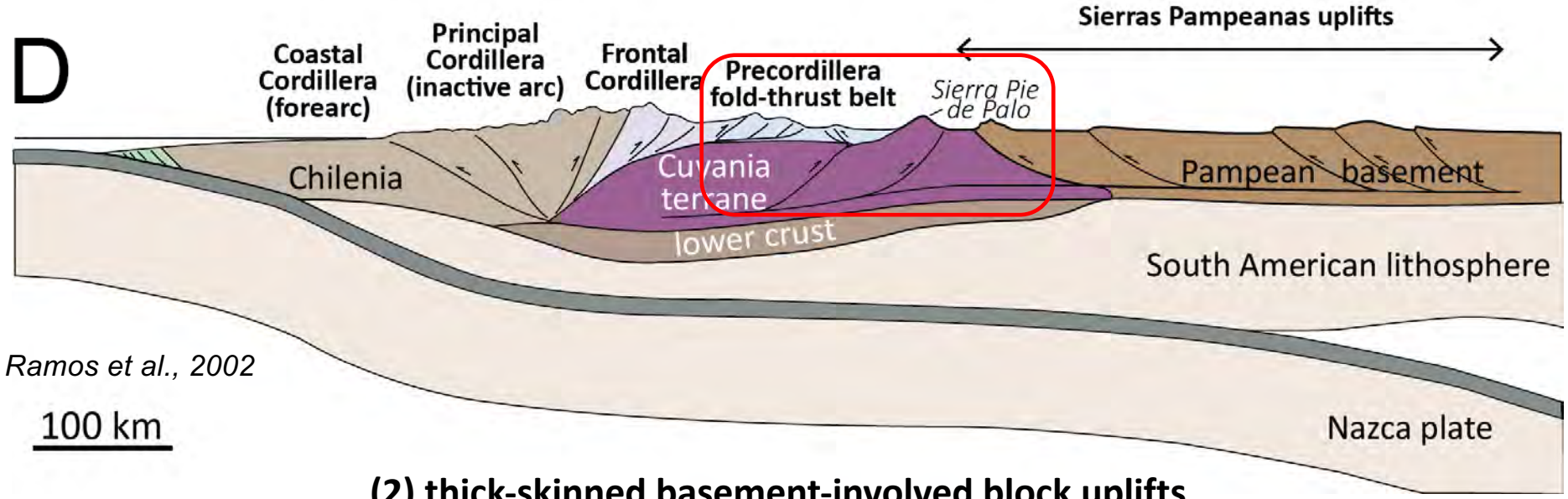
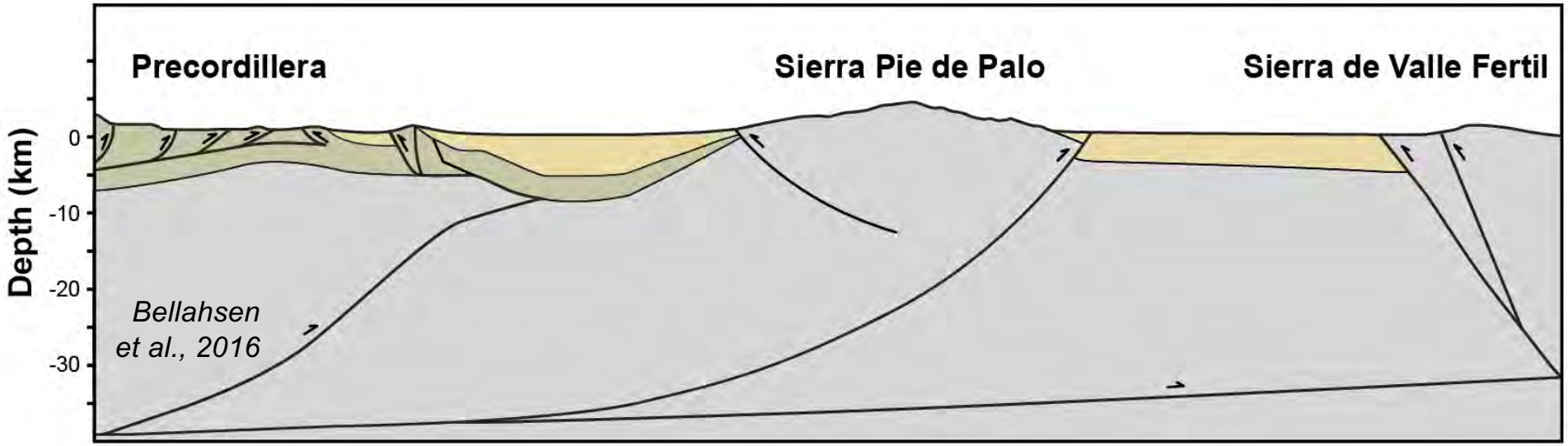


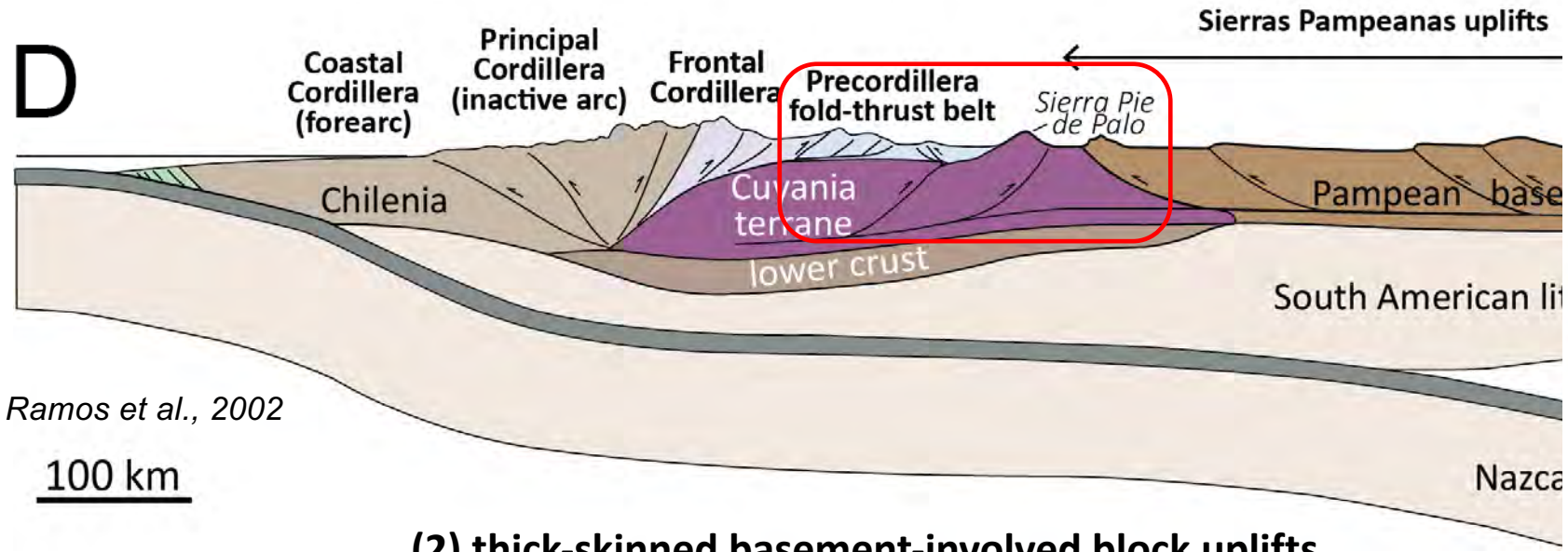




Andean structural styles

(2) thick-skinned basement-involved block uplifts delineated by isolated reverse faults that root in the lower crust;





