

GR Letter

# U–Pb SHRIMP zircon dating of Grenvillian metamorphism in Western Sierras Pampeanas (Argentina): Correlation with the Arequipa–Antofalla craton and constraints on the extent of the Precordillera Terrane

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## Abstract

Metamorphism of Grenvillian age (ca. 1.2 Ga; U–Pb zircon dating) is recognized for the first time in the Western Sierras Pampeanas (Sierra de Maz). Conditions reached granulite facies (ca. 780 °C and ca. 780 MPa). Comparing geochronological and petrological characteristics with other outcrops of Mesoproterozoic basement, particularly in the northern and central Arequipa–Antofalla craton, we suggest that these regions were part of a single continental crustal block from Mesoproterozoic times, and thus autochthonous or parautochthonous to Gondwana.

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**Keywords:** Sierras Pampeanas; Argentina; Metamorphism; U–Pb SHRIMP zircon dating; Grenville

## 1. Introduction

The Sierras Pampeanas of Argentina, the largest outcrop of pre-Andean crystalline basement in southern South America, resulted from plate interactions along the proto-Andean margin of Gondwana, from as early as Mesoproterozoic to Late Paleozoic times (e.g., Ramos, 2004, and references therein). Two discrete Paleozoic orogenic belts have been recognized: the Early Cambrian Pampean belt in the eastern sierras, and the Ordovician Famatinian belt, which partially overprints it to the west (e.g., Rapela et al., 1998). In the Western Sierras Pampeanas, Mesoproterozoic igneous rocks (ca. 1.0–1.2 Ga) have been recognized in the Sierra de Pie de Palo (Fig. 1) (McDonough et al., 1993; Pankhurst and Rapela, 1998;

Vujovich et al., 2004) that are time-coincident with the Grenvillian orogeny of eastern and northeastern North America (e.g., Rivers, 1997; Corrieau and van Breemen, 2000). These Grenvillian-age rocks have been considered to be the easternmost exposure of basement to the Precordillera Terrane, a supposed Laurentian continental block accreted to Gondwana during the Famatinian orogeny (Thomas and Astini, 2003, and references therein). However, the boundaries of this Grenvillian belt are still poorly defined, and its alleged allochthoneity has been challenged (Galindo et al., 2004). Moreover, most of the Grenvillian ages so far determined relate to igneous protoliths, and there is no conclusive evidence for a Grenvillian orogenic belt, other than inferred from petrographic evidence alone (Casquet et al., 2001). We provide here the first evidence, based on U–Pb SHRIMP zircon dating at Sierra de Maz, for a Grenville-age granulite facies metamorphism, leading to the conclusion that a continuous mobile belt existed throughout the proto-Andean margin of Gondwana in Grenvillian times.

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## 2. Geological setting

The Sierra de Maz, along with the nearby sierras of Espinal, Ramaditas and Aspercitos (Fig. 1), defines a NNW–SSE trending belt of metamorphic rocks ranging from high-grade in the east to low-grade in the west. Three parallel domains can be discriminated in the field, separated by first-order shear zones (Fig. 1). The eastern domain consists of garnet–sillimanite migmatitic paragneisses, few marble outcrops and amphibolites. The central domain consists for the most part of medium-grade (kyanite–sillimanite–garnet–staurolite) schists, quartzites, amphibolites and random marble outcrops. However, in the

easternmost part of this domain in the Sierra de Maz there is a distinct sequence of hornblende–biotite — garnet gneisses, and biotite–garnet gneisses with some interleaved quartzites and scattered marble lenses. Relics of mafic granulites and meta-peridotites are locally found within this sequence. Massif-type anorthosites are also found within this central domain, both in Maz and Espinal (Fig. 1) (Casquet et al., 2005) and are apparently hosted by the latter sequence of rocks. Other rock types of the central domain are orthogneisses and a still poorly known metaplutonic complex of meta-diorites to ortho-amphibolites apparently older than the anorthosites. The third domain, in the west, is formed by two low-grade metasedimentary

