Pure Appl. Geophys. 173 (2016), 3213–3216
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DOI 10.1007/s00024-016-1404-y

Pure and Applied Geophysics

Introduction

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The Latin American Pacific margin from the Californias to the tip of Tierra del Fuego shares a common geodynamic heritage; the geologic sculptures of this heritage have been chiseled out in large part by the geodynamic processes associated with the subduction of oceanic lithosphere beneath the continental margins. Many aspects of these processes are addressed in the 22 articles comprising this volume, articles which cover a broad spectrum of scientific disciplines. These processes include: (1) the emplacement of magmas within, and subsequent deformation of, the overriding continental lithosphere (Longo et al.; Ochoa-Chávez et al.; Núñez-Cornú et al.; Neumann et al.), the magmas being produced by a variety of processes, such as the melting of the subducted lithosphere, decompression melting related to the tearing of both the subducting and overriding plates, and mantle flow through tears in the subducting plate; (2) the subduction of buoyant bathymetric features, such as seafloor spreading segments of the EPR off the Californias and Chile and the Cocos Ridge in central America and their effects on the overriding plate (Brandes et al.; Bourgois et al.); (3) plate motion reorganizations and related changes in the state of stress in the overriding continental crust (Mortera Gutiérrez et al.); (4) plate margin truncation such as that which occurred in southern Mexico due to the translation of the Chortís Block, a process that is most likely occurring at present along the Pacific coast of Baja California (Munguía, Mayer et al.; Munguía, González-Escobar et al.); (5) processes that generate the great mega-thrust earthquakes and tsunamis (Papadopoulos and Minadakis; Bartolome et al.; Dañobeitia et al.); (6) tectonic processes related to hydrocarbon generation and accumulation (Michaud et al.; Longo et al.); (7) processes that generate slow-slip events along the mega-thrust (Graham et al.); (8) processes that produce tearing of continental plates as is occurring in the Gulf of California (Dañobeitia et al.; Ortega et al.); (9) processes that produce forearc deformations, such as trench parallel transcurrent faults, translation of forearc slivers, and crustal uplift of the forearc area (Suárez et al.; Gaidzik et al.; Rousset et al.; Arzate et al.); (10) ridge-trench collisions, ophiolite emplacement and overthrusting of continental terrains (Arzate et al.; Bourgois et al.); and (11) mantle flow associated with, or induced by, the subducting lithosphere (Bernal-López et al.; Rosas et al.; Neumann et al.).

The following studies help to illustrate the diversity of the investigations that are being conducted along this margin, the results of which will be of great value in furthering our understanding of the complex array of geodynamic processes that have been sculpting the geologic landscape of the Latin American Pacific margin.

Bourgois et al. provide a review and synthesis of the geology and recent tectonic history of the Chile Triple junction, at which an active spreading center has been colliding with the subduction zone resulting in ophiolite emplacement, Adakite-like generation, and the development of a slab window beneath the South American continent. The tectonic history reveals the need for a westward relocation of some of

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the ridge segments as they near the trench, as has been observed elsewhere (e.g., off Mexico).

Papadopoulos and Minadakis investigate the foreshock activity associated with several great earthquakes occurring in the Chile subduction zone to verify and better understand previously noted 3-D precursory patterns. Using the great earthquake of 1 April 2014 as a reference event, they observe that similar foreshock 3-D patterns precede the great earthquakes of 27 February 2010 and 16 September 2015 within critical distances of about 170 and 50 km, respectively.

Longo et al. perform an aeromagnetic analysis of the subsurface structure and magma emplacement of the Auca Mahuida Volcano, Argentina and find that the magma emplacement is being controlled by the regional fault system, and has played a major role in the maturation and subsequent accumulation of oil below the volcano.

Michaud et al. investigate the spatial distribution of gas flares along the Ecuadorian margin using water column acoustic backscatter data. High-resolution seismic profiles show that most flares occur close to the surface expression of active faults, deformed areas, slope instabilities or diapiric structures.

Suárez et al. study the 10 April 2014 Nicaraguan earthquake. They find, in conjunction with the results of previous studies, that arc-parallel strains associated with the NW moving Nicaraguan forearc sliver, located between the volcanic arc and trench, are being accommodated both by block rotations onshore and by an NW translation of a smaller forearc sliver located in the offshore and near-shore areas.

Rosas et al. present the first 3-D, steady-state kinematic–dynamic thermal model for the Costa Rica–Nicaragua subduction zone. The models predict that the mega-thrust seismogenic zone decreases from about 100 km below Costa Rica to just a few kilometers below Nicaragua and also indicates that variations in slab dip induce an along-strike mantle flow in the mantle wedge. They conclude that 2-D models are not suitable for use in this area.

