Geologic Evolution of the Argentinian Andes

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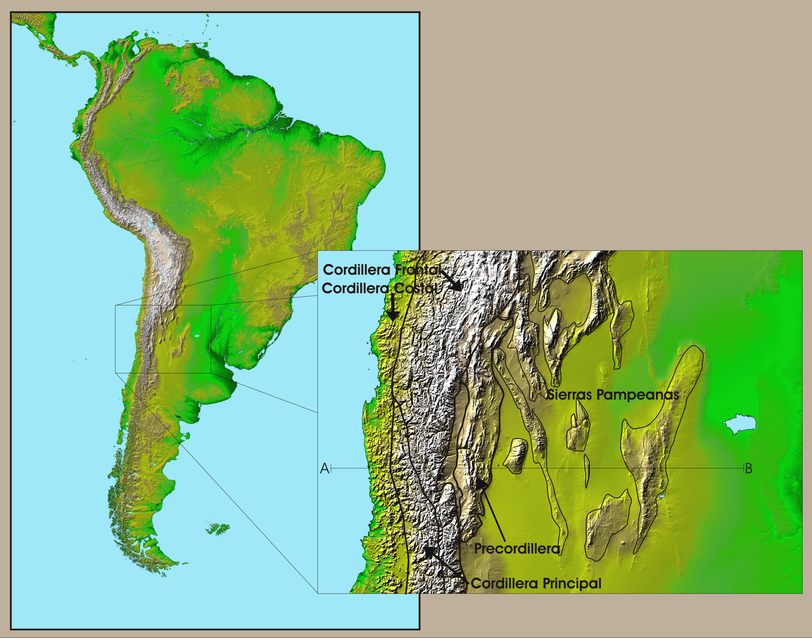
Abstract

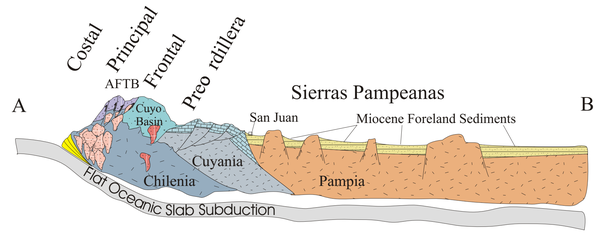
Over the past 2.1 Ga the western margin of South America has been subjected to a series of distinct orogenic events. Western Argentina is underlain by several northeast-trending terranes including, from east to west, the Sierras Pampeanas, Precordillera, Cordillera Frontal, Cordillera Principal, and the Cordillera de la Costa. The following table synthesizes the significant geologic events, style of formation, and ages of orogenesis.

Orogenesis	Significant Geologic Events	Style	Age
Pampean Orogeny	Ophiolite obduction, crustal thickening and uplift, high grade metamorphism	Terrane collision	500-520 Ma
Famatinian Orogeny	Famatinian Arc, Cuyania composite terrane, and the Chillenia terrane	Terrane collision	495-470 Ma
Gondwanian Orogeny	Final amalgamation of supercontinent Gondwana extension-related volcanism	Terrane collision Extensional collapse	354-290 Ma
Mesozoic-Cenozoic Orogenesis	Episodic continental arc volcanism	Andean style subduction	150 Ma-Present
Current Andean uplift and subduction	Fold and thrust belt, segmentation of Nazca plate	Shortening, transition to flat slab	23.8 Ma-Present



