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PALAEOMAGNETISM AND TECTONICS OF MIDDLE AMERICA AND ADJACENT REGIONS

PART 1

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PREFACE

Investigations, unified under the working hypothesis of plate tectonics, have produced a revolution in the earth sciences over the past decades. The effects of this have been profound since it has lead to a reexamination of the vast amount of available geological and geophysical data and of the approach for obtaining new information. Palaeomagnetism has played a major role in this endevour. Palaeomagnetic data have contributed to define the relative positions of crustal blocks through geological time, and constituted a compelling evidence in favour of the hypothesis of continental drift. Furthermore, palaeomagnetism applied to marine magnetic anomalies has showed that the hypothesis of sea-floor spreading, an imaginative concept which re-stated and provided a mechanism for continental drift, was essentially correct. This added a further means for quantitative analysis of the relative movements of lithospheric plates in the Mesozoic and Cenozoic. Substantial progress has been achieved along these lines, which still remain as the most challenging aspect of palaeomagnetism. However, this has not been the only contribution of palaeomagnetism. Our knowledge of the Earth's magnetic field behaviour through geological time has greatly improved. The discovery of polarity transitions and excursions and the definition of a polarity time scale are just a few examples which have also proved valuable in correlation and dating problems. Not only geology but other sciences are experiencing the beneficial influence of that branch of the earth sciences. Ap-

plication in archaeology has resulted in an intense and productive cooperation between palaeomagnetists and archaeologists, from which many outstanding advances have resulted.

This issue presents the first part of a special collection of papers concerned with recent palaeomagnetic and tectonic investigations of Mexico and adjacent regions. It contains a total of eight papers, written by twenty authors from seventeen different institutions and which cover a wide variety of topics.

In the first paper, Beck, Burmester, Engebretson and Schoonover discuss the palaeomagnetic evidence on the origin and tectonic history of the Mesozoic batholiths currently located along the western margin of North America. Palaeomagnetic results indicate that many of the batholiths record tectonic motion, including northward transport, which, it is suggested, was due to interaction of the North America, Farallon and Kula plates during Late Mesozoic-Early Cenozoic times. In the second paper, Gose and Sánchez-Barreda present palaeomagnetic results for the Lower Permian Paso Hondo and Grupera Formations and the Pennsylvanian-Permian Yododeñe Formation. The sampling sites are located in the States of Chiapas and Oaxaca, respectively, i.e. to either side of the Isthmus of Tehuantepec, which, they suggest, represents a major structural discontinuity. Their results indicate that by Pennsylvanian-Permian times the area to the W-NW of the Isthmus of Tehuantepec was already keeping a similar latitudinal position relative to cratonic North America as it does today. The area to the S of the Isthmus was rotated counterclockwise relative to cratonic North America. The present results do not permit to establish unambiguously a tectonic model for the evolution of the area, and further investigations are required. On the other hand, the data point out that Mexico consists of a collage of blocks, and in deciphering the tectonic history of the region, palaeomagnetic investigations will certainly play a major role.

In the next paper, Ortega-Gutiérrez offers a general description and discussion of some of the major metamorphic belts of Mexico. This paper covers a considerable portion of the geologic time scale from well into the Precambrian up to the late Mesozoic. Discussion centers about the following metamorphic complexes: middle Proterozoic Oaxaca, Palaeozoic Acatlán, Palaeozoic (?)-Mesozoic Xolapa and Palaeozoic (?)-Mesozoic 'Tierra Caliente'. Several tectonic processes seem to have been involved in the geologic-tectonic evolution of these complexes. The Oaxacan complex is associated with an intracratonic basin affected by anorthositic-gabbroid mantle diapirs. The Acatlán complex is associated with the opening and closure of a pre-Atlantic ocean (Appalachian-Caledonian orogenic belt). The Xolapa and 'Tierra Caliente' complexes are related to subduction-orogeny along the western palaeomargin of the American plate.

Next paper by Urrutia-Fucugauchi reports on a palaeomagnetic study of a Middle Cretaceous limestone sequence from southern Oaxaca. The age of the sequence is not firmly established, but available geologic evidence indicates an Albian-Cenomanian age, and so the sequence spans an interesting period when the Earth's magnetic field kept a relatively constant normal polarity (Irving and Pullaiah, 1975). The significance of the results in terms of the Earth's magnetic field behaviour and of the tectonic history of the area are briefly discussed. Cohen, Anderson and Schmidt, in the next paper, present palaeomagnetic results for the Upper Triassic-Lower Jurassic Antimonio Formation of northwestern Sonora. These authors discuss their results in terms of the tectonics of northern Mexico, mainly in relation to a possible tectonic model which involves a clockwise rotation of northern Mexico relative to cratonic North America. Once again further palaeomagnetic results are required to fully understand the tectonic history of the area, but in the mean time, left-lateral movement seems to be more firmly established.

The next paper by Böhnel and Negendank reports a vast amount of palaeomagnetic results for Tertiary-Quaternary igneous rocks from the eastern part of the Mexican volcanic belt. On the basis of these results the authors suggest that the area studied has remained stable during the Neogene and Quaternary. Previous studies (e.g. Guerrero, 1973; Bobier and Robin, 1975; Nairn *et al.*, 1975; Urrutia-Fucugauchi, 1981) have reported palaeomagnetic results for the Early Tertiary which diverge from equivalent results for cratonic North America. These diverging results have been discussed in terms of possible variations of the Earth's magnetic field and/or tectonic rotations in the western margin of Mexico and along the Mexican volcanic belt in central Mexico. Following Böhnel and Negendank's results, if any tectonic movements affected the Mexican volcanic belt area they have ended by Late Miocene time.

Liddicoat, Coe, Lambert, Malde and Steen-McIntyre, in the next paper, present the results of an extensive study of Pleistocene and Holocene sediments from Tlapacoya, Mexico and Valsequillo, Puebla. It illustrates the potential applicability of these studies not only for the study of the Earth's magnetic field (secular variation, polarity transitions and excursions, etc.), but for correlation and dating of sedimentary sequences and archaeological sites.

A preliminary study of cored sediment from Lake Atitlan, Guatemala is reported by Liddicoat, Denham and Paull in the final paper. Studies of lake sediments in Europe and the United States are greatly improving our knowledge of the Earth's magnetic field behaviour during short periods (Creer *et al.*, 1981; Turner and Thompson, 1981) and results for low latitudes may be particularly interesting.

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