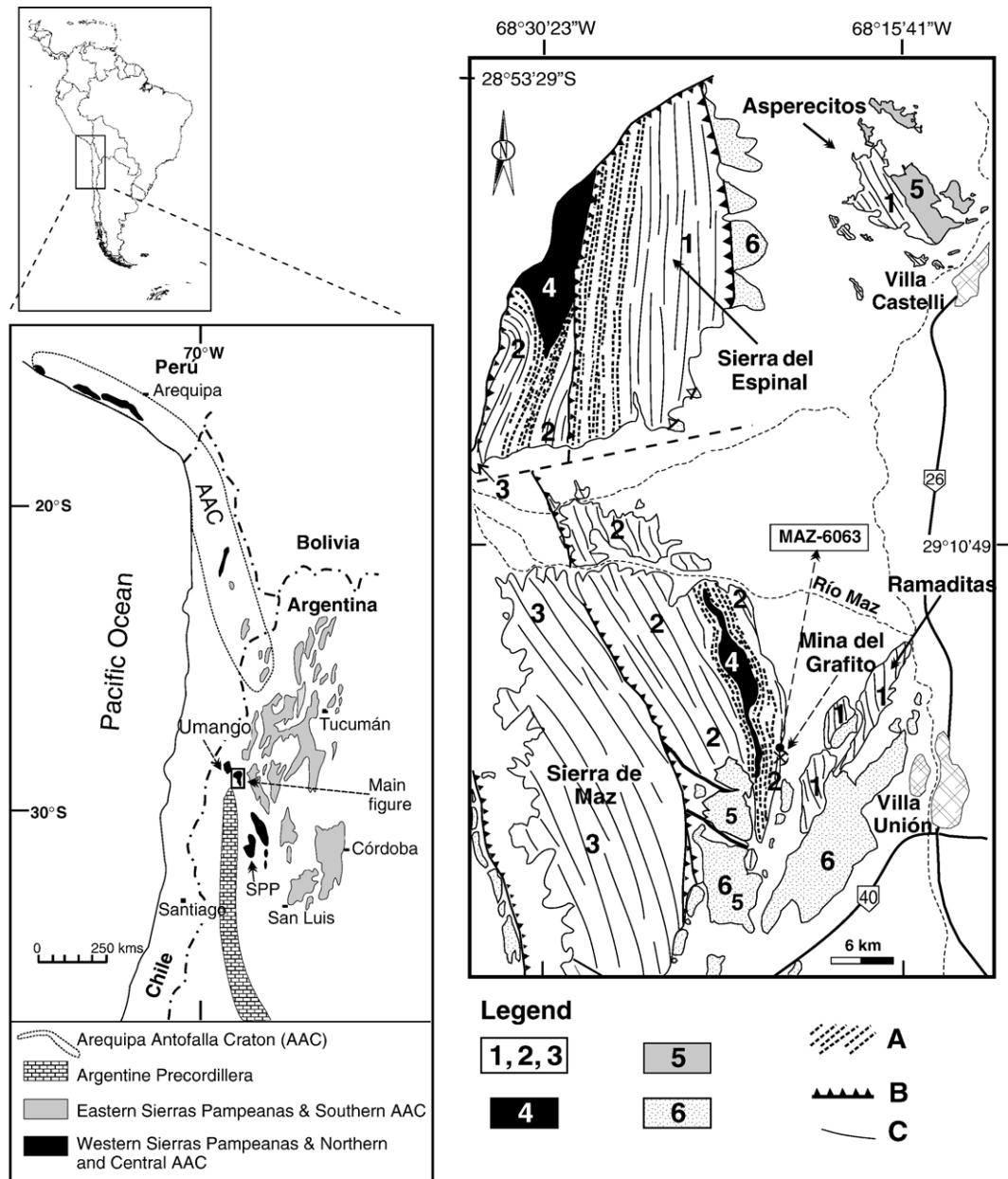


Fig. 1. Location of the Sierras Pampeanas and of the Arequipa-Antofalla craton (AAC) (based on Ramos and Vujovich, 1993). WSP, Western Sierras Pampeanas; ESP, Eastern Sierras Pampeanas; PC, Argentine Precordillera; SPP, Sierra de Pie de Palo. Main figure shows a geological sketch map of the Sierra de Maz and surrounding areas referred to in the text. Crystalline basement: 1, Eastern domain; 2, Central domain; 3, Western domain; 4, anorthosite massifs; 5, Famatinian plutons; 6, Upper Paleozoic sedimentary cover; Areas without ornaments: Mesozoic and Quaternary sedimentary cover; A, ductile shear zones; B, thrusts; C, main foliation trend lines. Mina del Grafito is the sampling location.

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