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Structure and Evolution of the Central Andes of Peru

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Three major units make up the Andes in Peru: (1) The Western Cordillera consists of the Cretaceous Coastal Batholith intruding Jurassic to Cretaceous volcaniclastics (Casma group) in the west, and a fold-and-thrust belt of Mesozoic sediments in the east. Eocene and Miocene volcanics (Calipuy group and equivalents) overly all of these rock types. (2) The Central Highland contains a folded Paleozoic-Mesozoic sedimentary sequence overlain by thick Quaternary deposits. A major fault puts Neoproterozoic basement rocks of the Eastern Cordillera next to these units. (3) In the Eastern Cordillera, Late Paleozoic clastic successions unconformably overly folded Early Paleozoic sediments and a Neoproterozoic basement in the east. Permian (locally Triassic) granitoids intruded these units and were affected by folding and thrusting. In the core of the Eastern Cordillera, Early Cretaceous overly Early or Late Paleozoic strata. To the west, a thrust belt of Paleozoic to Cenozoic strata forms the transition to the foreland of the Brasilian shield. The most external part of this thrust belt involves Pliocene sediments and is referred to as Subandine zone.

The Coastal Batholith is internally undeformed. The adjacent fold-and-thrust belt to the east is characterized by tight, nearly isoclinal upright folds with amplitudes of up to 1000 m. At the surface only Cretaceous rocks are observed. Using balancing techniques, a detachment horizon at the base of the Lowermost Cretaceous (Goyallarisquizga group - Oyon Formation) can be proposed. Further east, folds are more open, asymmetric and east verging, Jurassic sediments appear in the cores of the anticlines. The abrupt change in style from upright tight folding in the west to more open folding in the east is explained by a primary difference in the depositional sequence, most probably associated with synsedimentary faulting. The overlying volcanics of the Calipuy group and equivalents are, in turn, only slightly folded. In the Northern part of the Western Cordillera, near Huaraz, a vertical fault puts a Late Miocene to Early Pliocene batholith (Cordillera Blanca) in direct contact to Miocene volcanics (Calipuy group, Cordillera Negra).

The structure of the Central Highlands is characterized by relatively open folds in the Paleozoic to Mesozoic strata. Overlying Quaternary deposits are tilted and locally even folded. Eocene to Miocene undeformed granitoids intrude these structures.

A swarm of NNW-SSE striking and steeply dipping faults separate the Eastern Cordillera from the Highlands. Some of these faults suggest block faulting. However, near Huancayo a clear indication of strike-slip motion could be found. The Neoproterozoic basement rocks and the Early Paleozoic sediments are unconformably overlain by Late Paleozoic sediments which in turn are folded. Within the Subandine zone, the structural style is characterized by east directed imbricate thrusting. The thrust faults cut down into the crystalline basement going west, suggesting a detachment within upper crustal crystalline basement rocks.

In the Central Peruvian Andes, compressional deformation events progressed from west to east. Early Cretaceous plutons of the coast batholith intruded folded Jurassic to Early Cretaceous volcaniclastic rocks of the Casma group and suggest an Early Cretaceous phase of shortening in the Pacific coastal area of the Western Cordillera (referred to as Mochica phase in the literature). Within the Western Cordillera, a major phase of pre-Eocene erosion removed a substantial amount of the tight upright folds. The youngest strata folded are of Late Cretaceous to Early Paleocene age (Red Beds). The overlying volcanics are slightly younger (middle Eocene) and bracket the tight folding, referred to as Inca phase, to Late Paleocene to Early Eocene times. This is corroborated

by Eocene to Miocene granitic intrusions in the adjacent fold-and-thrust belt. Still younger deformations, referred to as Quechua Phase, produced gentle folds within the Eocene volcanics. Vertical motions in the Cordillera Blanca juxtaposed a Late Miocene-Pliocene batholith to Late Miocene volcanics. These movements are post-Pleistonce in age and still active. In the Central High Zone, even Pleistocene deposits were tilted and locally folded.

Timing of the steeply dipping faults bordering the Eastern Cordillera is more difficult to assess. Cretaceous strata in tectonic contact with Neoproterozoic basement indicate a Cenozoic age. But within the fold-and-thrust belt of the Subandine zone in the east, youngest strata affected by thrusting are progressively younger toward the east. They suggest thrust propagation ranging from Oligocene to Pliocene age. These young thrust faults were responsible for the uplift of the Central Highland to their present elevation.