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The E-MORB like geochemical features of the Early Paleozoic mafic-ultramafic belt of the Cuyania terrane, western Argentina

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ABSTRACT

The Argentine Precordillera is located in the central western region of Argentina, within the Central Andes. Throughout its westernmost sector, mafic and ultramafic bodies including serpentinites, mafic granulites, basaltic dikes/sills and pillow lavas are associated with metasedimentary rocks deposited in a deep marine and slope environment. These magmatic units, which are known as the Precordillera ultramafic-mafic belt, are considered to have a range of Early Paleozoic age based on published U–Pb zircon ages and fossil fauna. The entire sequence shows the effects of complex polyphase Paleozoic deformation and was subjected to a low grade metamorphism considered to be of middle-late Devonian age. The chemistry of the Peñasco and Cortaderas mafic dikes and sills in the southern part of this belt, which are largely plagioclase + clinopyroxene-bearing tholeiitic basalts, is the focus of this study. These volcanic rocks all have E-MORB-like major and trace element and εNd (+6.0 to +9.3) signatures with similarities to those previously reported throughout the belt. The new descriptions and major and trace-element analyses presented here confirm the similarity of the E-MORB-like chemistry of the Early Paleozoic mafic rocks along the entire belt, which spans some 500 km in length. There is a general consensus that these units are exposed as a consequence of the collision of the Chilenia terrane against the Gondwana margin during the middle to late Devonian, but the details of timing, the origins of the continental blocks and the nature of the collision are still debated. The results presented support the western Precordillera basaltic dikes/sills as having formed in the early stages of oceanic rifting along the Gondwana (Precordillera) continental margin with their E-MORB-like character reflecting mixing of depleted and enriched mantle and continental lithospheric sources.

1. Introduction

The basement of the South American plate, at the latitude of the Central Andes from 28°S to 33°S, consists of different terrains accreted to the Gondwana margin during the Paleozoic (e.g., Ramos et al., 1986). The boundaries between these terranes are evidenced by regional lineaments, mafic-ultramafic belts, presence of magmatic arcs associated with ancient subduction zones and other distinctive tectonic features. Particularly, the boundary between the Cuyania and Chilenia terranes (Fig. 1a) is marked by the presence of a mafic-ultramafic belt that outcrops in the western margin of the Argentine Precordillera.

The modern Argentine Precordillera (Fig. 1a) is located in west-central Argentina, over the subhorizontal segment of the subducting Nazca plate. It is part of the easternmost sector of the Andean orogenic front and can be divided into the eastern, central and western Precordillera based on its stratigraphic and structural characteristics (Baldis and Chebli, 1969; Ortiz and Zambrano, 1981; Baldis et al., 1982). The western and central parts of the Precordillera constitute a west-vergent thin-skinned belt, whereas the eastern Precordillera corresponds to an east-vergent basement block. The basement of the central Precordillera is indirectly known from xenoliths in Miocene volcanic rocks (Leveratto, 1968), which

