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Research Paper

Preandean geological configuration of the eastern North Patagonian Massif, Argentina

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ABSTRACT

The Preandean geological configuration of the eastern North Patagonian Massif is established through the use of geological and geophysical analysis. The positive gravity anomalies located near the Atlantic coast are due to 535 and 540 Ma old rocks belonging to the Pampean Orogeny (Precambrian–middle Cambrian), which are widely recognized in central and northern Argentina. The Famatinian Cycle (Ordovician–Devonian) is represented by a Silurian–Devonian marine basin equivalent to those of eastern-central Argentina and South Africa, and which was deformed at the end of the Devonian by an ~E–W to WNW–ESE compressional event, part of the Famatinian Orogeny. Containing strong gravity gradients, the NW–SE belt is coincident with fault zones which were originated during the Gondwanide Orogeny. This event also produced NW–SE overthrusting of the Silurian–Devonian sequences and strike-slip faults that displaced blocks in the same direction. This deformation event belongs to the Gondwanide Orogeny that includes movements related to a counterclockwise rotation of blocks in northern Patagonia. The strong negative anomalies located in the western part of the area stem from the presence of rocks of the Jurassic Cañadón Asfalto basin interbedded in the Marifil Complex. These volcaniclastic sequences show mild deformation of accommodation zones in a pre-Jurassic paleorelief.

1. Introduction

The southern regions of the Buenos Aires, La Pampa and Mendoza provinces, part of the so-called central Argentina, show minor physiographic, geological and structural differences with respect to the Patagonian Rio Negro and Neuquén provinces. In between lies, according to Llambías (2008), a 'hinge zone' that shows mixed geological features of both regions. In this particular area, N–S Paleozoic geological structures, typical of central parts of Argentina, turn to an NW–SE direction and seem to be truncated at the latitude of the Rio Colorado–Río Negro against a nearly E–W-oriented structure (Fig. 1).

Due to poor outcrops of Paleozoic rocks, and abundant Mesozoic and Cenozoic cover, absence of detailed geological mapping and the truncation of the structures, several authors have visualized Patagonia as a terrane exotic to South America.

Earlier, Keidel (1925), Windhausen (1931) and later Dalmayrac et al. (1980) outlined the differing geological characteristics of Patagonia with respect to the rest of Argentina. Ramos (1984, 1986) explained these differences by proposing that Patagonia represents an allochthonous terrane, separated from Gondwana–South America by an oceanic basin before the Carboniferous. Later, Patagonia approached Gondwana–South America, initiating N–S directed subduction with a final stage of collision between both continental blocks occurring during the Permian. Paleomagnetic studies carried out by Rapalini (1998, 2005), on the Silurian–Devonian rocks of the