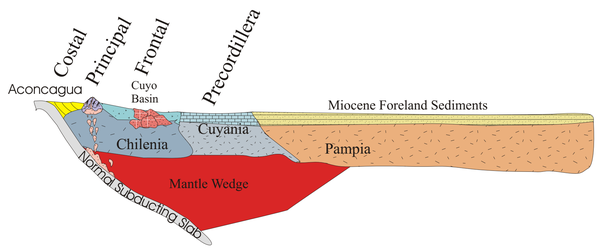
Regional Cross Sections

9 Ma- present



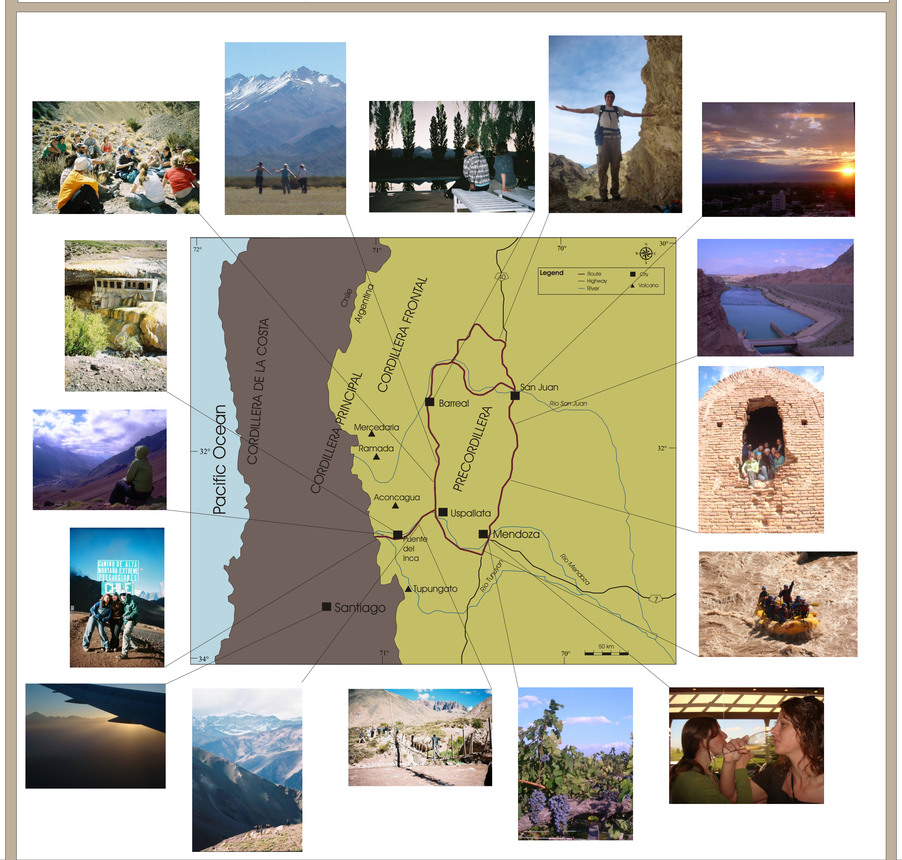
The change from a normal subducting slab (below) to a shallow subducting slab (above) terminates volcanism in the Central Volcanic Zone and is responsible for the uplift of the Precordillera, Cordillera Frontal and Cordillera Principal.

25-9 Ma

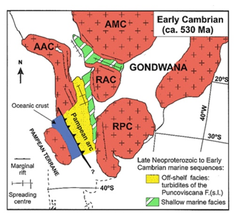


Geologic Excursions in Argentina

Geologic Field Excursion: Argentina is an upper division geology course that explores the geology of the southern Andes and the history and culture of Argentina. The southern Andes consist of five different geologic provinces produced by four tectonic events over the past billion years, including the most recent uplift of the current Andes. Over the course of the semester, we explored the geologic processes, history, economy and culture that have shaped Argentina. The class culminated in a two week excursion to Argentina examining the geologic provinces of western Argentina.



(A) Pampean Orogeny

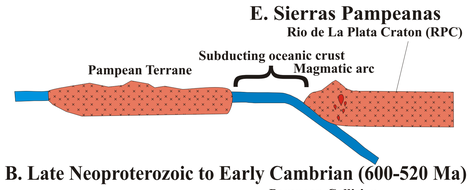


A. Pampean Orogeny

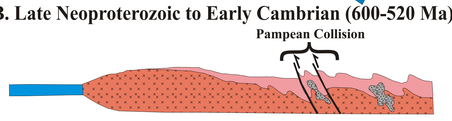
E. Sierras Pampeanas

A. Pampean Orogeny
Map view of the Pampean Orogeny .

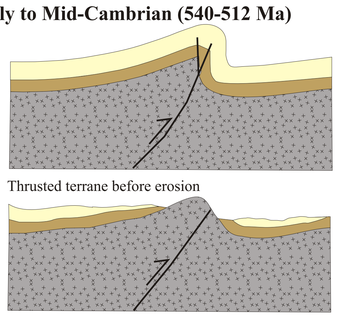
B. Late Neoproterozoic to Early Cambrian
Subduction has started along the western edge of Gondwana; ocean floor is accreted onto the continent and a continental magmatic arc develops.



