DYNAMICS AND EVOLUTION OF THE LITHOSPHERE - RESULTS AND PERSPECTIVES OF GEOPHYSICAL RESEARCH IN MEXICO

SPECIAL VOLUME - PART B

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Guest Editor

PREFACE

This number of Geofísica Internacional includes the second part of a special volume being published as part of the activities of the National Committee for the International Lithosphere Program (ILP). The ILP was established in September 1980 by the International Council of Scientific Unions (ICSU), with the objective of constituting the major international interdisciplinary research program for the decade 1980-1989. The ILP main concern is the study of the origin, evolution, dynamics and characteristics of the lithosphere, through active basic research of geophysicists, geologists, geochemists, etc., all joined as earth scientists. Then, an ultimate goal of the ILP is a consistent comprehensive understanding of how the earth works. As passengers of planet Earth, it is our responsibility not only to search for an improved knowledge of the mineral and energy resources and natural hazards so important for human society, but of a global comprehensive perception of the geological and environmental maintenance of earth's life and earth.

Earth sciences have been currently in the midst of a major scientific revolution known as plate tectonics, which has affected virtually every discipline, and fostered (which is perhaps the most important achievement) an ever increasing interdisciplinary approach in basic and applied research. It is both a pleasure and an honor introducing this special volume on earth sciences research in Mexico, which is appropiately being published in this 'silver' 25th volume of the journal Geofísica Internacional. This second part includes seven papers written by ten authors from several institutions, which cover distinct aspects of research on *e.g.* geology, seismology, tectonics, geochemistry and palaeomagnetism.

In the first paper, Urrutia-Fucugauchi (UNAM, Mexico) and Valencio (U. de Buenos Aires, Argentina) present the results of palaeomagnetic study of the metavolcanic-metasedimentary sequence at Ixtapan de la Sal, Mexico State in the Tierra Caliente Complex. They suggest a tectonic model for the evolution of the area involving the

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closure of a small ocean basin, associated with a south-southwestward dipping, subduction zone, between a 'Michoacan' block and a 'Morelos-Guerrero' block.

In the second paper, Canas (U. P. Cataluña, España) presents a study of Q from coda for earthquakes in the central and eastern Mexican volcanic belt. He founds differences between the two regions, *e.g.* in the coda excitation coefficients, in the S-wave attenuation coefficients, and in Q_0; which are explained in terms of a higher degree of faulting and/or higher concentration of magmatic chambers under the eastern portion than under the central portion. In this study Q was found to be strongly frequency dependent. The Q values have been correlated elsewhere with other geophysical parameters such as heat flow, electrical conductivity, crustal thickness, seismic wave velocity distribution, and tectonics. This may also be the case in Mexico and further studies are required to test and document the correlations.

In the next paper, Yamamoto Victorio (UNAM, Mexico) reports a study of earthquakes associated with the subduction zone of Chiapas, southern Mexico. He finds evidence for the presence of an abnormal seismic signal attenuation (P-waves) in a given range of distances and azimuths, particularly for seismic stations located in eastern North America. The observations may be explained in terms of three alternatives, *i.e. (a)* anelastic attenuation caused by an anomalous region close to the source; *(b)* a sort of defocusing effect produced by refractions in an heterogeneous region beneath the Caribbean; and *(c)* ray propagation in the presence of a downgoing lithospheric plate.

In the fourth paper, Delgado-Argote, Rubinovich-Cogan (UNAM, Mexico) and Gasca-Durán (CRM, Mexico) present a study of the ultrabasic complex of Loma Baya, Guerrero State, southern Mexico. This complex is one of four complexes identified within a mid-Cretaceous magmatic belt of the margin of Guerrero. The authors report petrologic, mineralogic and geochemical data, and propose an emplacement mode in terms of a diapiric intrusion during the Late Cretaceous. The observations and data on this complex are compared with complexes from other parts of the world.

In the next paper, Urrutia-Fucugauchi (UNAM, Mexico) presents a review and discussion of heat flow, crustal thickness and tectonics of Mexico. The isopachs roughly follow the coastline of the Pacific continental margin and the Gulf of Mexico. Crust is thicker ($\gtrsim$40 km) beneath the central-eastern portion of the TMVB. Heat flow is generally higher than 1.5 HFU for the areas studied, except for the Precam-

brian-Paleozoic terranes of southern Mexico and the northern portion of the Gulf of Mexico plain (~ 1.0 HFU). High heat flow (> 2 HFU) is observed in the Sierra Madre Occidental and the TMVB, which represent Mesozoic-early Cenozoic and Late Cenozoic-Recent magmatic arcs.