Brandes et al., using multichannel seismic reflection profiles, carry out 3-D kinematic retro-deformation modeling to analyze the spatial evolution of a bend in the South Limón fold-and-thrust belt, Costa Rica. They find that the bend can be modeled by a simple NNE-directed transport during a single deformational phase, and also indicates the need for the presence of a Trans-Isthmic fault system during this deformational phase.

Arzate et al. present a magnetotelluric profile oriented perpendicular to the trench in southern Mexico. They find evidence for a low angle thrust contact between the Oaxaca and Juárez terranes, with the older Oaxaca terrain overthrusting the younger Juárez terrane. They also find evidence that uplift in the Sierra Madre del Sur is facilitated by slab-dehydration driven bouyancy.

Bernal-López et al. employ shear wave splitting measurements to study the mantle flow under southern Mexico. They find that in the forearc, the fast axes are oriented NE–SW, whereas in the backarc, they are oriented N–S. The differences are proposed to be due to the entrainment of mantle flow under the subducting, subhorizontal slab in the forearc region and induced corner flow in the backarc mantle wedge.

Neumann et al. use scaled analog laboratory modeling to investigate the mantle flow beneath western Mexico near the gap between the Rivera and Cocos plates. They find a deep toroidal flow of asthenospheric mantle through the gap and a shallow counter-toroidal flow in the uppermost 100 km of the mantle wedge that draws mantle from the western Trans-Mexican volcanic Belt to the Jalisco block and then plunges into the deep mantle by the poloidal cell of the Cocos slab. They conclude that the model can explain the eruption of OIB lavas in the vicinity of Guadalajara.

Gaidzik et al. perform geomorphic, structural and fault kinematic analyses of the forearc area of Guerrero to determine the tectonic processes active in this area. They find evidence for active, sinistral transcurrent and normal faults oriented subparallel to the trench, consistent with GPS measurements, and the sense of oblique plate convergence in this area.

Graham et al. estimate the time-dependent slip distributions and Coulomb failure stress changes for six slow-slip events along Guerrero and Oaxaca using continous GPS data. They find evidence of slow slip on the mega-thrust everywhere between Oaxaca and Guerrero. In addition, slow slip reduces the slip deficit in the Guerrero Gap, whereas in Oaxaca, little or no slip is relieved by slow slip along the megathrust.

Rousset et al. use GPS data and morphology to explore links between variations in inter-slow-slip-event coupling along the southern Mexico subduction zone and the long-term topography of the coastal areas of Guerrero and Oaxaca. Their results favor a model in which frictional asperities partly control short-term inter-SSE coupling as measured by geodesy and in which those asperities persist through time.

Ochoa-Chávez et al. perform a P-wave tomographic analysis of the crustal and upper mantle structure of the Jalisco block and adjacent areas. They find that magma emplacement under the Colima Volcanic Complex is fracturing the crust, forming a well defined, classical, rift–rift–rift fracture pattern at mid crustal levels. No evidence is observed to support either a trenchward migration of the volcanic front or toroidal asthenospheric flow through the slab tears bounding the Jalisco Block to the NW and SE.

Núñez-Cornú et al. analyze seismic characteristics of explosions at Colima Volcano, Mexico, associated with the 2003–2005 eruption to determine characteristic features, propagation velocities, and origin times for both deep seismic sources and the associated explosions. The results suggest the presence of various magmatic pathways beneath the volcano.

Mortera Gutiérrez et al. determine the morphology, magnetic anomalies and shallow structure of the Bahía de Banderas, Mexico using multibeam bathymetry, marine total field magnetics and subbottom seismic reflection data. They find evidence that the stress field within the bay is presently extensional, oriented NNW–SSE, roughly parallel to the trench axis. Furthermore, they find no evidence for the previously proposed Bandera Fault, a regional fault proposed previously to extend westward from the bay to the Middle America Trench.

Bartolome et al. use multichannel seismic reflection data from TSUJAL project (2014) to obtain a better understanding of the complex interactions between Rivera and North American plates. They characterize the internal crustal structure of Rivera plate off Puerto Vallarta as a smooth dipping subduction of the Rivera plate beneath the North American plate, dominated by subduction–accretion along the lower slope of the margin. They noted significant mass wasting of the continental slope and they concluded from the data that the region appears to be prone to generation of great earthquakes.