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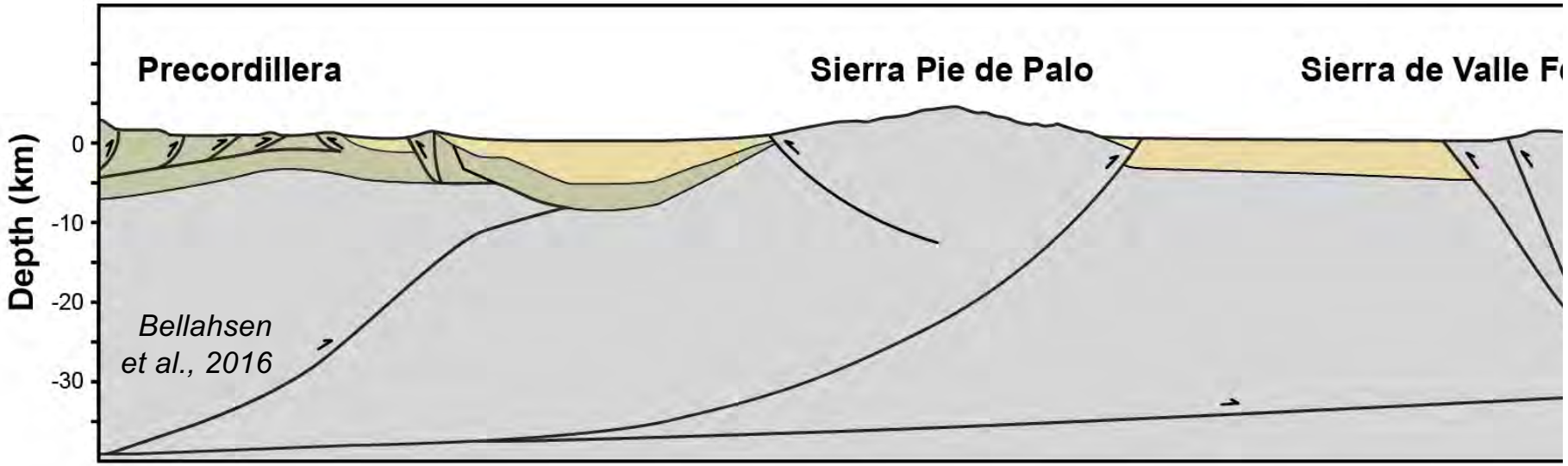

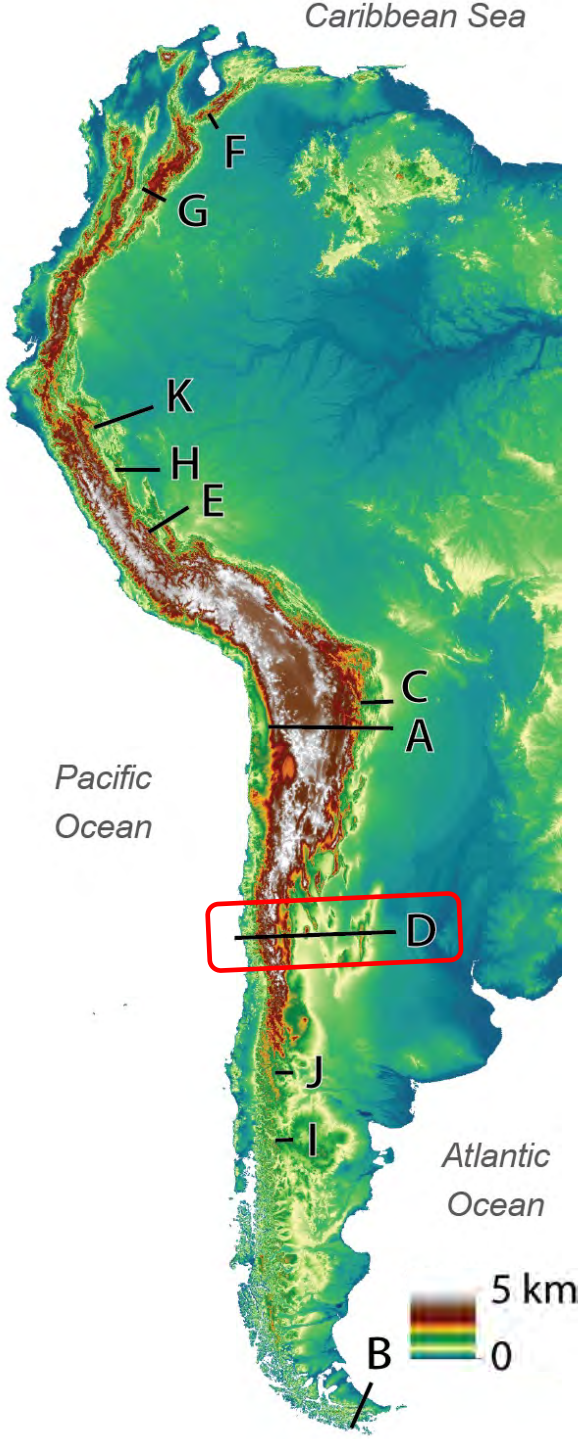

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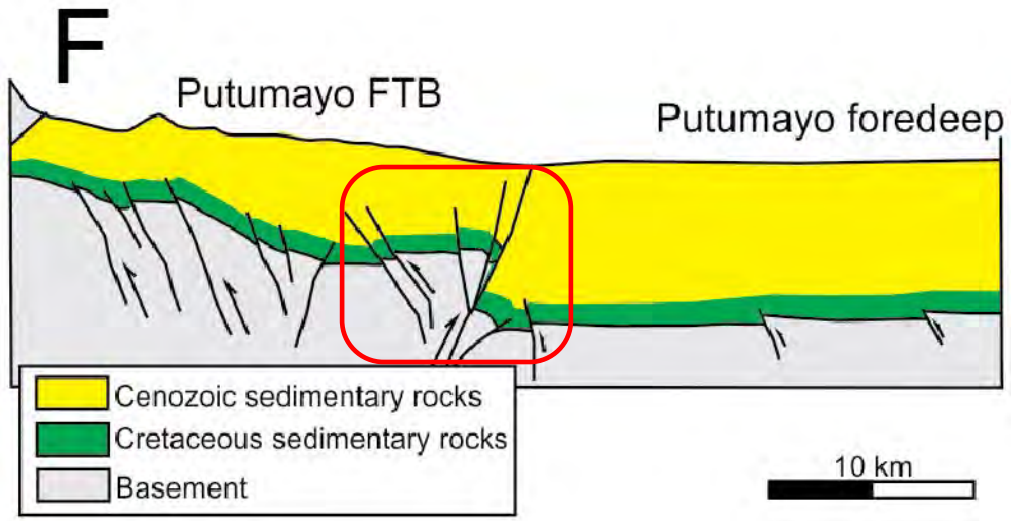
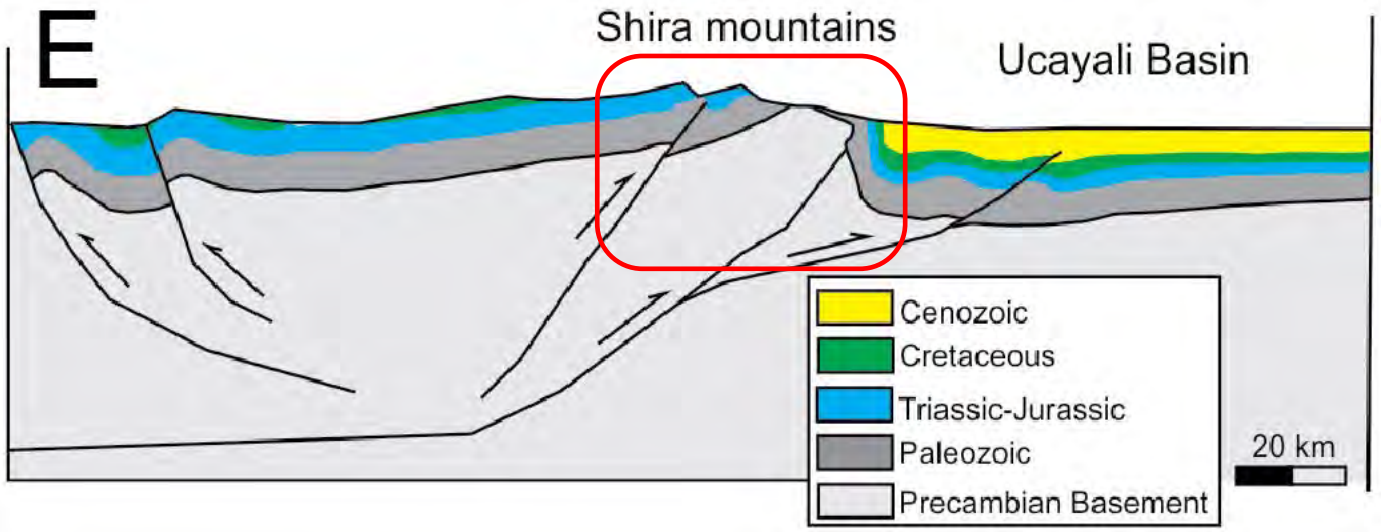
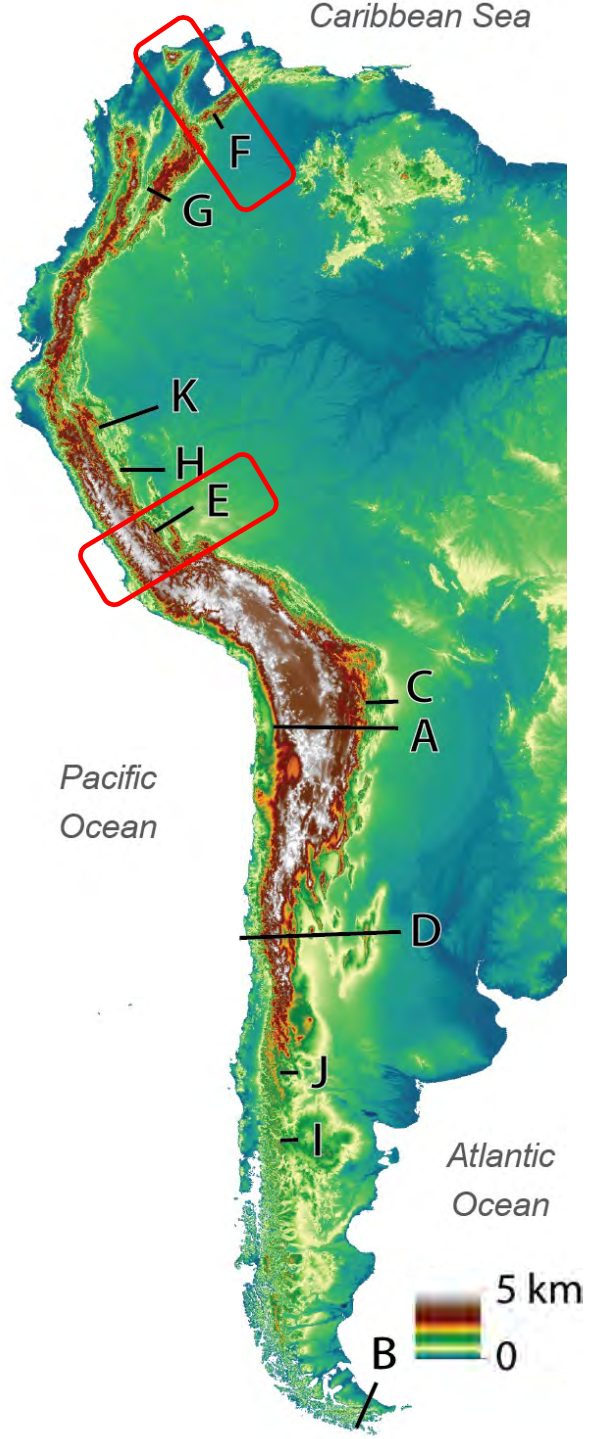


