Decoupled cooling and exhumation signals in subduction orogens: An example from the Argentinean Pampean Ranges

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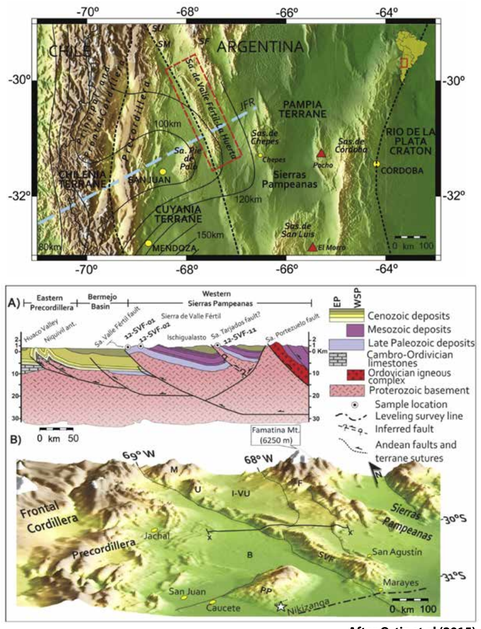
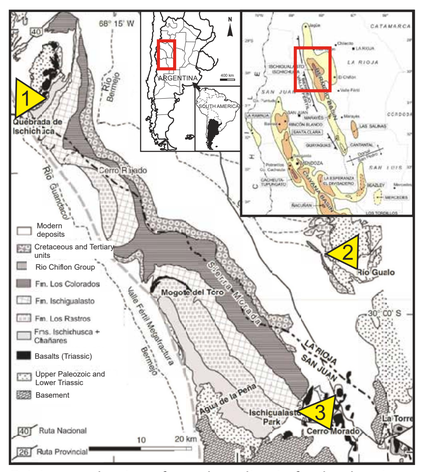
INTRODUCTION



After Ortiz et al (2015)

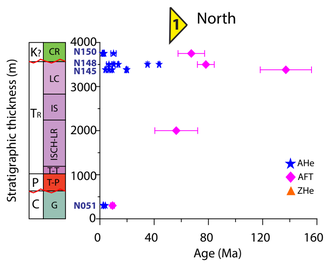


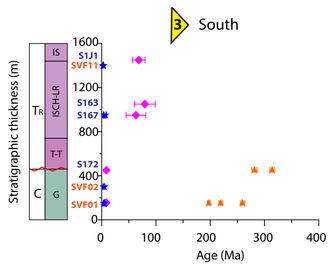
Driving mechanisms for rock cooling in foreland regions of subdction orogens:

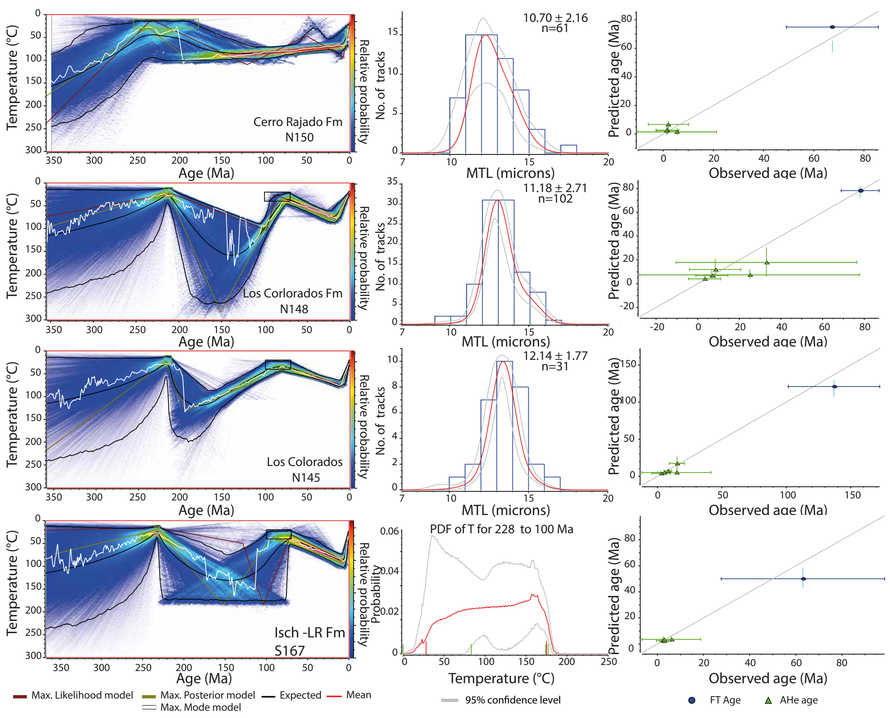
- **Erosional exhumation induced by thrusting?**
- **Temporal variations in heat flow?**