B. Late Neoproterozoic to Early Cambrian (600-520 Ma)



C. Early to Mid-Cambrian (540-512 Ma)



D. Tertiary Block Uplifts (9 Ma)

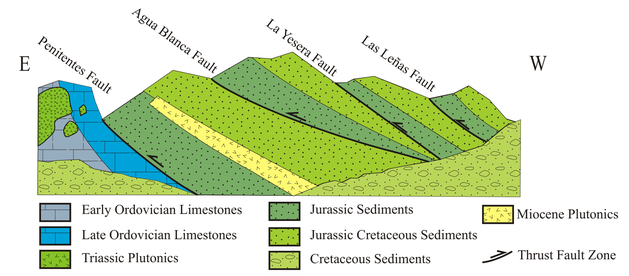
C. Early to Mid-Cambrian
Consumption of the oceanic crust leads to a continent - continent collision. The Pampean Terrane is welded to the Rio de La Plata Craton. The suture zone contains accreted ocean floor and metamorphic and igneous rocks.

D. Tertiary Block Uplifts
Initiation of flat slab tectonics in the Tertiary causes thick and thin skinned deformation; metamorphic basement rocks and overlying sediments are thrusted up as blocks. After a period of erosion the thin sediment layers are eroded exposing the metamorphic basement rocks as topographic massifs east of the Precordillera.

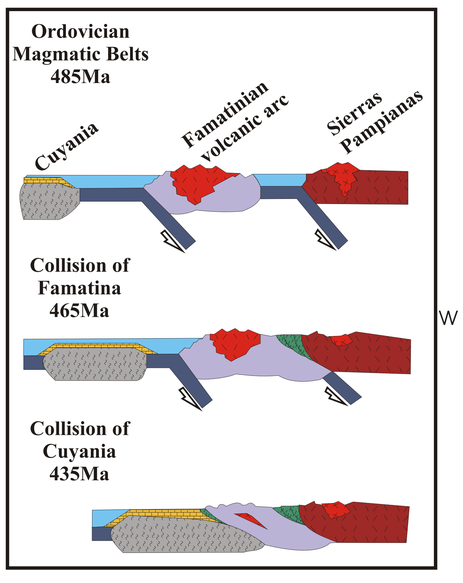
E. Sierras Pampeanas
Thrusted blocks of metamorphic basement are outlined in the background.

(D) Aconcagua Fold and Thrust Belt

The now dormant andesite volcano, Volcano Aconcagua, is active between 16 and 9 Ma. When flat slab subduction initiated at 9 Ma, magmatism ceased. At this time, thrusting begins in the west and migrates to the east causing older lithologies to be thrust on to younger. These faults are actively thrusting eastward today.

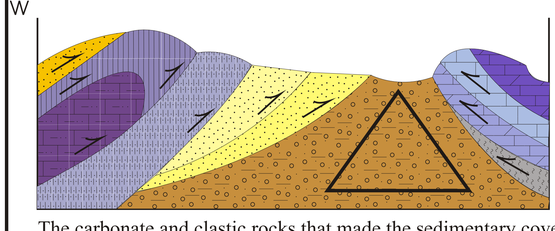


(B) Famatinian Orogeny



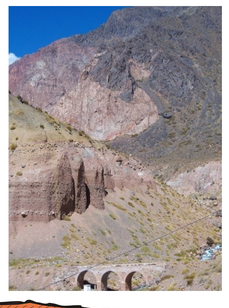
Pillow basalts from the suture zone between Chilenia and Cuyania.

The contact between Triassic sedimentary rocks and Famatinian basement rocks.



Cambrian and Ordovician platform carbonates collide with the western margin of Gondwana during the Famatinian orogeny 435 Ma. The carbonate and clastic rocks that made the sedimentary cover of Chilenia when it collided with Cuyania brings the Famatinian Orogeny to a close in the Middle Carboniferous. The Chilenia Terrain is now part of the Cordillera Principal.

(C) Permo-Triassic Rifting



Permo triassic (255-241 Ma) extensional rifting is characterized by bimodel rhyolitic and basaltic volcanism along the suture zone of Chilenia and Cuyania. As rifting proceeds, listric faults cut the Precordillera Terrane generating half grabens. Erosion fills the rift with sediments.