LATERAL VARIATIONS IN LATE CENOZOIC DEFORMATION, CENTRAL ANDES, 20 – 28°S

R. W. ALLMENDINGER, T. GUBBELS, B. ISACKS, T. CLADOUHOS

Dept. of Geological Sciences & Institute for the Study of the Continents
Snee Hall, Cornell University, Ithaca, NY 14853-1504 USA

RESUMEN:

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INTRODUCTION

Major changes in the timing and geometry of late Cenozoic Andean structure occur between 23 and 24°S and include: (1) The southward terminus of the Subandean thin-skinned thrust belt occurs at between 23 and 24°S and farther south the foreland is dominated by the thick-skinned, basement-cored blocks of the Sierras Pampeanas. (2) The temporal transition from major thrust faulting to minor normal and strike-slip faulting across the entire plateau region occurs much later in the south (at ~1-4 Ma) than it does in the north (at ~10 Ma). In general, neotectonic activity is much greater in the Puna than it is in the Altiplano. (3) The average topography of the Puna is about 1 km higher, and its internal relief is greater, than that of the Altiplano. (4) Cenozoic sedimentary basins of the Eastern Cordillera-northern Puna are 2-4 km thinner than those of the southern Puna. Major geophysical and petrologic changes between 23 and 24°S — including the southward termination of a high-low paired isostatic residual gravity anomaly, lateral variations in seismic waves attenuation, and primitive mafic magmatism — are described in the accompanying paper by Whitman et al. (this volume). We suggest that these spatial and temporal variations in late Cenozoic structure and volcanism in the Central Andes are probably linked to major, N-S changes in lithospheric structure and thickness. Some of these changes have been associated with changes in angle of subduction (e.g. Jordan et al., 1983) and several are spatially correlated with major paleotectonic features.

FORELAND: SUBANDEAN BELT TO SIERRAS PAMPEANAS

Throughout Bolivia, the thin-skinned Subandean foreland thrust belt bounds the eastern margin of the Andes. The thrust wedge taper varies from about 7° north of Santa Cruz to 2-3° in southern Bolivia. The basal decollement is at ~12 km beneath the Principal Frontal thrust which marks the boundary between the Subandean belt and Eastern Cordillera. Between 23° and 24°, the structure of the foreland changes dramatically. At 24°, Cahill et al. (1992) showed that seismicity in the foreland extends to depths greater than 30 km. This area, known as the Santa Barbara ranges, constitutes the northernmost extent of the Sierras Pampeanas province of thick-skinned basement deformation. Seismicity data throughout the Sierras Pampeanas shows that virtually the entire crust is involved in young deformation (Chinn & Isacks, 1983; Smalley et al., 1993).

Shortening in the Subandean belt is probably less than 10 Ma in age (Gubbels et al., in press). Several

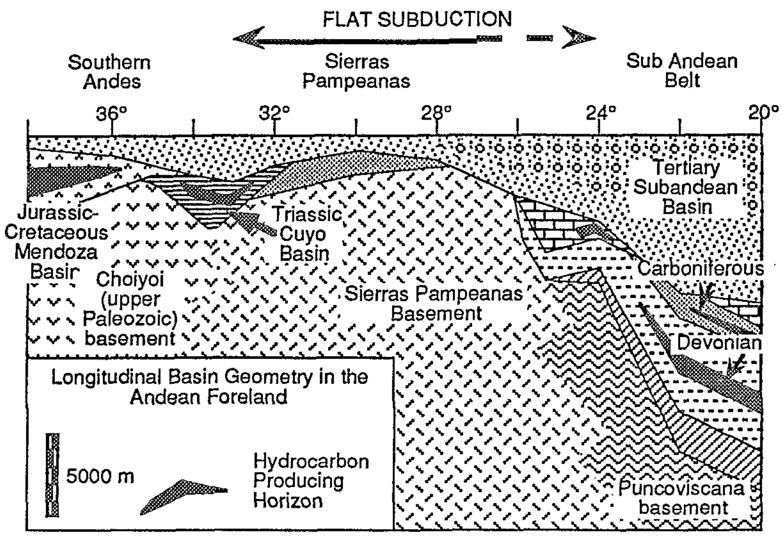

Fig. 3. Longitudinal stratigraphic section which shows the orogen-parallel variation in basin geometry in the Andean foreland. Note that most of the variation is in the pre-Tertiary subcrop and thus pre-dates the Cenozoic Andes.

sequence (Fig. 2) but the transition from older thrust faulting to younger strike-slip and normal faulting occurred as recently as 1 Ma in the Quebrada del Toro and < 4 Ma in the Puna. Younger deformation is probably no older than about 1 Ma and continues today. Tertiary strata in the northern Puna and Eastern Cordillera are generally less than 1 km in thickness. Tertiary strata in the Puna from ~23° southward are much thicker than farther north. Several Neogene basins have more than 2000 m of strata, including the Hombre Muerto region with 5000 m of Miocene rocks (Alonso et al., 1991).

Paleotectonics

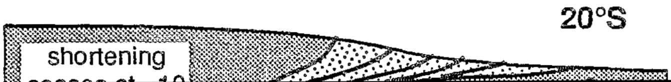

Fig. 4. Schematic, lithospheric-scale cross-sections across the

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