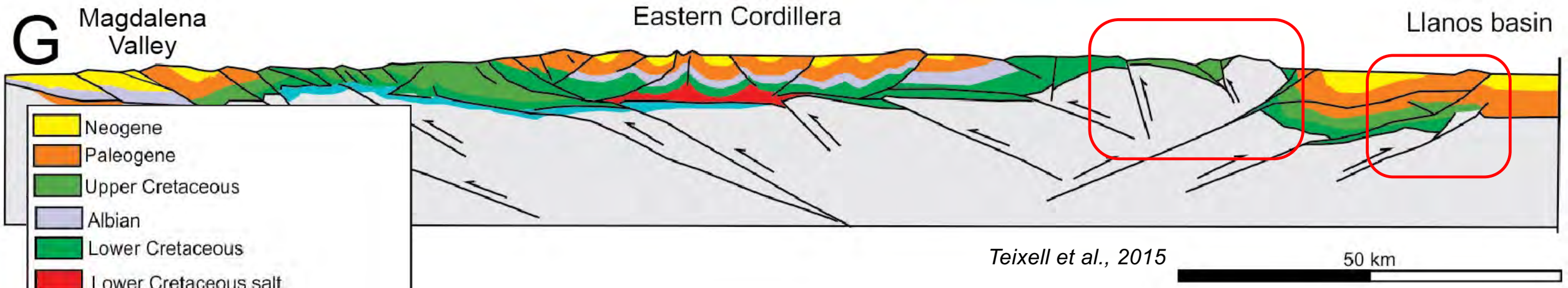
Macellari & Hermoza, 2009

(3) pre-Andean (preorogenic) extensional basins that have been inverted by fault reactivation during later shortening.



McClay et al., 2018





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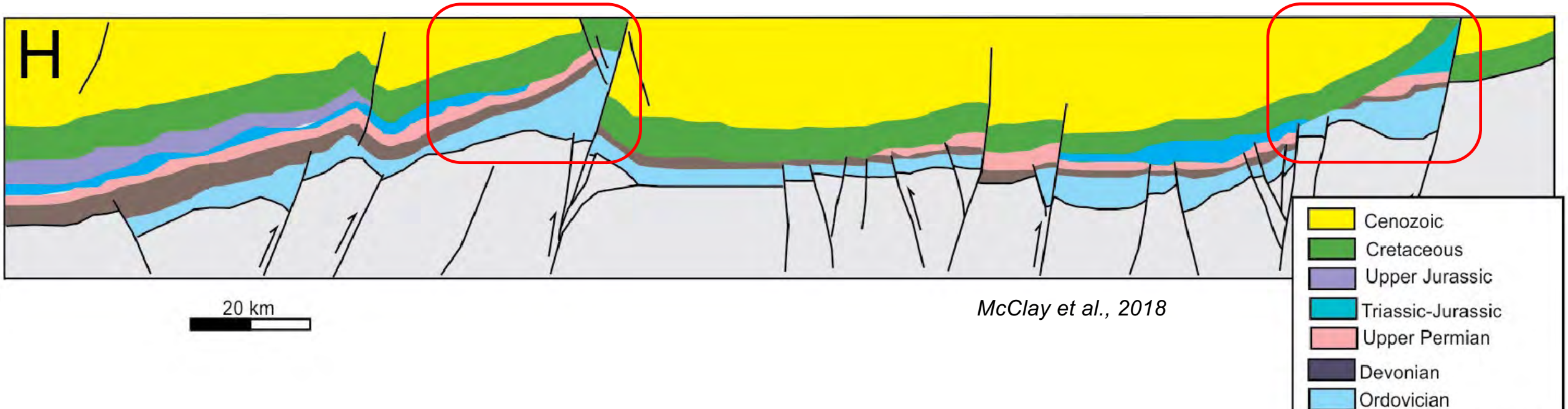