The Ischigualasto-Villa Unión Basin in the Pampean flat-slab region of the Central Andes in Argentina is a natural laboratory.

2. THERMOCHRON AGES AND THERMAL MODELS

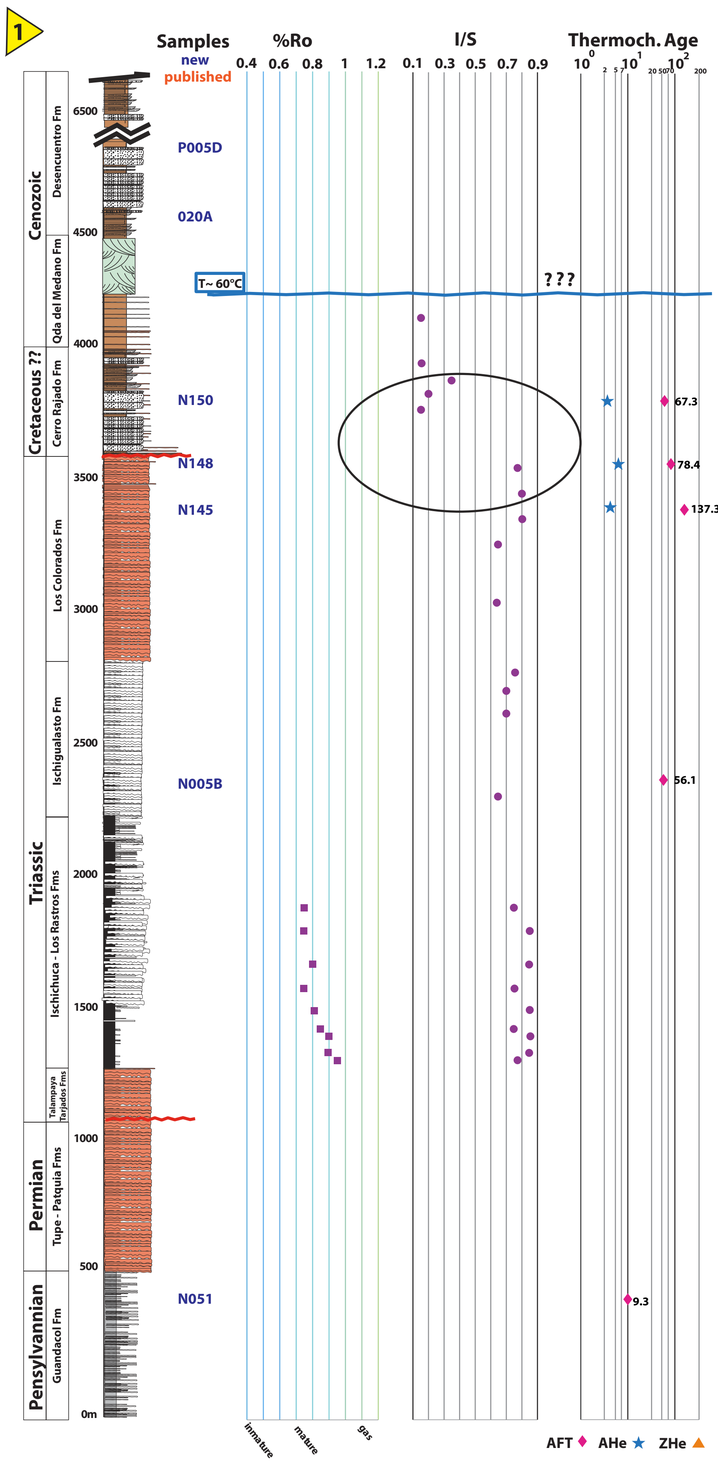


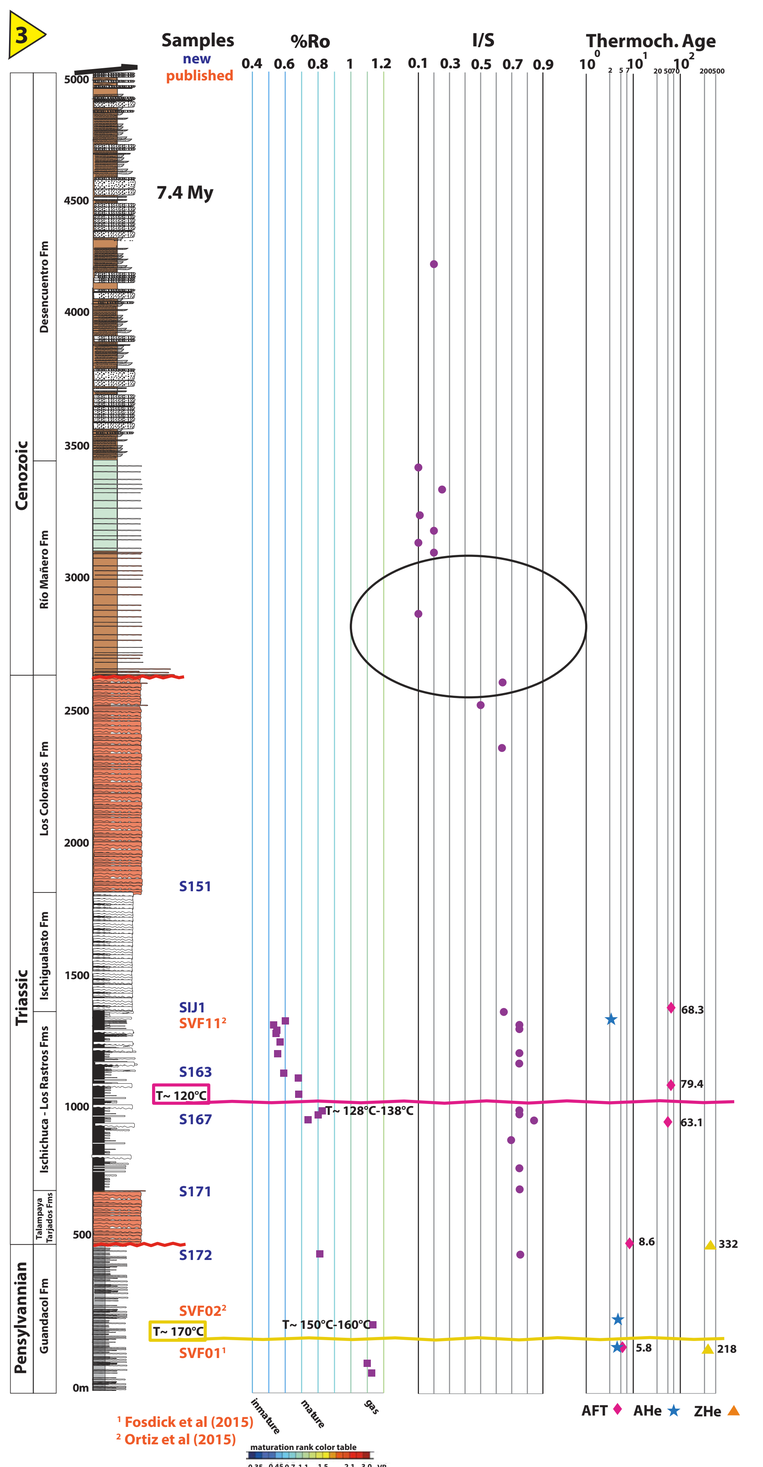




