Geodesy and Geodynamics xxx (2017) 1–13

Contents lists available at ScienceDirect

Geodesy and Geodynamics

journal homepages: www.keaipublishing.com/en/journals/geog; http://www.jgg09.com/jweb_ddcl_en/EN/volumn/home.shtml

Within plate seismicity analysis in the segment between the high Cordillera and the Precordillera of northern Mendoza (Southern Central Andes)

Julián Olivar [a, *], Silvina Nacif [b], Lucas Fennell [a], Andrés Folguera [a]

[a] CONICET – Universidad de Buenos Aires, Instituto de Estudios Andinos 'Don Pablo Groeber' (IDEAN), Facultad de Ciencias Exactas y Naturales, Pabellón II, Ciudad Universitaria, Buenos Aires, C1428EGA, Argentina

[b] CONICET – Instituto Geofísico-Sismológico 'Ing. F.S. Volponi' (IGSV), Ruta 12 km17 Jardín de los Poetas Marquesado, Rivadavia, Provincia de San Juan, Argentina

ARTICLE INFO

Article history:
Received 25 April 2017
Received in revised form
25 September 2017
Accepted 26 September 2017
Available online xxx

Keywords:
Crustal seismicity
Seismogenic structures
Frontal Cordillera
Blind thrusts
Decollement

ABSTRACT

Crustal seismicity in northwestern Mendoza Province in Argentina, corresponding to the transition zone between the Chilean–Pampean flat subduction zone (26.5–33.5°S) and the Southern Central Andes normal subduction zone to the south, is studied in order to i) identify its relationship with the mapped structure, ii) determine deformational mechanisms and iii) constrain the geometry of the fold and thrust belt in the lower crust. Through this, we aim to determine which are the structures that contribute to Andean construction, east of the Frontal Cordillera in Argentina and at the western Principal Cordillera in Chile. Data from a temporary local seismic network are reprocessed in order to achieve a precise location of hypocenters and, whenever possible, to build focal mechanisms. Results are interpreted and compared with previous seismic studies and structural models. Analyzed seismicity is grouped around the eastern front of Frontal Cordillera, with hypocenters mainly at depths of 25–40 km. Contrastingly, earthquakes in the Principal Cordillera to the west are located at the axial Andean sector and Chilean slope, with depths shallower than 15 km. Obtained focal mechanisms indicate mainly strike-slip displacements, left lateral at Frontal Cordillera and right lateral at Principal Cordillera. Based on these observations, new possible structural models are proposed, where seismogenic sources could be either associated with inherited basement structures from the Cuyania–Chilenia suture; or correspond to deep-blind thrusts linked with a deeper-than-previously-assumed *decollement* that could be shared between Frontal Cordillera and western Precordillera. This deeper *decollement* would coincide in turn with the one determined from receiver function analysis for the eastern Sierras Pampeanas in previous works, potentially implying a common *decollement* all through the fold and thrust belt configuration. Apart from this, a new interpretation of seismogenic structures in Principal Cordillera near the Argentina–Chile boundary is provided.

1. Introduction

The northern Mendoza-southern San Juan provinces Andean sector in Argentina is one of the highest regions of the entire Andes containing peaks such as Aconcagua and Mercedario, and ranges such as Plata, Ramada and Ansilta reaching heights over 5500–6000 m. These heights have been attributed to the subduction of the Juan Fernández aseismic ridge at depth and its relation to the development of the Chilean–Pampean flat subduction zone (see Ramos et al. [1] for a synthesis). This segment is constituted by several morphostructural systems with contrasting *decollements* and characterized by variable surficial geology, although seismogenic structures and therefore neotectonic deformations through

* Corresponding author.
E-mail address: olivar@gl.fcen.uba.ar (J. Olivar).
Peer review under responsibility of Institute of Seismology, China Earthquake Administration.

Production and Hosting by Elsevier on behalf of KeAi

https://doi.org/10.1016/j.geog.2017.09.004

Please cite this article in press as: J. Olivar, et al., Within plate seismicity analysis in the segment between the high Cordillera and the Precordillera of northern Mendoza (Southern Central Andes), Geodesy and Geodynamics (2017), https://doi.org/10.1016/j.geog.2017.09.004

them are barely addressed from a seismological point of view; with the exception of those easternmost structures in the foreland zone which are beyond the scope of this work [2–5]. Consequently, deep geometry of the main crustal faults is based on models with little to no constraining geophysical evidence. The main goal of this study is to analyze the crustal seismicity (less than 50 km deep) of northwestern Mendoza in order to either identify its link to already identified structures, or otherwise suggest new possible seismogenic structures. Additionally, calculated seismicity depths will allow refining the style of deformation both beneath the eastern front of Frontal Cordillera and the western Principal Cordillera where most neotectonic structures are located in the studied sector. Such goals are approached through the reprocessing of seismic data from a local and temporary network (Fig. 1B), which allowed to locate hypocenters and build focal mechanisms.

The study zone comprises a broad area located at the northwestern corner of Mendoza Province in Argentina, delimited by 32°20′–33°40′S and 70°00′–69°00′W (Fig. 1). It lies within a tectonic setting characterized by the transition zone from a flat slab segment (Chilean–Pampean flat slab) towards a normal subduction segment (South Volcanic Zone) [1]. In this context, four morphostructural domains can be identified; from west to east: Principal Cordillera, Frontal Cordillera, Precordillera of Mendoza and the Cerrilladas Pedemontanas (piedmont hills) (Fig. 1C).