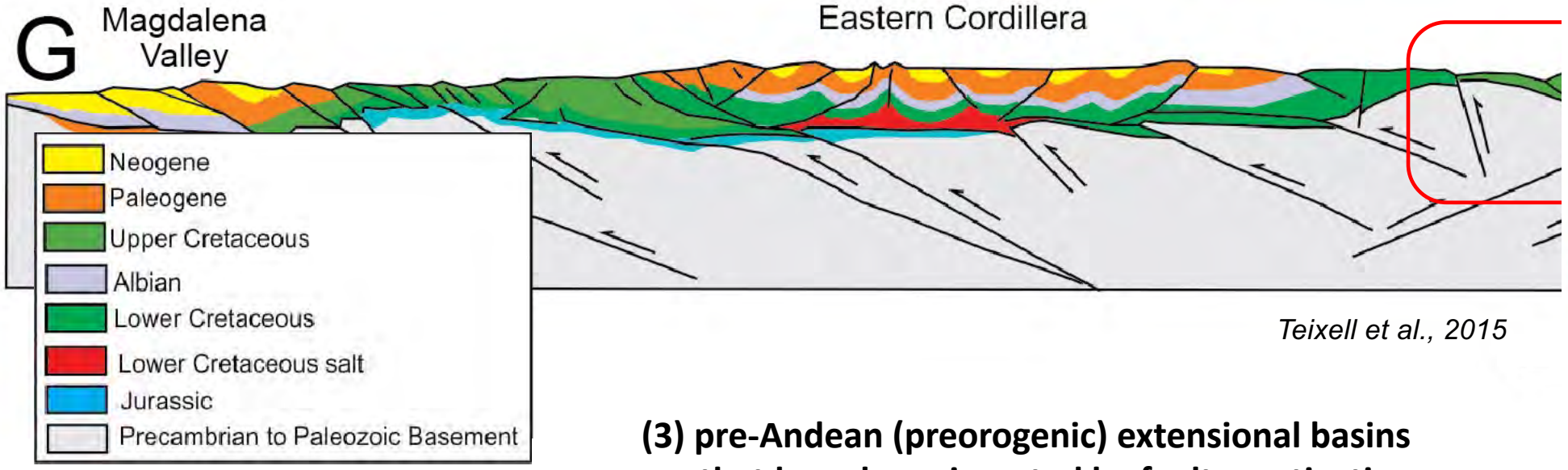

Teixell et al., 2015

Andean structural styles

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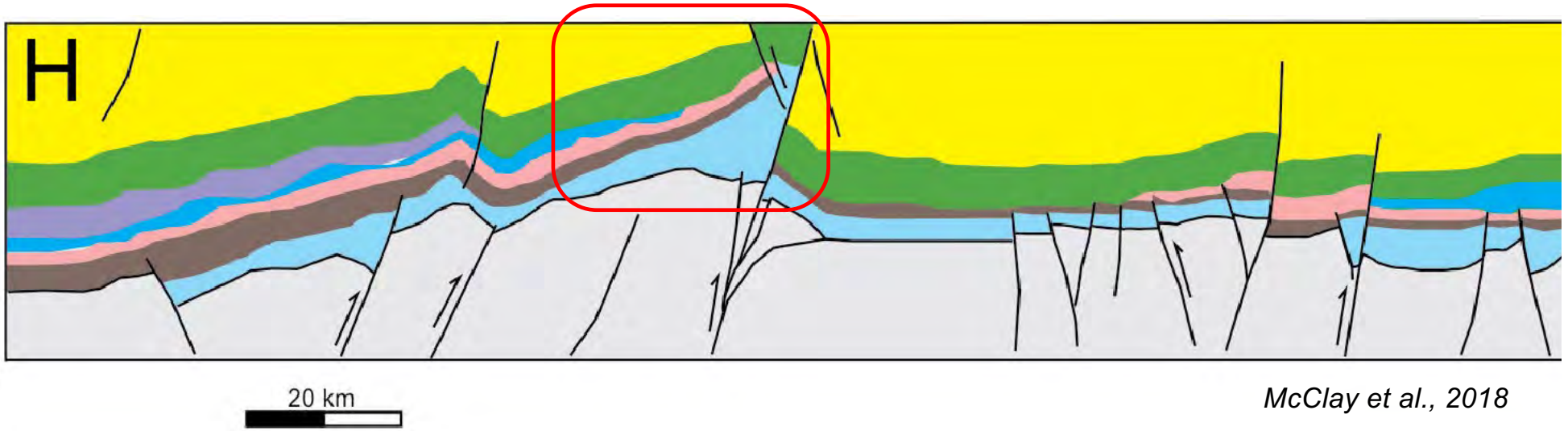
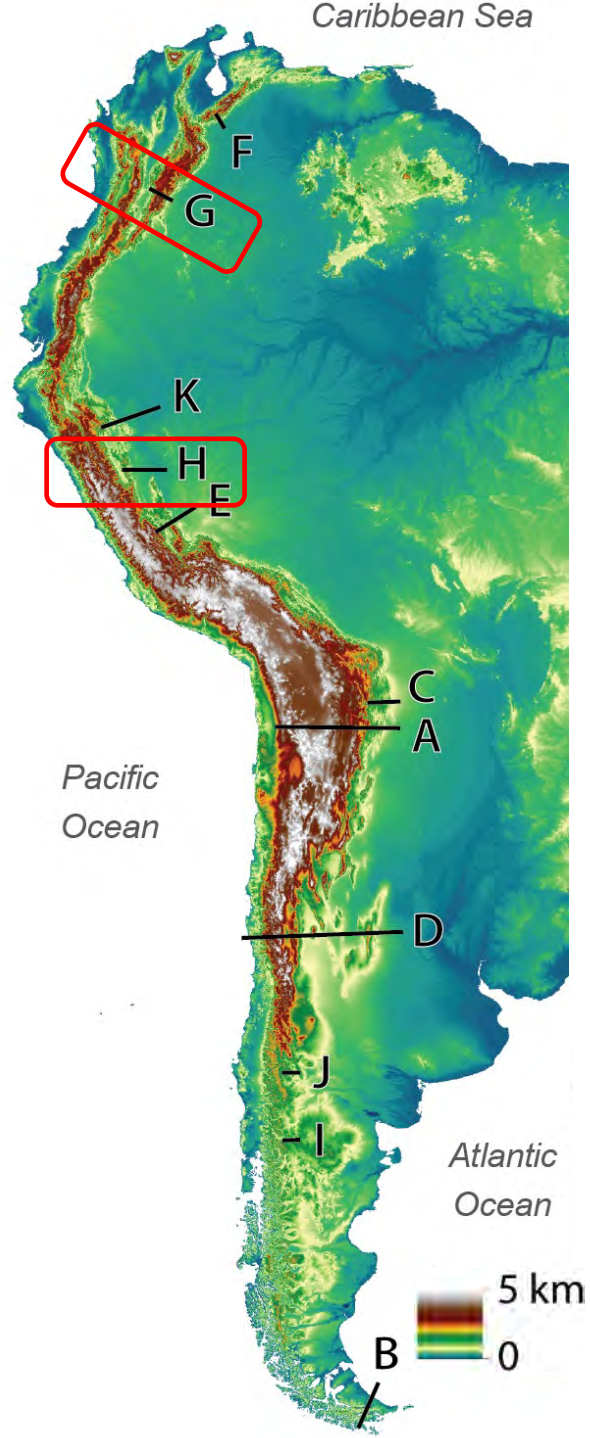
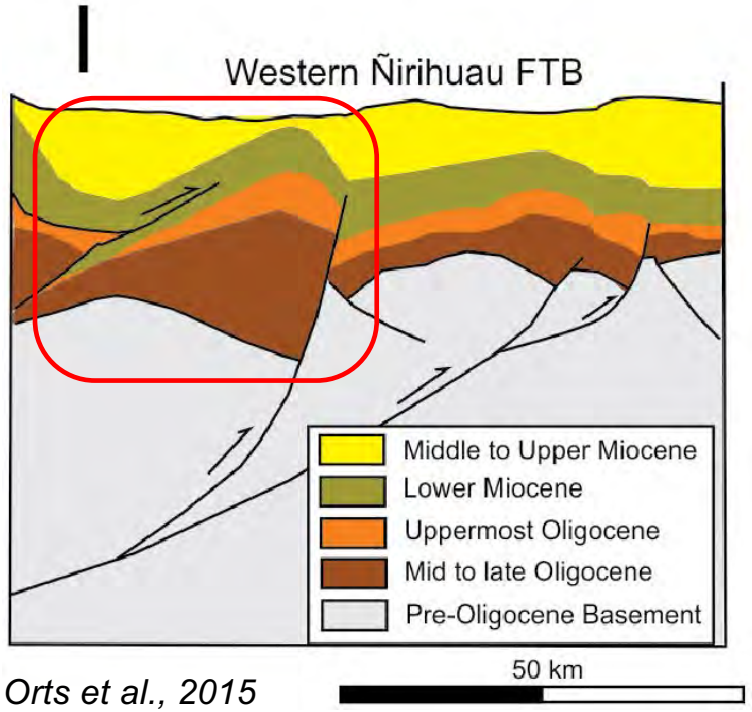


