Zeitschrift: Eclogae Geologicae Helvetiae
Herausgeber: Schweizerische Geologische Gesellschaft
Band: 56 (1963)
Heft: 1

Artikel: Contribution to the geology and paleontology of the area of the city La Habana, Cuba, and its Surroundings
Autor: Brönnimann, Paul / Rigassi, Danilo
Kapitel: Introduction
DOI: https://doi.org/10.5169/seals-163038

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ferior a pleistocénica. Las serpentinas parecen ser anteriores al grupo sedimentario Habana. No se ha podido establecer la relación que exista entre las serpentinas y el grupo Habana con un afloramiento aislado, cerca a Santa María del Rosario, de calizas con *Nannoconus* del Cretáceo Inferior. El carácter esencialmente de «flysch» de los sedimentos del grupo Habana refleja movimientos orogénicos en las áreas de origen. De otra parte el grupo Marianao consiste principalmente en una serie de carbonatos depositados en condiciones relativamente tranquilas. Se enumeran pero no se describen en detalle los depósitos post-Cojímar del grupo Marianao incluyendo las formaciones del Mioceno Inferior al Pleistoceno de las areas costeras. Se incluyen mapas paleogeológicos que presentan la extención y facies de las formaciones oligo-miocénicas Husillo y Cojímar. Estructuralmente el área de la Habana es el extremo que buza al Oeste de un macizo orientado en dirección Este-Oeste y formado por serpentinas y estratos del grupo Habana plegados en un intrincado sistema. Dicho macizo está rodeado por una faja de formaciones del grupo Marianao relativamente no disturbadas. Se sugiere que el plegamiento del núcleo del macizo Habana-Matanzas fué causado por movimientos plásticos en dirección norte que se iniciaron durante el Cretácico Superior y terminaron en el Eoceno Inferior. Se proponen correlaciones entre las diferentes zonas bioestratigráficas basadas en foraminíferos planktónicos, en discoastérides y en asociaciones típicas de foraminiferos bentónicos de gran tamaño. La base del Eoceno se define por la aparición de globorotálidos con quilla formada por la misma sustancia, clara e imperforada, del caparazón.

INTRODUCTION

The geological description of the area of the city of La Habana, Cuba, and its immediate surroundings covers an area more or less equivalent to that of the sheet La Habana, scale 1:50000, of the new topographic map of Cuba (Edition 1, 1956). Field and laboratory work was started by BRÖNNIMANN in 1952, but was done mainly by RIGASSI and BRÖNNIMANN during the years 1957 to 1959. Relevant geological observations were contributed by CH. DUCLOZ, who independently mapped certain parts of the Habana area in the years 1956 and 1957, and by J. P. BAUGHMAN and A. SISSON, who did extensive field work for Esso Standard (Cuba) Inc. east and west of the city of La Habana. Mapping was done on the 6 sheets of the new topographic map, scale 1:20000, into which the 1:50000 sheet La Habana is subdivided, and the results transferred as an interpretive geological map to the 1:50000 sheet (plate II). Some sections were surveyed on a scale of 1:10000, and many detail maps of type localities and other important outcrop areas were prepared on smaller scales. Aerial photographs of the scale 1:40000 were used to trace regional trends, faults and contacts. The sample stations are located on the new topographic map with reference to a system of rectangular coordinates with 1000 m spacing. The coordinates and the numerous detail maps and locality descriptions enable the reader to establish relatively accurately the geographic locations of the sample stations. The new topographic map with its system of coordinates is a major improvement on the unsatisfactory topography of the old Mapa Militar referred to by L. RUTTEN (1939, p. 493) as the factor limiting more than anything else the geological exploration of Cuba. A spot map has been compiled giving the geographic

localities of all of the BRÖNNIMANN (BR) stations and of most of the type outcrops of the formations and members (plate IV). Certain samples collected by BAUGHMAN, SISSON, and DUCLOZ have been made available to us and, where they furnished pertinent information, included in our descriptions.

The Habana area is the steeply plunging western end of an east–west trending uplift which is generally called the Habana-Matanzas anticlinorium. Geomorphologically it shows inversion of relief, the actual uplift being breached and eroded in form of two elongate depressions separated from each other by a tectonic saddle at Hershey and bordered by rim-rocks. The topography is of relatively low relief. River valleys are drowned and erosion is at a minimum in many parts of the Habana area. Good natural outcrops are relatively scarce in comparison with the great number of artificial exposures such as road cuts, quarries, excavations for buildings, etc. The extraordinary construction activity during 1958, in particular road building, enabled us to study many otherwise unavailable exposures. The geologist visiting the Habana area in the future may discover that the here described outcrop pattern has changed at many places through construction work and that even type localities may have disappeared. Intrapolations between outcrops in the core of the anticlinorium where structures are often small and may change rapidly along strike may lead to wrong conclusions. Hence additional field control is required before a geological map can be drawn of the densely overbuilt old part of the city of La Habana, and of the suburbs of Cerro, Luyanó, Víbora, Jacomino, Lawton, etc. Many of the old quarries, in particular in the geologically important Marianao area, are today used as refuse dumps and difficult to investigate. Our work was further impeded by the tense political situation in the second half of 1958 and in 1959, which made it practically impossible to visit outcrops in the vicinity of railroads, bridges and water installations.