Neotectonic deformation and crustal seismic activity on the axial and Chilean Principal Cordillera near these latitudes was generally associated with the El Fierro fault system, an active west-dipping fault system which corresponds to the eastern edge of the Abanico basin. Current displacement on these faults is thought to have mainly a right lateral strike-slip component based on seismic

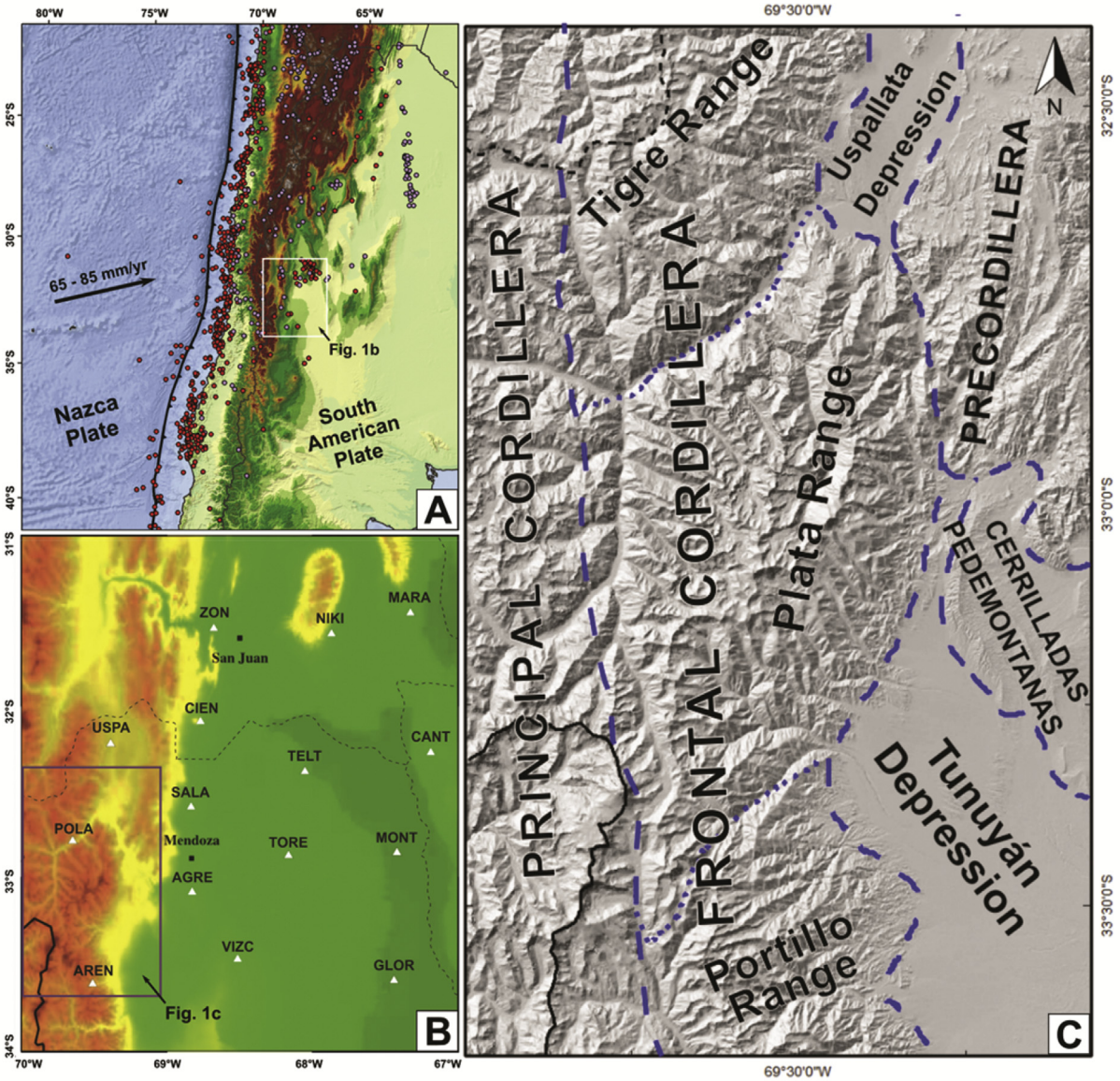

Fig. 1. A) Seismicity from ISC-GEM Catalog from 1900 to 2013 (http://www.isc.ac.uk/iscgem/). This catalog is the result of a special effort to adapt and substantially extend and improve currently existing bulletin data of large global earthquakes (magnitude 5.5 and above). Red and lilac circles are seismic events with depths less than 50 km and greater or equal to 50 km, respectively. The white rectangle shows the extension of the map shown in B. B) Location of broad band seismological stations deployed by CHARSME experiment; the rectangle shows the extension of the study zone. C) Study zone divided into morphostructural domains mentioned in the text.

Please cite this article in press as: J. Olivar, et al., Within plate seismicity analysis in the segment between the high Cordillera and the Precordillera of northern Mendoza (Southern Central Andes), Geodesy and Geodynamics (2017), https://doi.org/10.1016/j.geog.2017.09.004