McClay et al., 2018

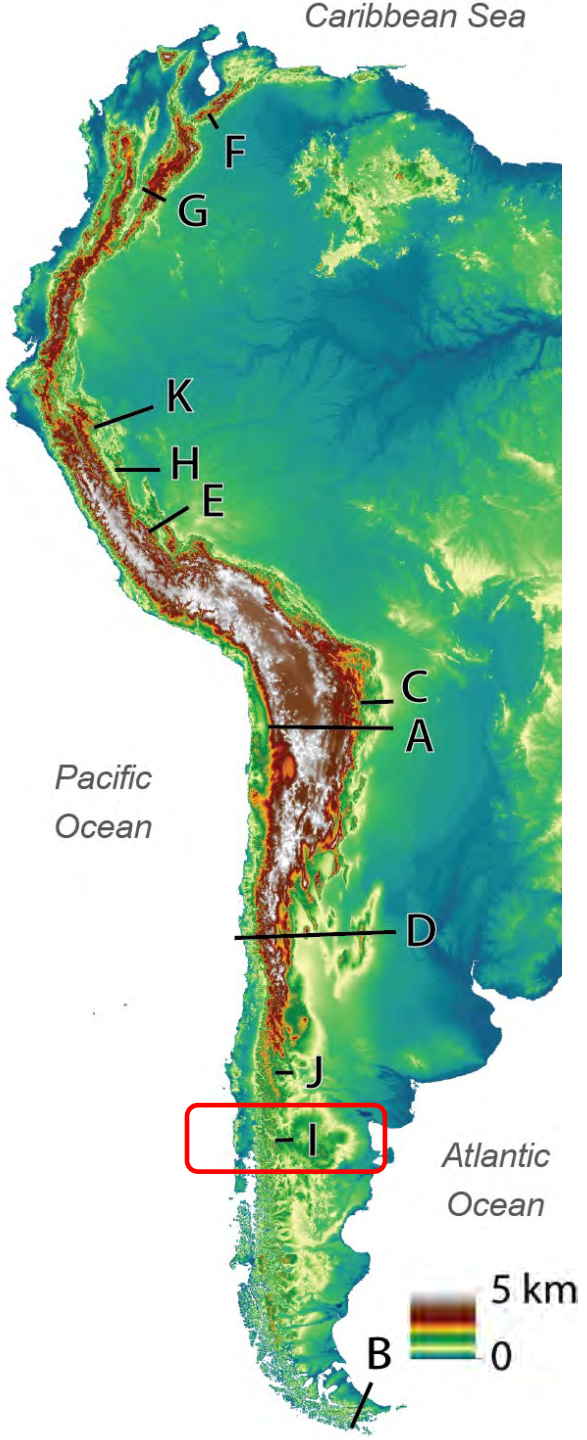


Andean structural styles

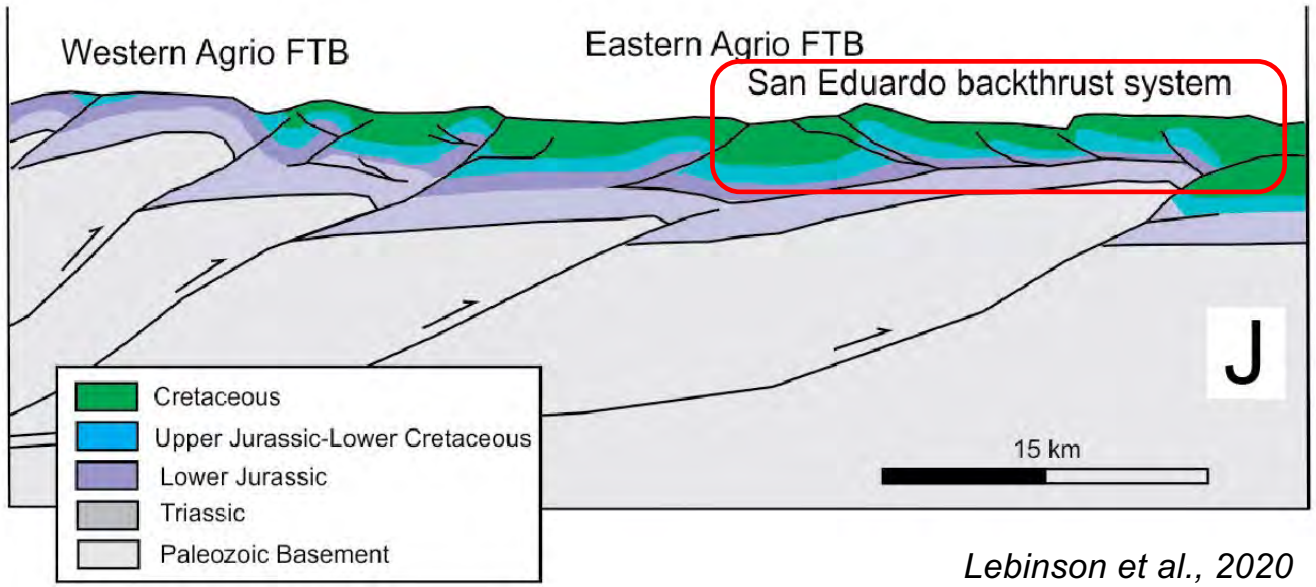


Orts et al., 2015

(4) Andean (synorogenic) extensional basins that have been inverted by fault reactivation during later shortening.