Peak temperatures reached in Mesozoic times, before Cenozoic peak burial

1. STRATIGRAPHY AND MULTI-METHOD PALEOTHERMOMETRY

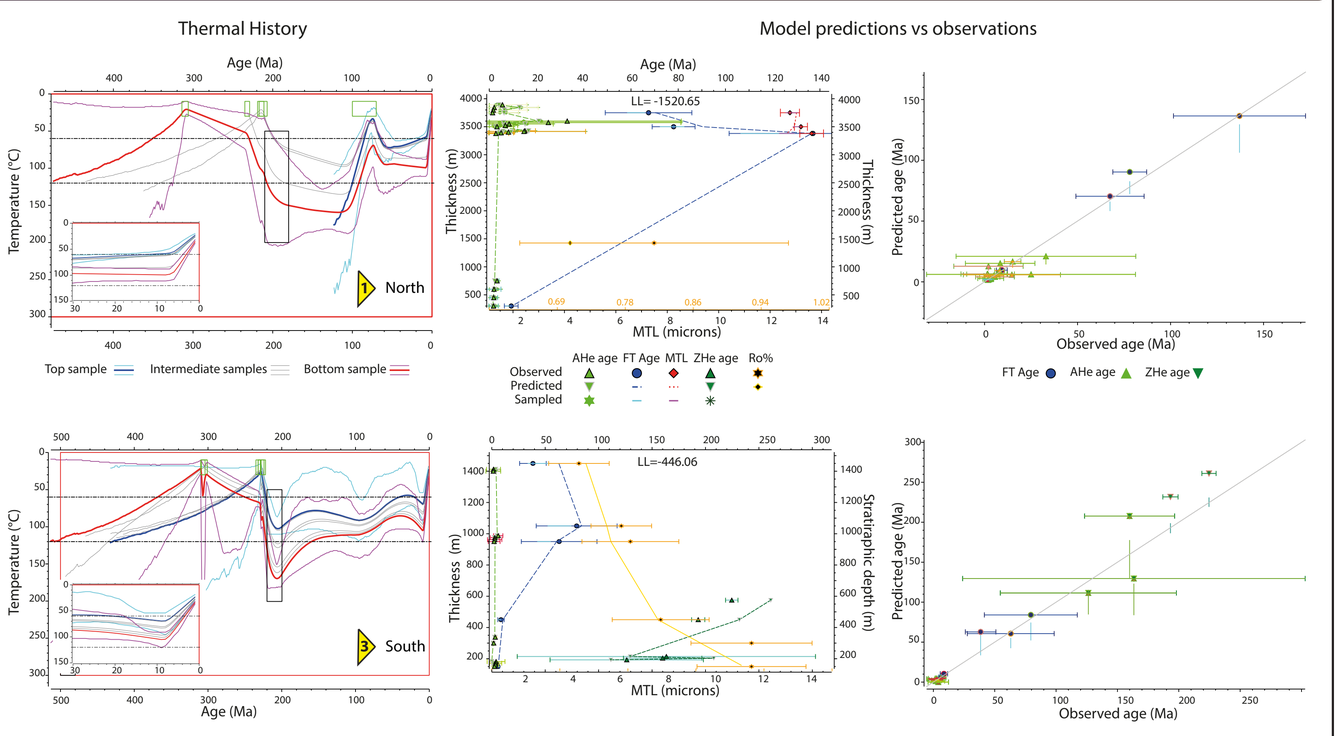




[1] Fosdick et al (2015)
[2] Ortiz et al (2015)

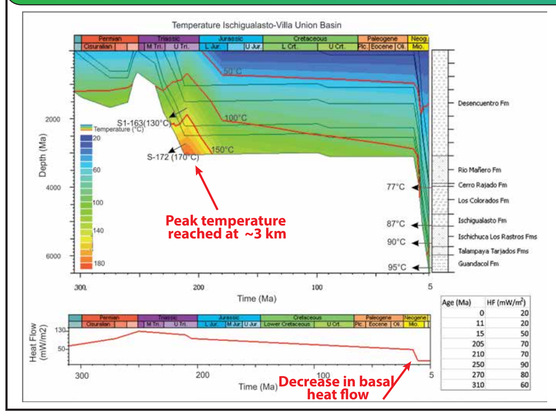
- Three stratigraphic sections covering up to 6.5 km of Carboniferous to Miocene strata.
- New vitrinite reflectance and clay crystallinity analyses, new and published AFT, AHe, and ZHe data
- Marked increase in maximum paleotemperatures across sub-Cretaceous unconformity (black circles)
- Cooling ages (see Section 2) allow defining limits of exhumed PRZs