Dañobeitia et al. use multichannel and wide-angle data from TSUJAL project (2014) to obtain a better understanding of the complex interactions between Rivera and North American plates in the area of the Tres Marias Islands, located at the northern terminus of the Middle American Trench. These data show a crustal thickness of the oceanic slab of 6–7 km, and anomalous crustal velocity ($\leq$5.5 km/s) underneath Maria Magdalena Rise, located south of the islands, probably related to the initial phases of the Baja California Peninsula continental breakup. The Moho depth varies from 10 km west of TMI to $>$15 km east of the islands. The bathymetric escarpment located south of the islands is quite steep, resulting in numerous large slumps. These data also indicate compression west of the Islas Marias, suggested by the deformation of sedimentary wedges and elevated islands.

Ortega et al. investigate whether earthquake source mechanisms reflect important variations going from the Gulf of California to the East Pacific Rise. They find that the moment tensor solutions of the GC and EPR are similar; however, there is a clockwise rotation in the s_1 and s_3 directions for the GC compared to the EPR. They also found that the full moment tensor inversion best resolves complex faults, composed mainly of two double couples.

Munguía and Mayer et al. analyze the earthquake swarm of 2006 occurring within the Bahía Asunción, Mexico. They find that these earthquakes occurred on the coastline of the peninsula, east of the Tosco-Abreojos fault, indicating that the boundary between the Baja California and the Pacific plate is wider than previously thought.

Munguía and González-Escobar et al. analyze earthquake sequences located near San Carlos, Baja California Sur that occurred during three time periods. These events were found to be associated with the Santa Margarita fault, located about 60 km east of the Tosco-Abreojos fault system, and showed both normal and strike-slip components of fault motion. They conclude that the boundary between the Baja California and the Pacific plate is about 60 km wide in this area, and is a transtensional boundary.

González-Escobar et al. analyze the structure and stratigraphy of the Magdalena shelf located along the Pacific margin of Baja California using multichannel seismic reflection data. They imaged the old pre-Miocene forearc basin that is presently disrupted by the faults (Tosco-Abreojos to the west and the Santa Margarita and San Lázaro faults to the east) forming the transtensional boundary between the Baja California and the Pacific plate. The boundary is about 90 km wide in this area. They also observed a series of eastward deepening half-grabens containing a thick sediment infill.

Acknowledgments

We thank all the authors for their contributions to this special volume and Renata Dmowska for her help during the preparation of this volume and for handling the reviews of our contributions. We are most grateful to the many reviewers for their efforts to improve the quality of this special volume. These people include, in alphabetical order, José Miguel Azañón Hernández (U. Granada, Spain), Peter Bird (UCLA, USA), Thierry Calmus (UNAM, MEXICO), Eduardo Camacho (U. Panama, PANAMA), Paterno Castillo (UCSD, USA), Timothy Dixon (U. of South Florida, USA), Christian Escudero (U. Guadalajara, MEXICO), Donald Fisher (Penn State, USA), Victor Hugo Garduño Monroy (U. Michoacan, MEXICO), Antonio González (CICESE, MEXICO), Yoshihiro Ito (Kyoto U., JAPAN), Vladimir G. Kossobokov (IETP RAS, RUSSIA), Geoffroy Lamarche (NIWA, NEW ZEALAND), Dan Lizarralde (WHOI, USA), Maureen Long (Yale, USA), Héctor López Loera (IPICYT, MEXICO), John Makario Londoño (SGC, COLOMBIA), Jack Loveless (Smith College, USA), Anthony Lowry (Utah State, USA), Vlad C. Manea (UNAM, MEXICO), François Michaud (UPMC, FRANCE), Neil Mitchell (U. Manchester, UK), Hirata Naoshi (U. Tokyo, JAPAN), James Ni (New Mexico State U., USA), Jaime Humberto Ortega (U. Chile, CHILE), Javier Pacheco (UNA, COSTA RICA), Patricia Persaud (CalTech, USA), Cristina Pomposiello (INGEIS, ARGENTINA), Luis Quintanar Robles (UNAM, MEXICO), Charlotte Rowe (Los Alamos Nat. Lab., USA), Hartmut Seyfried (U. Stuttgart, GERMANY), Joann Stock (CalTech, USA), Gerardo Suárez (UNAM, MX), Patrick Taylor (NASA, USA), Gustavo Tolson (UNAM, MEXICO), Paul Umhoefer (Northern Arizona, USA), Gabriel Vargas (UCHILE, CHILE), Ikuko Wada (U. Minnesota, USA), F. Ramón Zúñiga (UNAM, MEXICO), and several anonymous reviewers who reviewed our contributions.