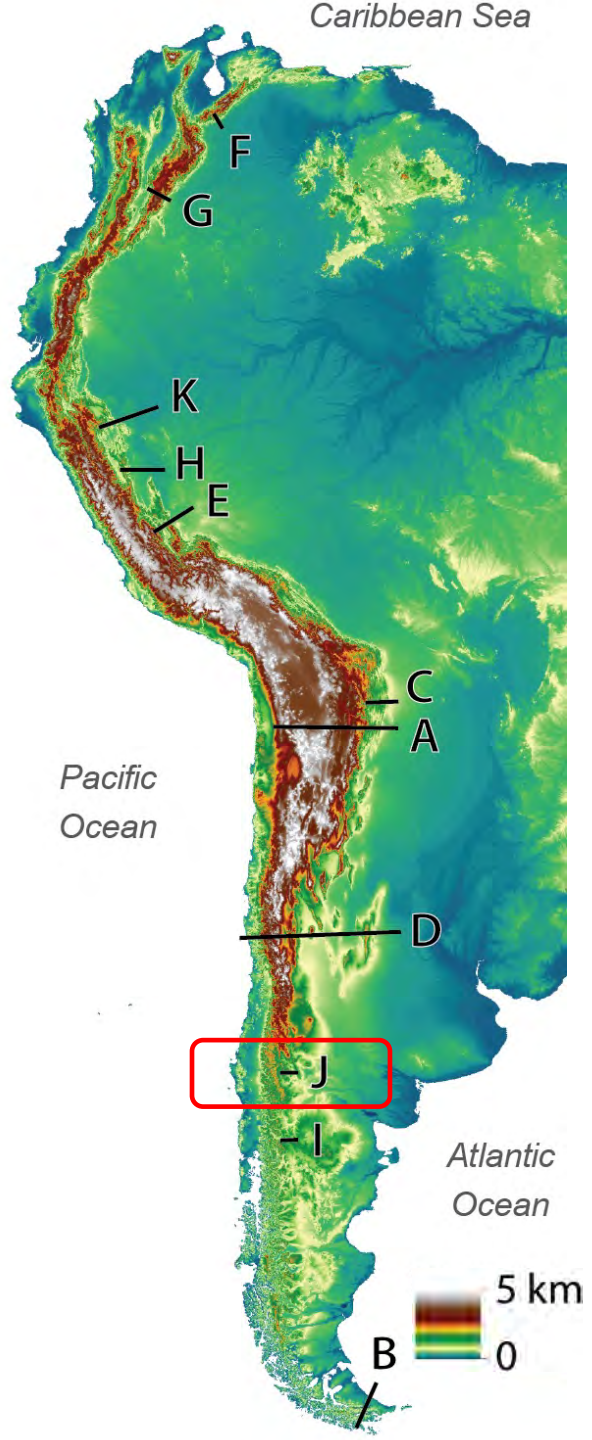


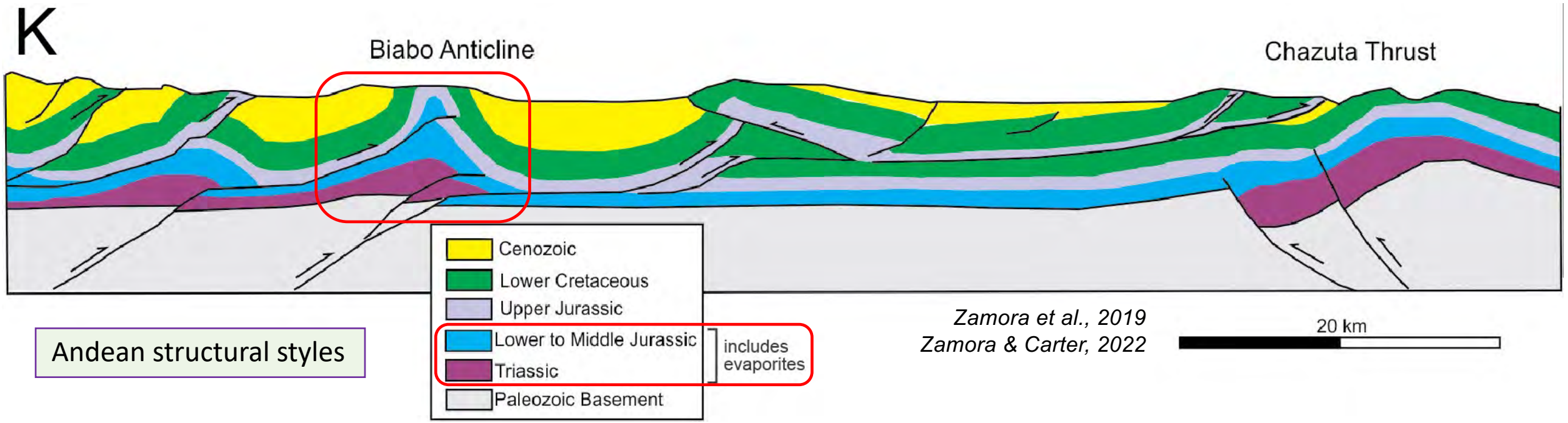
Andean structural styles



Lebinson et al., 2020

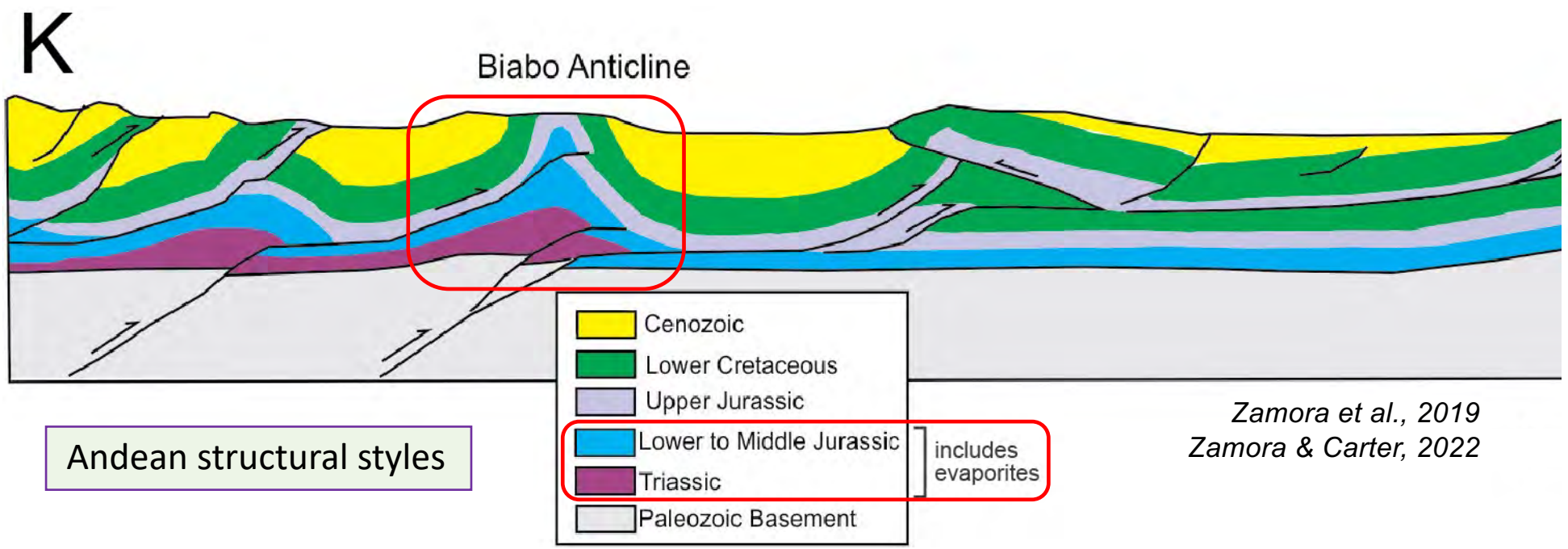
(5) upper-crustal backthrust belts linked to deeper foreland-directed structures.





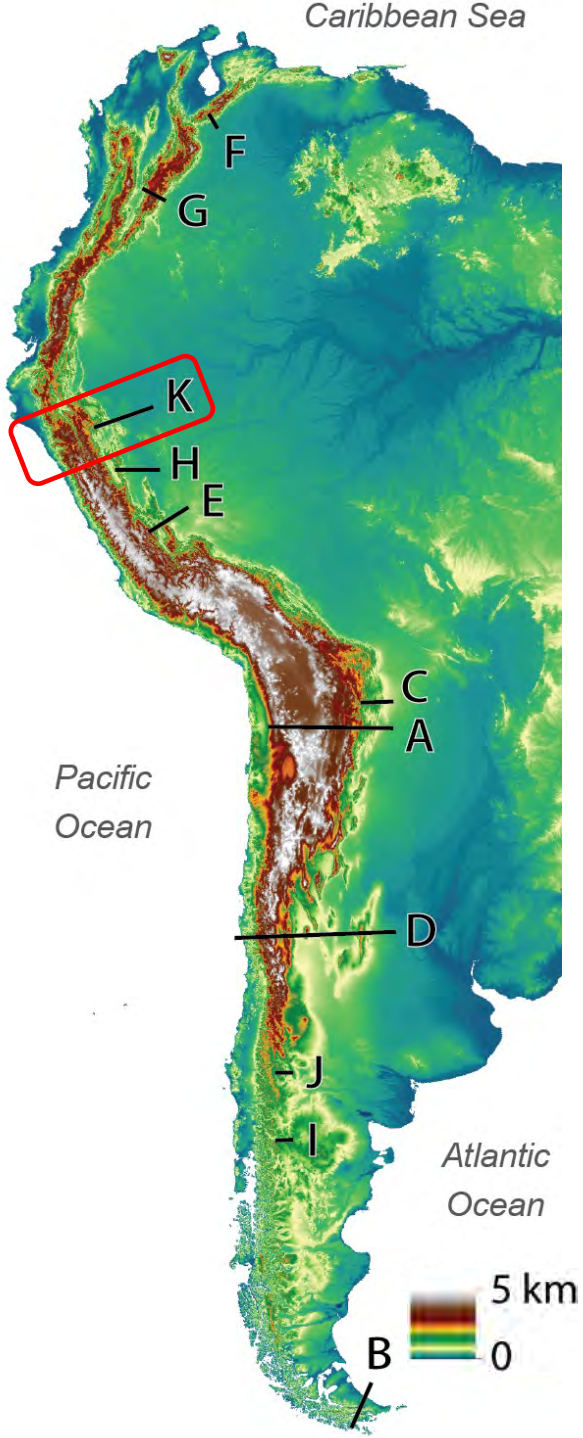
Andean structural styles

(6) salt-involved contractional structures with weak décollement horizons that facilitate lateral flow of evaporite facies.



Andean structural styles

Zamora et al., 2019
Zamora & Carter, 2022



(6) salt-involved contractional structures with weak décollement horizons that facilitate lateral flow of evaporite facies.

Structural Styles & Tectonic Inheritance

Structural styles —

- not mutually exclusive
- may overlap in time and space.

(1) thin-skinned fold-thrust systems

(2) thick-skinned basement block uplifts

(3) pre-Andean inverted basins

(4) Andean inverted basins

(5) upper-crustal backthrust belts

(6) salt-involved structures

Tectonic inheritance —

4 factors that influence Andean deformation.