In the next paper, Ruiz-Kitcher (UNAM, Mexico) reports a study of the Oaxaca earthquake of November 29, 1978, particularly for the seismic activity ($M_L \geqslant 3.0$) following the event between December 1 to 12, 1978. Focal mechanism solution for 9 aftershocks ($M_L \geqslant 4.0$) and composite solutions for 13 minor aftershochs show a predominance of normal faulting with azimuths parallel to the trench axis. The author suggests a model for the subduction zone in which the plate is broken along faults parallel to the trench.

In the last paper, Aubert (IOPG - UAID, France) and Lima-Lobato (JEC, Fukuoka, Japan) report results of a self-potential (SP) survey of the area of Nevado de Colima and Volcán de Fuego, Colima State. They interpret the results in terms of hydrothermal activity of the volcanic area, correlating the SP anomalies with a fractured zone above a heat source, along the N-S volcanic axis between the Nevado and Fuego.

In the appendix, a study of the batholiths and volcanics of southern Mexico by Negendank and coworkers (Federal Republic of Germany) is summarized. The distribution and characteristics of I-type granites and calcalkaline volcanics correspond well with an ancient active continental margin currently associated with plate subduction.

Work as guest editor for this issue was facilitated by the assistance of H. N. Böhnel (U. of Münster, FRG), J. O. Campos Enríquez (Geotermia, CFE, México), J. Canas (U. de Cataluña, España), R. Canul Dzul (Geotermia, CFE, México), V. H. Garduño Monroy (Geotermia, CFE, México), E. Herrero-Bervera (U. of Hawaii, USA), Cinna Lomnitz (UNAM, México), W. D. MacDonald (U. of New York, USA), J. A. Madrid (CICESE, México), A. L. Martin (UNAM, México), D. J. Morán Zenteno (UNAM, México), R. Mota Palomino (UNAM, México), Alejandro Nava (UNAM, México), J. F. W. Negendank (U. of Trier, FRG), J. Nieto Obregón (UNAM, México), M. Ruiz Castellanos (UNAM, México), S. K. Singh (UNAM, México), David J. Terrell (UNAM, México) and Daniel A. Valencio (U. de Buenos Aires, Argentina). It is a pleasure to acknowledge their collaboration. The responsibility however is of the

editor. I would also like to thank the assistance of Thelma del Cid, Francisco Graffé, Nydia Figueroa, Guillermo García and Yazmin Torres (Editorial Staff of Geofísica Internacional) and of Lucía Castrejón, Jorge Camacho, Selma Campos, José Ruiz and Mauro Pérez.

J. Urrutia-Fucugauchi, Chairman, National ILP Committee, Member ICL-WG-2B and Correspondent Member ICL-WG-2.

APPENDIX

NEGENDANK, J. F. W. (Trier), EMMERMANN, R. (Giessen), KRAWCZYK, R. (Giessen) and TOBSCHALL, H. (Mainz):

"Granites" and igneous rocks in the Sierra Madre del Sur. Plutonic complexes (of Cretaceous? - Tertiary age) between Puerto Vallarta and Acapulco have been investigated geochemically and compared with the surrounding volcanics of Eocene-Oligocene (Miocene) age. Irrespective of the Cretaceous-Tertiary age of these plutonic complexes - the acid rocks can be characterized as I-type-"granites". As a whole all these batholithic intrusions (Puerto Vallarta; Punta Mita and Puerto Vallarta-Manzanillo, Manzanillo, Arteaga, Punta San Telmo, Nuxco - Petatlán, Atoyac de Alvarez, Acapulco, Xaltianguis, Tierra Colorada) range from gabbros through diorite and granodiorite to granite. The granites have I-type characteristics. The dominant rocks are of intermediate chemical composition with calcalkaline characteristics. (In summary 116 plutonic rocks have been investigated (bulk and trace element studies) inclusive xenolith's etc.).

The investigated volcanic rocks accompaning the batholithic complexes also have calcalkaline characteristics, but show extraordinary alteration properties (anomalous petrography and bulk chemical analyses) over the whole area of the Sierra Madre del Sur.

Field geological observations in the area east of Puerto Vallarta seem to suggest near surface intrusions of the granites. Additionally granitic dykes intruded into the covering Eocene-Oligocene volcanics.

The observed distribution pattern of batholithic intrusion with I-type granites and associated volcanics both with calcalkaline character, seem to indicate a formation at an ancient active continental margin by cordilleran orogeny. However this has to be proved by more detailed geological studies. Similar patterns are well known from the western USA and the Andes.