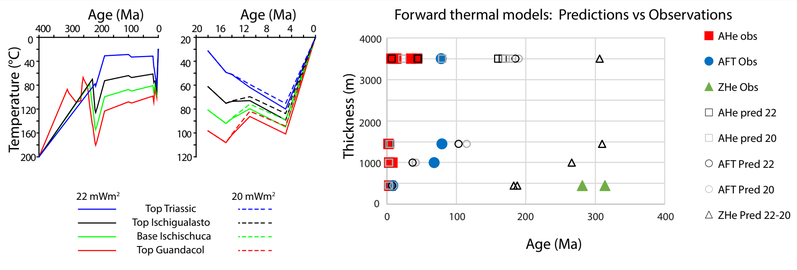
3. MULTI-SAMPLE THERMAL MODELING



- Triassic-Cretaceous unconformity provides important geological constraint to thermal modeling.
- Maximum temperatures reached during Triassic rifting (geological evidence)
- Limited Cenozoic reheating despite peak burial conditions

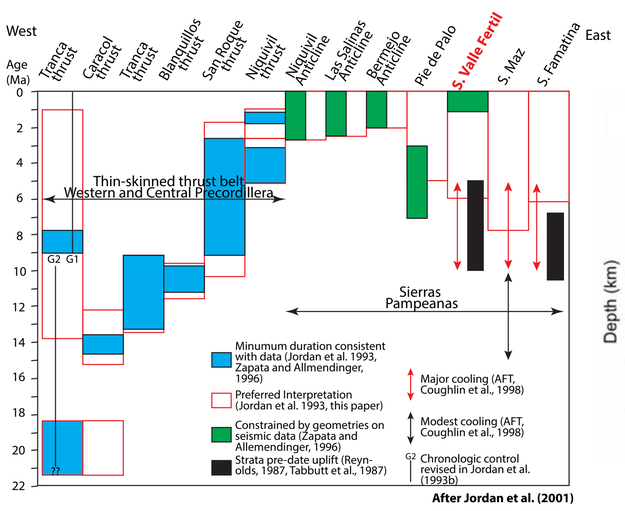
4. FORWARD THERMAL MODELING



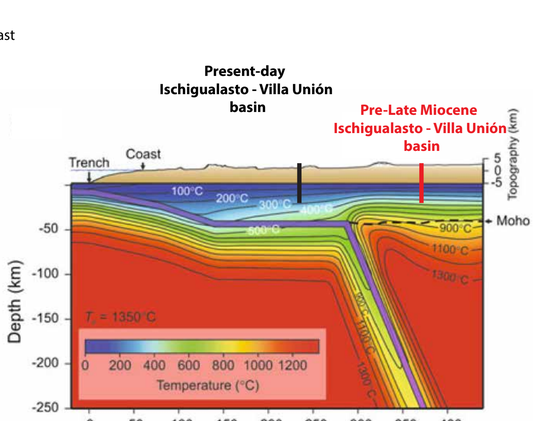


Cooling ages modeled with late Miocene heat flow of 20-22 mWm^{-2}

5.COOLING VS EXHUMATION SIGNALS



After Jordan et al. (2001)



- Maximum temperatures of ~170°C at the base of the section (Carboniferous strata) were achieved in the Triassic, with only about half of the (minimum) burial present in the Late Miocene. **High heat flow associated with rifting.**
- Cenozoic rehating to ~120°C at the base of the section despite up to 6 km of burial, and to < 100°C in Triassic strata. **Lower heat flow associated with flat-slab subduction.**

Example of cooling and exhumation signal decoupled in subduction orogens, call for a rigurous interpretation of cooling paths in Andean fold-and-thrust belts.

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REFERENCES

Fosdick et al. (2015), Faulting and erosion in the Argentine Precordillera during changes in subduction regime: Reconciling bedrock cooling and detrital records, *Earth and Planetary Science Letters* 432, 73-83.

Jordan et al. (2001), Unsteady and spatially variable evoltion of the Neogene Bermejo foreland basin, Argentina, *Journal of South American Earth Sciences* 14, 775-798.

Ortiz et al. (2015), Active deformation in the northern Sierra de Valle Fertil, Sierras Pampeanas, Argentina, *Journal of South American Earth Sciences* 64, 339 - 350.