(after Kley et al 1999; McGroder et al. 2015; Macellari & Hermoza 2009; Lacombe & Bellahsen 2016)

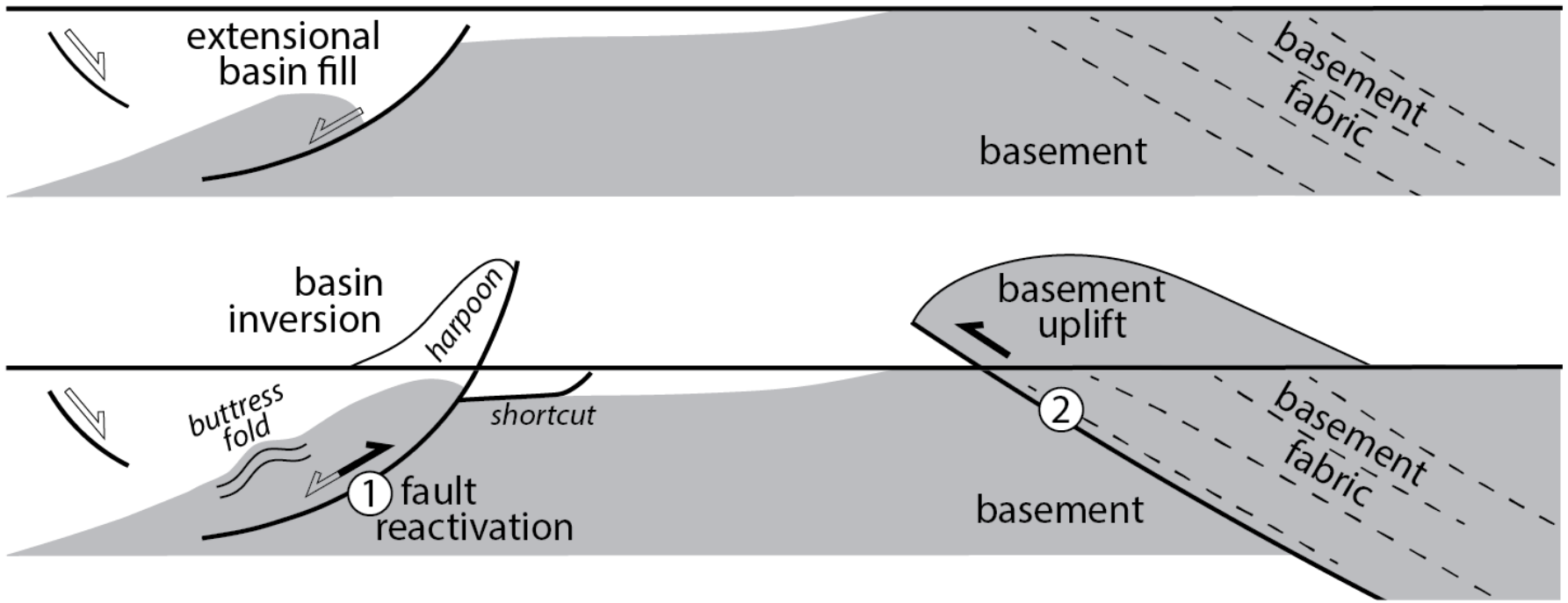
(1) ***Structural inheritance*** – reactivation of preexisting faults or basement fabrics.

(2) ***Stratigraphic inheritance*** – thin vs. thick-skinned structures reflect presence vs. absence of wedge-shaped stratigraphic prisms.

(3) ***Rheological framework*** – strength, composition, fluids guide the activation of new structures.

(4) ***Thermal structure*** – initial conditions and later thermal perturbations can promote advance or retreat of deformation.

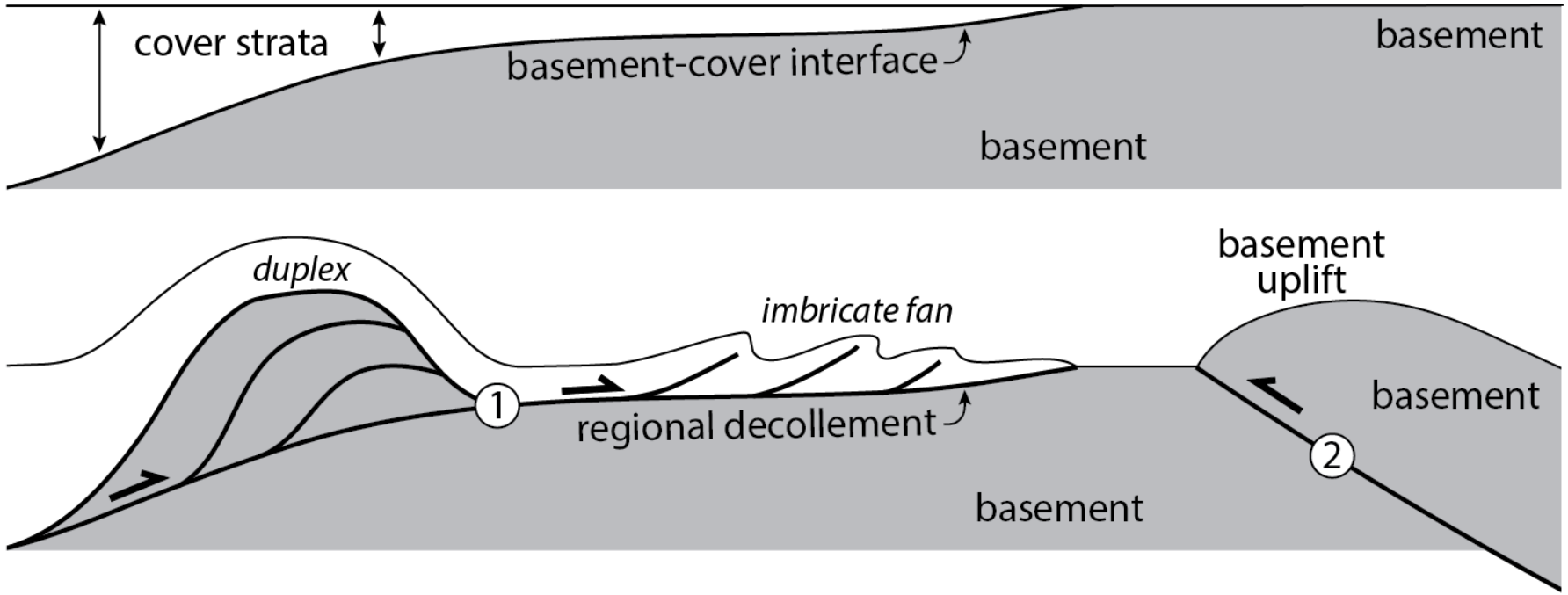
1 Structural Inheritance



(1) *Structural inheritance* — reactivation of preexisting faults or basement fabrics and accompanying inversion of sedimentary basins.

Horton & Folguera, 2022

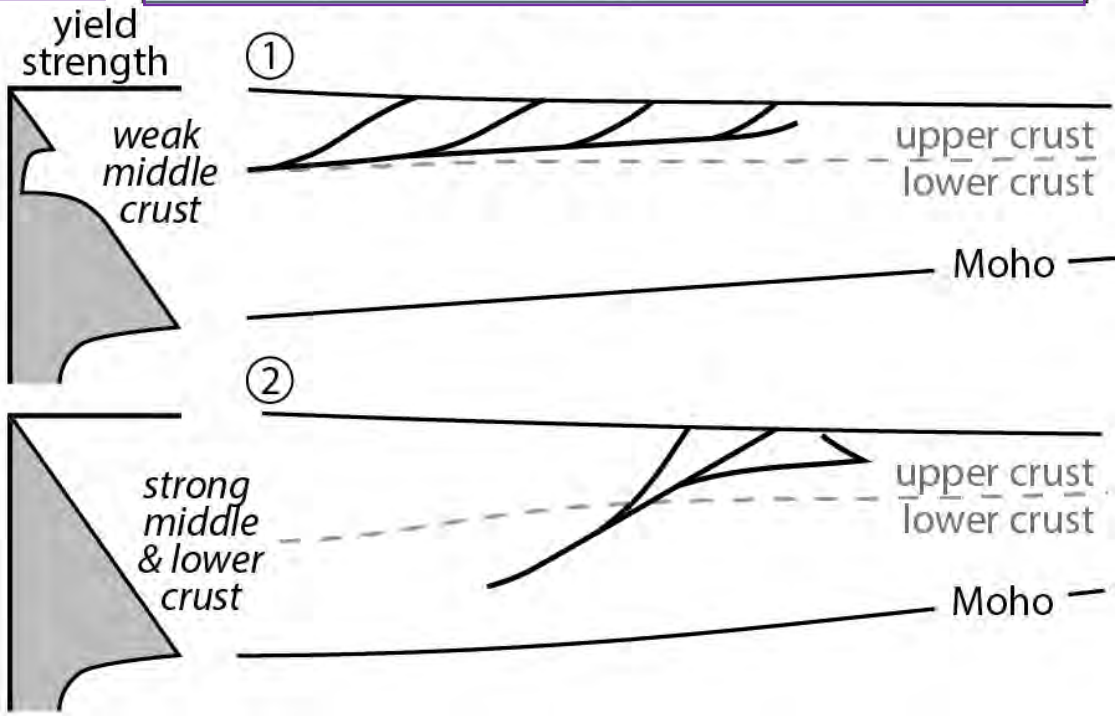
2 Stratigraphic Inheritance



(2) *Stratigraphic inheritance* — localization of interconnected thin-skinned structures above regional décollements developed in wedge-shaped stratigraphic prisms vs. isolated thick-skinned basement structures formed in zones with limited/no cover strata.

