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Seismic and field evidence for selective inversion of Cretaceous normal faults, Salta rift, northwest Argentina

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Abstract

Northwestern Argentina was the site of the continental Salta rift in Cretaceous to Paleogene time. The Salta rift had a complex geometry with several subbasins of different trends and subsidence patterns surrounding a central high. Fault trends in the rift were extremely variable. There is evidence of normal and/or transfer faults trending N, NE, E and SE. It is not clear if all these faults were active at the same time, indicating a poorly defined extension direction, or if they formed in different, non-coaxial extension phases. In either case, their trends were very likely influenced by preexisting fault systems. Beginning in early Eocene time, the rift basins were superseded by Andean foreland basins and later became caught in the Andean thrust deformation propagating eastward, resulting in the inversion of rift faults. Due to their different orientations, not all faults were equally prone to reactivation as thrusts. N to NNE trending faults were apparently most strongly inverted, probably often to a degree where the traces of their normal fault origin have become obliterated. We present seismic evidence of moderately inverted N trending faults in the Tres Cruces basin and field examples of preserved E trending normal faults. However, reactivation sometimes also affects faults trending approximately parallel to the main Neogene shortening direction, indicating short-term deviations from the general pattern of Neogene thrust deformation. These pulses of orogen-parallel contraction may be linked to the intermittent activity of oblique transfer zones.

Keywords: Central Andes; Eastern Cordillera; Tres Cruces basin; Seismic lines; Inversion structures; Transfer zones

1. Introduction

Beginning in late Jurassic or early Cretaceous time, the continental Salta rift developed in northern Argentina (Galliski and Viramonte, 1988; Salfity, 1982; Salfity and Marquillas, 1994). This rift was

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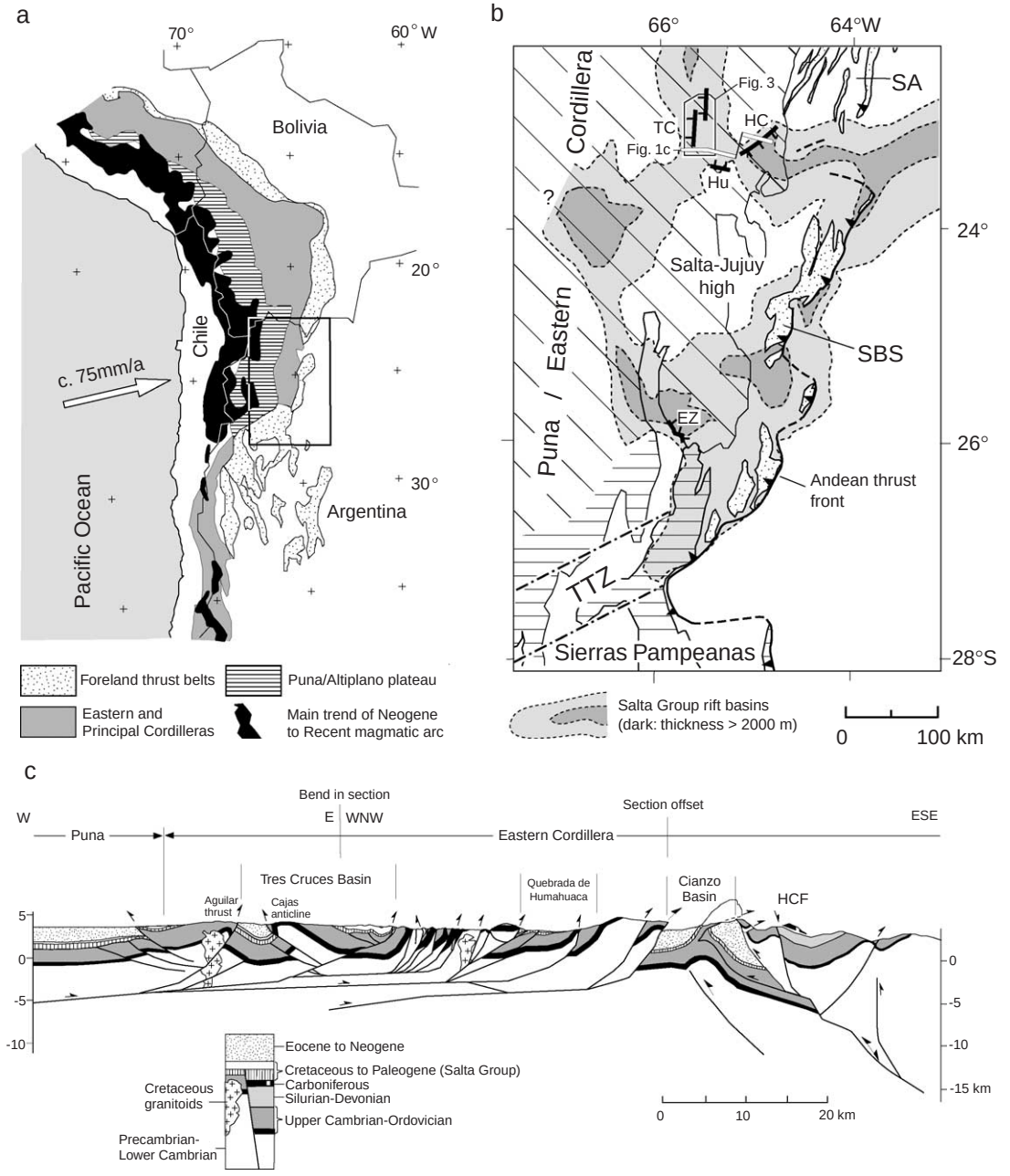

Fig. 1. (a) Main structural units of the Central Andes and location of the study area. Arrow indicates present-day Nazca/South America convergence direction and rate (after DeMets et al., 1994; Norabuena et al., 1998). (b) Outline and depocenters of the Cretaceous to Paleogene Salta rift system in northwestern Argentina (after Salfity and Marquillas, 1994) and its relation with the present-day Andean thrust front. Subandean (SA) and Santa Bárbara System (SBS) foreland thrust belts are stippled. Normal faults discussed in the text are indicated with general trend and sense of displacement. Abbreviations are HC, Hornocal fault; TC, Tres Cruces Area; Hu, Quebrada de Humahuaca near Huacalera; EZ, El Zorrito fault. TTZ is Tucumán transfer zone after De Urreiztieta et al. (1996). (c) Cross-section of the Eastern Cordillera and easternmost Puna in northwestern Argentina, mostly after own field data. Structure in Puna part is adopted from an interpreted seismic line in Gangui (1998), easternmost part is modified from Kocks (1999). HCF is Hornocal fault. Location in (b).