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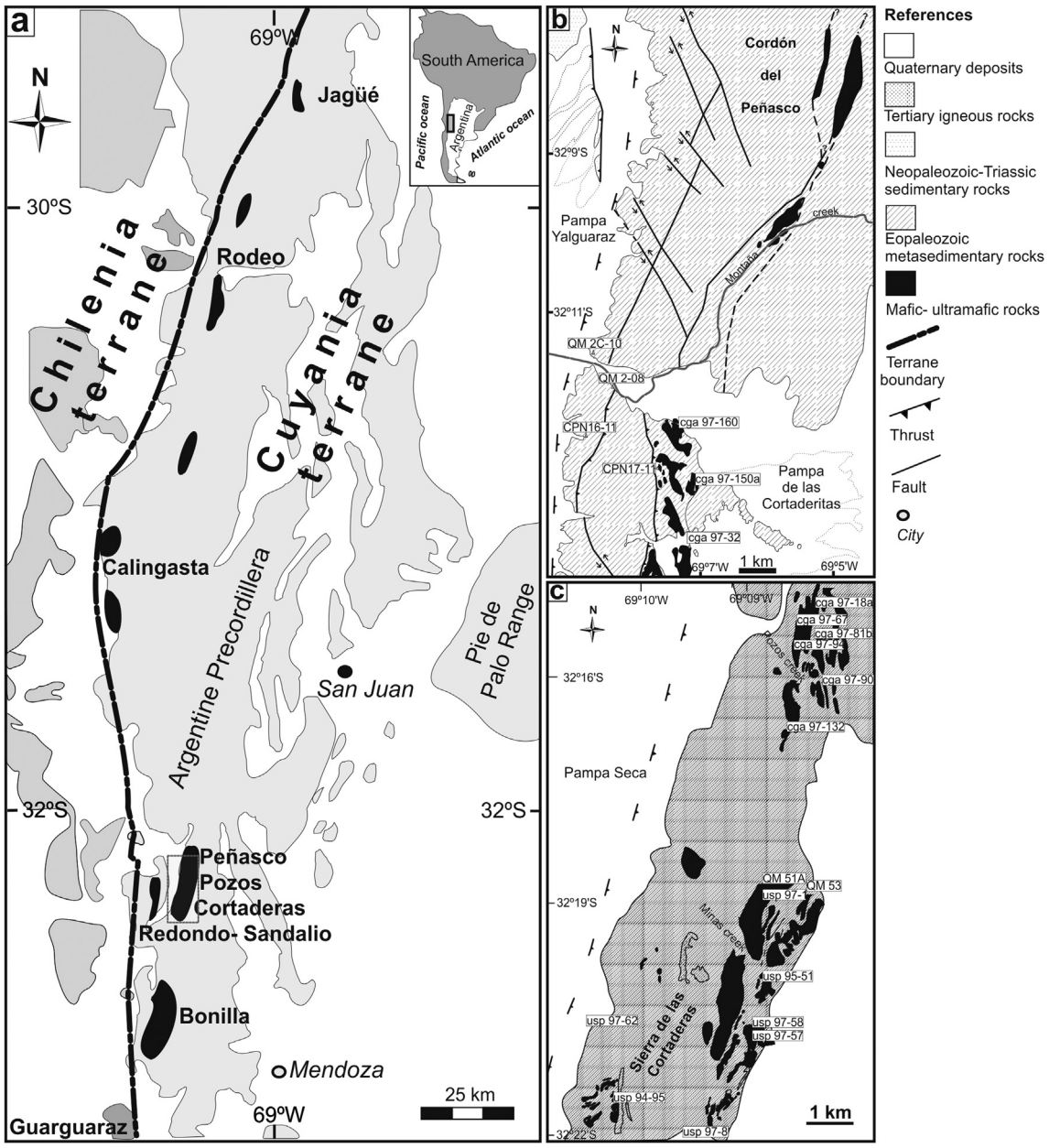

Fig. 1. a) Schematic geological map of central-western Argentina showing the boundary between the Cuyania (to the east) and Chilenia (to the west) terranes. This boundary is evidenced by the Precordillera mafic-ultramafic belt. b) Geological map of the Peñasco area modified from Boedo et al. (2012). c) Geological map of the Cortaderas area modified from Davis et al. (1999).

have yielded U/Pb zircon ages near 1100 My (Kay et al., 1996; Rapela et al., 2010). Distinctive Early Paleozoic stratigraphic sequences are well documented in the three subunits of the Precordillera. Particularly, the western Precordillera consists of slope and deep marine siliciclastic facies, some of which include carbonate platform and basement siliciclastic olistoliths (Thomas and Astini, 2003 and others therein). These associations are spatially related with mafic and ultramafic bodies, which are grouped into the Precordillera mafic-ultramafic belt. This belt extends discontinuously between 28°S and 33°S latitude and consists of pillow lavas, basaltic dikes and sills, massive gabbros, mafic granulites (layered gabbros) and serpentinized ultramafic rocks with E-MORB-like (*Enriched Mid-Ocean Ridge Basalts*) chemical signature and positive εNd values (+6 to +9.3) (Haller and Ramos, 1984, 1993; Kay et al., 1984; Ramos et al., 1986; Cortés and Kay, 1994; Davis et al., 2000; Fauqué and Villar, 2003; Kay et al., 2005). Both the meta-igneous bodies and the meta-sedimentary rocks record a greenschist facies metamorphic event, whose middle to late Devonian age is based on K–Ar and Ar–Ar mica ages (Cucchi, 1971; Buggisch et al., 1994; Davis et al., 1999).

The Precordillera mafic-ultramafic belt can be divided into two regional sectors. The first includes the Jagüé, Rodeo and Calingasta localities in the central and northern part of the belt (Fig. 1a). The mafic and ultramafic units in this region consist principally of pillow lavas, basaltic dikes and sills and massive gabbros. These units are interlayered or in tectonic contact with deep-marine metasediments which have been assigned Ordovician ages based on graptolite faunas (Blasco and Ramos, 1976; Brussa, 1999) and a zircon U–Pb age of 454 ± 35 My (Fauqué and Villar, 2003). Both the mafic and meta-sedimentary rocks have been affected by a low