Horton & Folguera, 2022

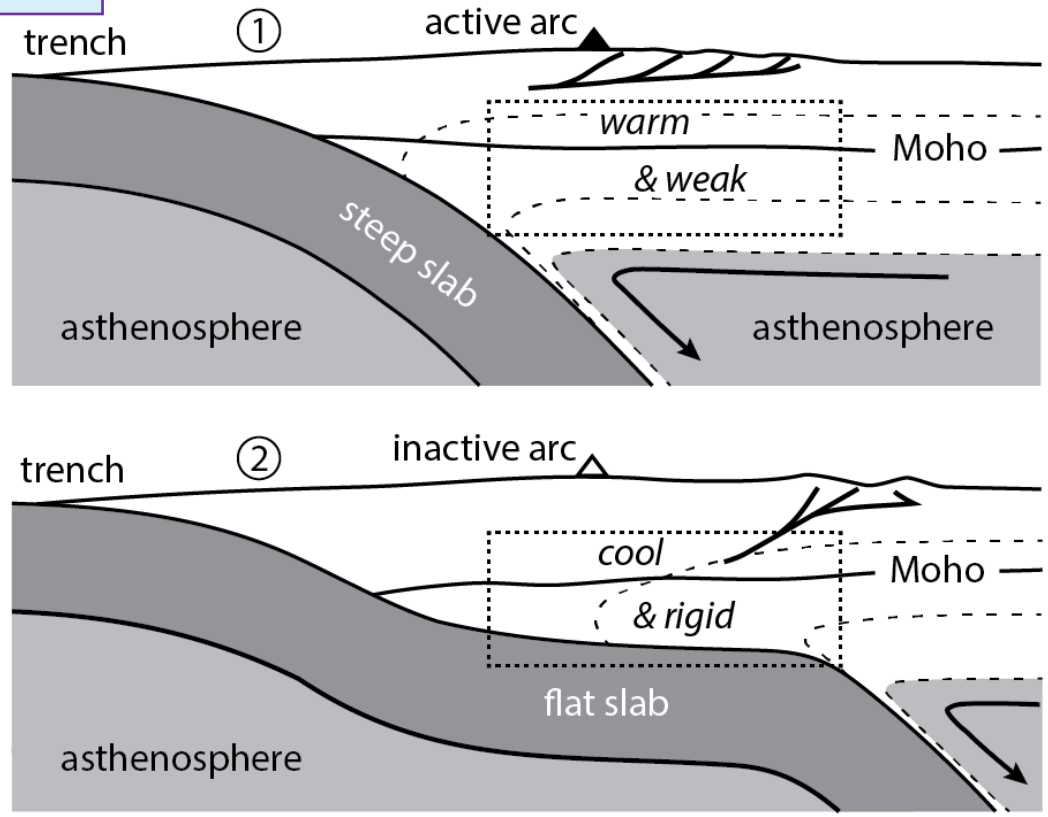
3 Strength/Rheological Inheritance



3) *Rheological framework* — the integrated strength, rock & mineral composition, and fluid content & pressure guide the activation of new structures.

Horton & Folguera, 2022

4 Thermal Inheritance



(4) *Thermal structure* — initial temperature conditions and later thermal perturbations (ex: cooling/heating episodes related to arc magmatism, subducting slab dynamics, or lithospheric removal) can promote advance or retreat of deformation.

Horton & Folguera, 2022

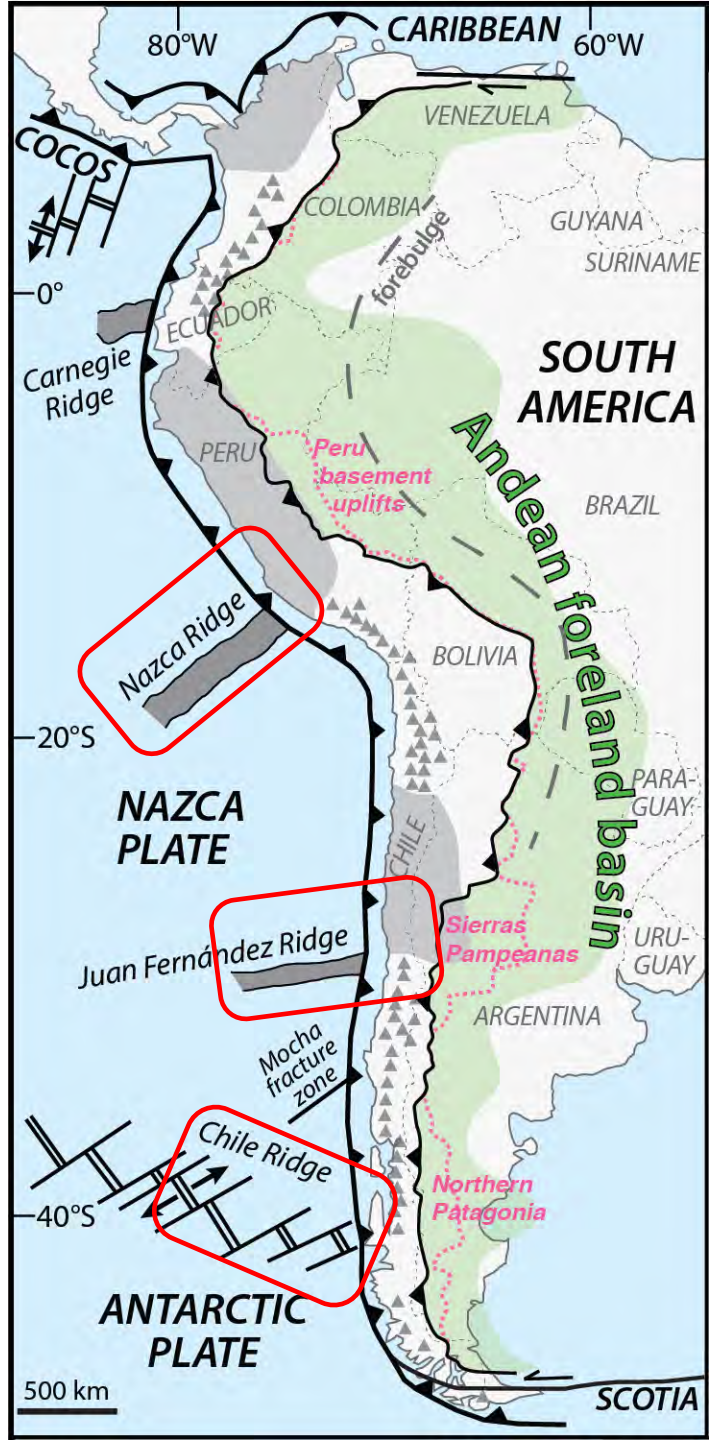
Implications

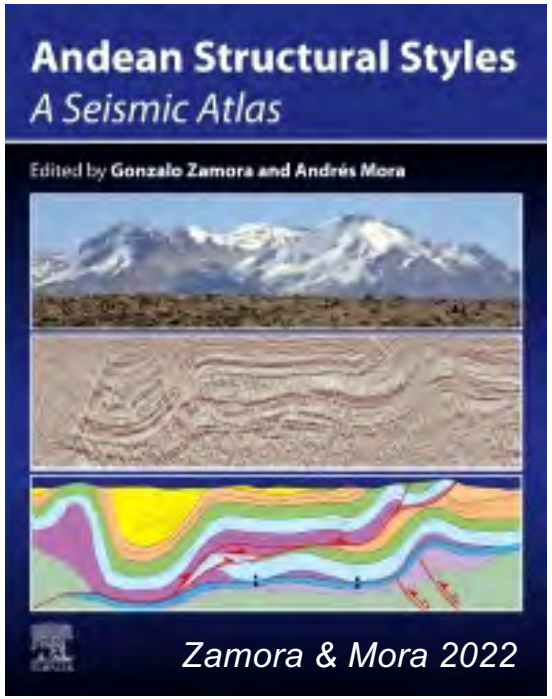
Tectonic inheritance *may help explain why many* ***Andean structural styles*** *do not bear simple relationships to the history of plate convergence, subduction, and magmatism along the western margin of South America.*

Other influences:

- *Flat slab subduction*
- *Ridge subduction*

Horton et al., 2022 (Geology)





Chapter 1: Horton & Folguera 2022

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