Emphasis is put on the stratigraphic description of the sedimentary section up to and including the Cojímar formation. We believe that the here presented stratigraphy will serve as a useful basis for future geological work in the Habana area and adjoining regions. The stratigraphy of the post-Cojímar beds was not studied in the same detail and referred to in a general way only in the chapter on the stratigraphic summary. The petrographic treatment of the igneous rocks is outside the scope of our work. It is our understanding that a comprehensive account of igneous and metamorphic rocks will be published in the near future by M. VUAGNAT, Geneva, who completed in the summer of 1959 an island-wide field investigation of igneous and metamorphic rocks, in particular of the serpentines. Only general remarks are made on the tectonics of the Habana area, because one of us (D.R.) is at present writing a paper on the tectonic features of Cuba and on the mechanics of the Cuban orogeny based on observations gathered not only in the Habana area but throughout the island.

The lithologic terminology of WILLIAMS, TURNER, and GILBERT (1955) was used in general, and the colors of the rocks were determined with the Rock-color Chart of the U.S. National Research Council (1948). The classification of the clastic calcareous sediments of the Habana group follows the generally accepted size-range subdivisions with the exception of the calcirudites in which, for practical reasons, average grain sizes of about 700 μ were already included.

The samples are consistently described by a brief megascopic lithologic characterization followed either by the enumeration of textural features and organic elements or by the listing of diagnostic fossils obtained from the washed residues. As this paper is essentially a geologic-stratigraphic study, no attempt was made to furnish complete lists of fossils, elements of which are arranged not alphabetically but rather in order of abundance and/or stratigraphic significance. However, particular attention is given to biostratigraphically significant microfossils on which the zonal subdivisions are based, such as planktonic Foraminifera and discoasterids. Reference is made to the description of some of the discoasterids of the Habana area by BRÖNNIMANN and STRADNER (1960). Zones established on planktonic forms are correlated with assemblages of characteristic and in the field easily recognizable benthonic Foraminifera. With the exception of the echinoderms little is known of megafossils in our area. In future, considerable attention should be given to the collecting of megafossils which are absolutely necessary for the relative dating of the post-Cojímar formations.

For a brief review of the geological literature of the Habana area, the reader's attention is directed to the introductory chapters of the papers by R. H. PALMER (1934), and J. BRODERMANN (1940) and P. J. BERMÚDEZ (1952).

DEPOSITORY OF MATERIAL

The microfaunal material from the BR (BRÖNNIMANN) and the here described DUCLOZ stations is deposited in the Museum of Natural History, Basle; that referring to BAUGHMAN and SISSON stations is in the collections of Esso Standard Oil, S. A. Megafossil collections and the illustrated planktonic Foraminifera are deposited in the United States National Museum, in Washington, D.C. A complete set of the lithologic samples is in the collections of Esso Standard Oil, S.A., and another one in the Museum of Natural History, Basle. H. STRADNER, Klosterneuburg, Austria, has in his collection a set of Tertiary *Discoaster* samples.

ACKNOWLEDGMENTS

We are indebted to the Standard Oil Company (New Jersey) for the permission to publish this paper, and to the management of the exploration department of Esso Standard Oil, S.A., for the use of laboratory and drafting facilities. Much is owed to our colleagues J. P. BAUGHMAN, CH. DUCLOZ, M. KOZARY, A. SISSON, G. STOBER and M. VUAGNAT, who contributed field observations, material, ideas, and criticisms and were our companions on field trips. For the identification of fossils and petrographic descriptions of igneous rocks we are pleased to acknowledge the cooperation of G. C. AMSTUTZ, La Rolla, U.S.A.; W. A. VAN DEN BOLD, Baton Rouge, U.S.A.; J. P. BECKMANN, Teheran, Iran; W. S. COLE, Ithaca, U.S.A.; C. W. DROOGER, Utrecht, Holland; S. HANZAWA, Sendai, Japan; H. H. HESS, Princeton, U.S.A.; H. PURI, Tallahassee, U.S.A.; H. STRADNER, Klosterneuburg bei Wien, Austria; and W. P. WOODRING, Washington, D.C., U.S.A. Mrs. MARIA LUISA ROBLES RAMOS, Mexico City, Mexico, very kindly furnished material from Mexican type localities. We also included faunal assemblages from Cuban localities donated by the late W. H. GRAVELL. Special thanks are due to W. H. BUCHER, New York,