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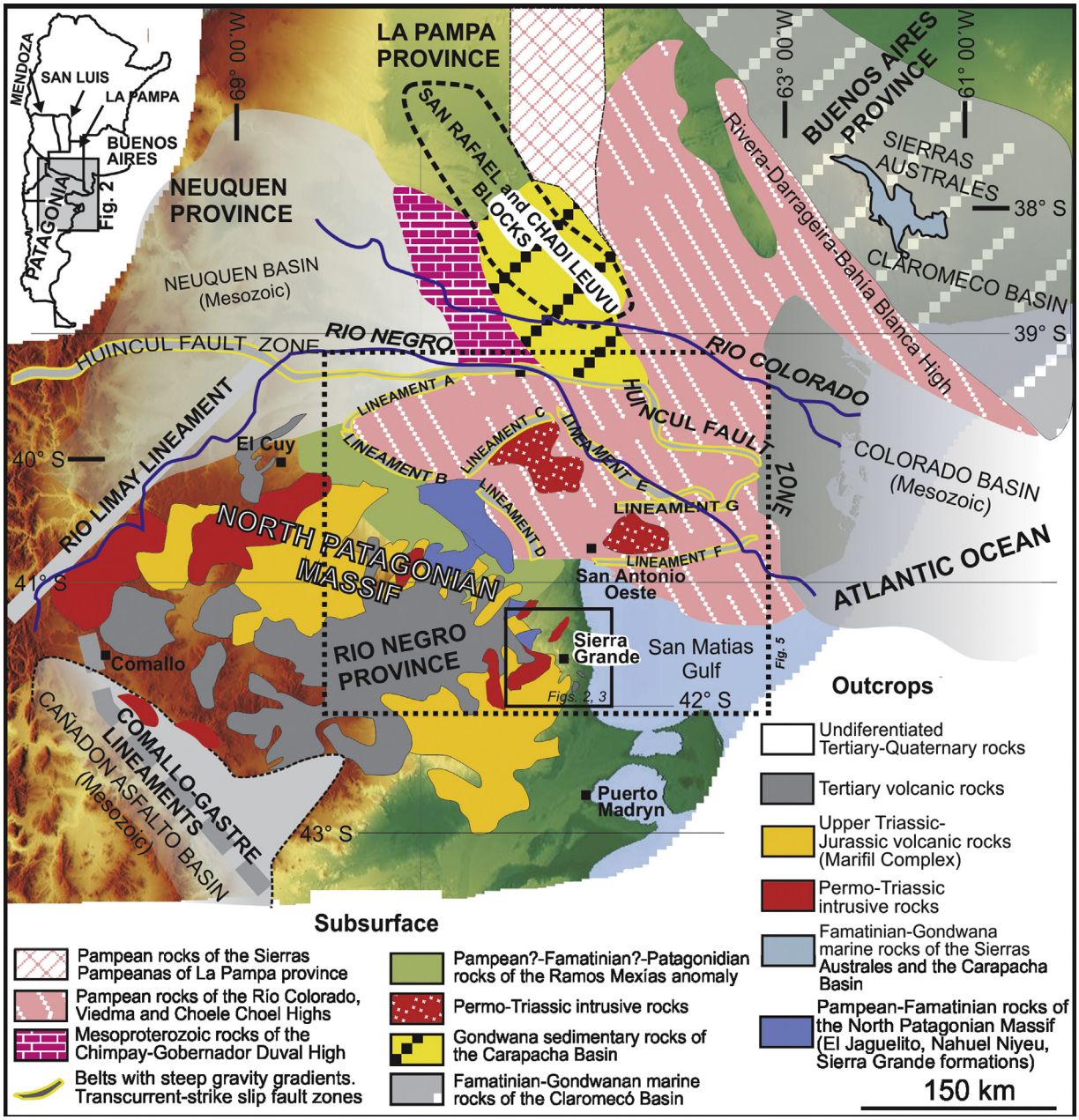

Figure 1. Map showing the southern parts of the Buenos Aires, La Pampa and Mendoza provinces, located in central Argentina. The region with N–S-oriented geological structures is mostly located in the north and central parts of La Pampa province. These structures turn NW–SE when approaching the Río Colorado, where they are truncated by a nearly E–W-oriented structure at the latitude of the Río Colorado–Río Negro. The change to an NW–SE orientation can be observed also in the middle part of the Buenos Aires province and in the southern part of La Pampa province. The Pampean basement appears both in northern Patagonia and in central Argentina.

North Patagonian Massif indicate that Patagonia has not undergone major latitudinal displacement relative to South America since the Devonian. Ramos (2008), López de Luchi et al. (2008) and Rapalini et al. (2010) have all proposed models that combine the autochthony of Patagonia, the limited separation of Patagonia with respect to Gondwana by a Silurian–Devonian marine basin, and finally a Carboniferous–Permian approach and deformation that originated the closure of this basin.

However, several doubts remain that preclude considering this hypothesis as accepted. As yet no evidence has been found of rocks exhibiting oceanic crustal affinities, or of Carboniferous basins located either in the suture zone or in the northern part of Patagonia. The pattern of gravity and magnetic anomalies (Kostadinoff and Labudía, 1991; Kostadinoff et al., 2005; Gregori et al., 2008) north, south and directly over the proposed boundary are incompatible with the existence of a belt of high-density-oceanic crustal rocks below the Quaternary cover. There is however proof of the continuity of the Pampean (Neoproterozoic–middle Cambrian) and Famatinian (Upper Cambrian–Devonian) orogens southward of the supposed boundary (González et al., 2002; Rapela and Pankhurst, 2002; Kostadinoff et al., 2005; Gregori et al., 2008; Martínez Dopico et al., 2011).

Geological and geophysical studies of northern Patagonia by Gregori et al. (2008) have shown the existence of several areas characterized by positive and negative gravity anomalies. The former occur north and south of the supposed boundary and are interpreted as continental crust of Pampean affinity (late Neoproterozoic–middle Cambrian: see Fig. 1). The negative ones