



The buried southern continuation of the Oaxaca-Juarez terrane boundary and Oaxaca Fault, southern Mexico: Magnetotelluric constraints

J.O. Campos-Enriquez^{a,*}, F. Corbo-Camargo^b, J. Arzate-Flores^b, J.D. Keppie^c, C. Arango-Galván^a, M. Unsworth^d, S.I. Belmonte-Jiménez^e

^a Instituto de Geofísica, Universidad Nacional Autónoma de México, D.F., Mexico

^b Centro de Geociencias, Universidad Nacional Autónoma de México, Juriquilla, Querétaro, Mexico

^c Instituto de Geología, Universidad Nacional Autónoma de México, D.F., Mexico

^d Department of Physics, Alberta University, Alberta, Canada

^e CIIDIR-IPN, Oaxaca, Mexico

ARTICLE INFO

Article history:

Received 28 November 2011

Accepted 7 January 2013

Keywords:

Tectonostratigraphic terranes

Limit

Cortical structure

Oaxaca fault

Southern continuation

Magnetotelluric study

Electric resistivity images

ABSTRACT

Thirty magnetotelluric soundings were made along two NW–SE profiles to the north and south of Oaxaca City in southern Mexico. The profiles crossed the N–S Oaxaca Fault and the Oaxaca-Juarez terrane boundary defined by the Juarez mylonitic complex. Dimensionality analysis of the MT data showed that the subsurface resistivity structure is 2D or 3D. The Oaxaca and correlative Guichicovi terranes consist of ca. 1–1.4 Ga granulitic continental crust overlain by Phanerozoic sedimentary rocks, characterized by high and low resistivities, respectively. The Juarez terrane consists of oceanic Mesozoic metavolcanic and metasedimentary rocks, characterized by a low to medium resistivity layer, that is approximately 10 km thick. The Oaxaca Fault is a Cenozoic aged, normal fault that reactivated the dextral and thrust Juarez mylonitic complex north of Oaxaca City: its location south of Oaxaca City is uncertain. In the southern profile, the MT data show a ca. 20–50 km wide, west-dipping, relatively low resistivity zone material that extends through the entire crust. This is inferred to be the Juarez terrane bounded on either side by the ca. 1–1.4 Ga granulites. The Oaxaca Fault is imaged only by a major electrical resistivity discontinuity (low to the west, high to the east) along both the western border of the Juarez mylonitic complex (northern profile) and the San Miguel de la Cal mountains (southern profile) suggesting continuity.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

The Oaxaca Fault is a major Cenozoic fault located on the western boundary of the 10–15 km wide, polyphase mylonitic, Juarez shear zone that has been interpreted to form the boundary between the Oaxaca (Zapoteco, Oaxaquia) and Juarez (Cuicateco) terranes (Campa and Coney, 1983; Sedlock et al., 1993; Alaniz-Alvarez et al., 1994) (Fig. 1). The Oaxaca Fault has a mean strike direction of N10°W and dips steeply toward the west. It is made up of a series of parallel to slightly (<25°) oblique faults segments that are named (from north to south): Tehuacán, Coxcatlán, Domingillo Teotitlán, Jayacatlán, and Etna (Centeno-García et al., 1990). The Oaxaca/Juarez terrane boundary has a complex history: (i) pre-Jurassic, east-vergent thrusting; (ii) Jurassic dextral mylonitic shearing; (iii) Late Cretaceous east-vergent thrusting; and (iv) Cenozoic normal faulting (Alaniz-Alvarez et al., 1996; Alaniz-

Alvarez and Nieto-Samaniego, 1997). South of Oaxaca City, the southward continuation of the Oaxaca Fault is less certain and it may continue unbroken southwards along the western margin of a horst in the Zaachila sub-basin or be offset along with the terrane boundary.

The crustal structure in southern México has been investigated with through seismic and magnetotelluric (MT) studies (Nuñez-Cornú, 1988; Nava et al., 1988; Arzate et al., 1993; GEOLIMEX, 1994; Spranger, 1994; Jording et al., 2000; Joedicke et al., 2006) (Fig. 1). The seismic refraction studies did not image the Oaxaca Fault. However, a previous regional MT study suggests that the Oaxaca-Juarez terrane boundary lies to the east of the Zaachila and Mitla sub-basins (Jording et al., 2000; Joedicke et al., 2006; Arzate-Flores et al., 2007; Corbo-Camargo et al., 2008) (Figs. 1 and 2), which implies that sinistral displacement has occurred on the Donaji Fault.

Based on detailed gravity and magnetic studies, Campos-Enriquez et al. (2010) established the shallow structure of the Oaxaca Fault and of the Oaxaca-Juarez terrane boundary to be: 1) a composite depression comprising three N–S sub-basins: the

* Corresponding author.

E-mail address: ocampos@geofisica.unam.mx (J.O. Campos-Enriquez).