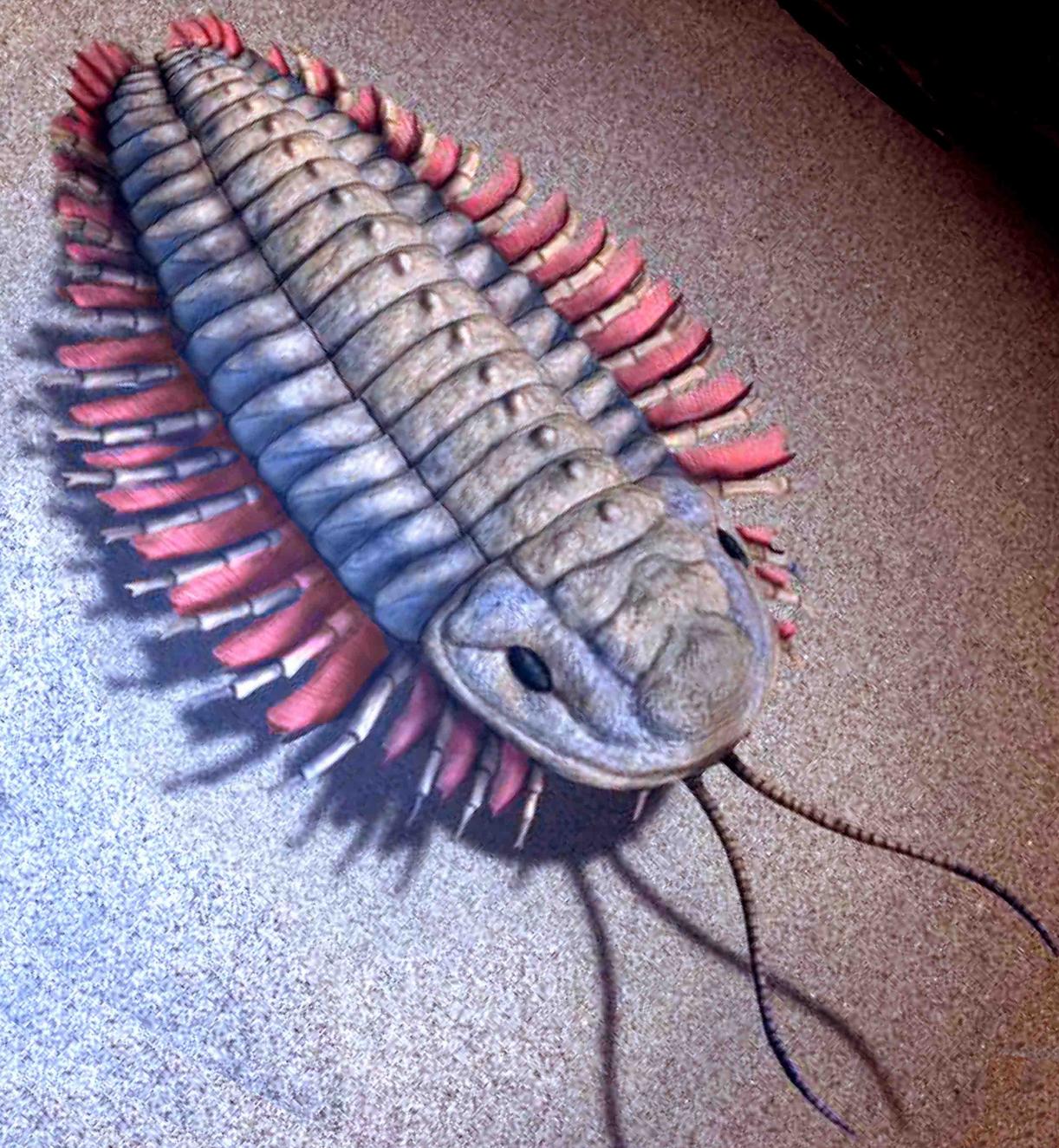


Fossil News

The Journal of Avocational Paleontology



Vol. 20.2—Summer 2017

Cuba's Madruga Formation

Mogotes and Cenozoic Secrets

The best-known Cuban fossils (Oxfordian ammonites and giant marine reptiles) come from a place 180 kilometers to the west of the city of Havana, in the Viñales Valley, the most famous karstic valley in Cuba and one of the most beautiful landscapes in the world. In the eastern portion of Mayabeque Province, ~~on Cuba's northwest coast~~, however, very interesting fossils have also been found near the town of Madruga. Although the Madruga area yields fossils preserved in Late Cretaceous, Paleocene, Miocene, and Pleistocene rocks, only a few papers have been dedicated to their study and investigation over the last few decades.

How Old Are Madruga Formation Fossils?

According to Manuel Iturralde-Vinent, past president of the Cuban Geological Society:

The oldest rocks known in Madruga are the serpentinites, greenish-blue rocks that commonly form small hills and which originated more than 100 kilometers deep in the upper mantle of the Earth. Rocks of the Cretaceous Period are also exposed around Madruga, formed when reptiles, especially the dinosaurs, dominated our planet. These ancient rocks constitute the remains of volcanic islands that existed more than seventy million years

ago in the Pacific Ocean. Continental drift brought them here, to what is now Cuba.

The fossils from the Late Cretaceous that have been found in Madruga are rudists (*Durania*, *Biradiolites*, and *Praebarretia*), a strange group of extinct mollusks that attached their shells to the ocean floor; spatangoid echinoids (*Cardiaster palmeri*, *Hemiaster madrugensis*, and *Hemiaster siboneyensis*); scaphopods (*Hamulus*); brachiopods (*Orthothyris radiata*, *Terebratulina* spp., *Cruralina cubensis*, and *Dyscritothyris cubensis*); and fairly common foraminifera (*Bulimina madrugensis*, *Operculina bermudezi*, and *Vaughanina cubensis*).

The rocks on which most of the town of Madruga itself was founded are classified by geologists as belonging to the Madruga Formation. They represent a piece of Tertiary (Paleocene) history. Iturralde-Vinent, who directed the geological investigation of the area at the end of the 1970s, explains:

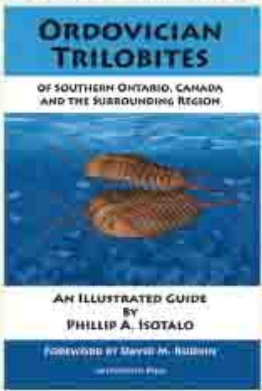
The type locality of the Madruga Formation was located in a roadcut on both sides of the central highway under the railroad bridge of the central Boris Luis Santa Coloma at the entrance of the town of Madruga. Studies indicate that



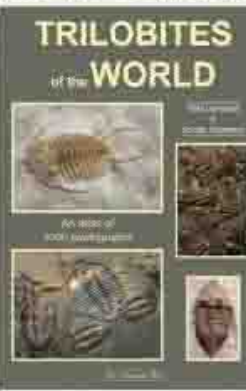
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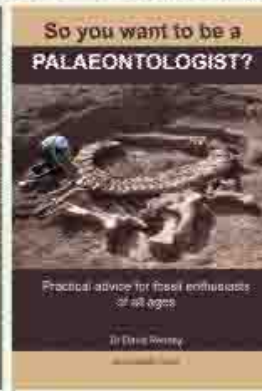
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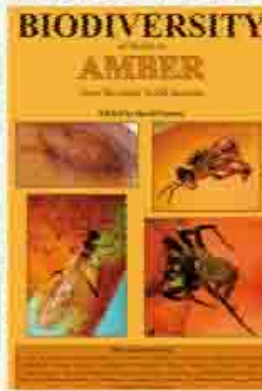
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Life-restoration of Cenozoic vertebrates from Madrugá. A) Giant ground megalonychid sloth B) Ancient woodpecker C) Cuban red macaw, *Ara tricolor* D) The Cuban giant owl, *Ornimegalonyx*. Art ©Dmitry Bogdanov. Used by permission.

those rocks have about sixty to sixty-four million years old and were formed at the bottom of the primitive Caribbean Sea, when Cuba did not yet exist, at a depth of than 300 meters.

The Madrugá Formation is a sequence of shales, sandy shales, and fine radiolarian sandstones that irregularly conserve calcareous cement. The formation is difficult to observe in places today because the original roadcut (already deteriorated) is covered with vegetation.

In Iturralde-Vinent's view, when the brown earth of the cut is washed and filtered, it yields a fossiliferous residue that today still manifests a rich and varied small marine fauna of Late Paleocene exotic foraminifera (*Eponides vanbelleni*, *Cibicides madrugensis*, *Boldia*

madrugensis, *B. cubensis*, *Anomalina madrugensis*, *Valvulineria madrugensis*, and *Gyroidina madrugensis*); radiolarians, brachiopods, mollusks, and echinoderms from little more than sixty million years ago. Using foraminifers (*Marginulina tuberculata*, *Dentalina gardnerae*, *Bullopore chapmani*, *Siphogenerinoides eleganta*), paleontologists correlated this Paleocene assemblage with similar fauna from Alabama, Texas, Arkansas, Illinois, and Mississippi.

A Complex Geologic History

Between fifteen and twenty-five million years ago, Madrugá lay beneath the sea, though the waters between Mayabeque Province and Isla de la Juventud (~~the modern-day Gulf of Batabona~~) were shallower than they are today. During that time, remains

of corals, mollusks, algae, and calcareous microorganisms became fossilized, later forming the rocks of the Sierra del Grillo mountains. Those seas were also infested by the giant extinct shark *Carcharodon megalodon*, whose enormous teeth sometimes appear among the red soils of the plain. This occurrence is probably related to the existence of a Lower-Middle Miocene water channel across western Cuba that connected the Atlantic Ocean with the Caribbean Sea.

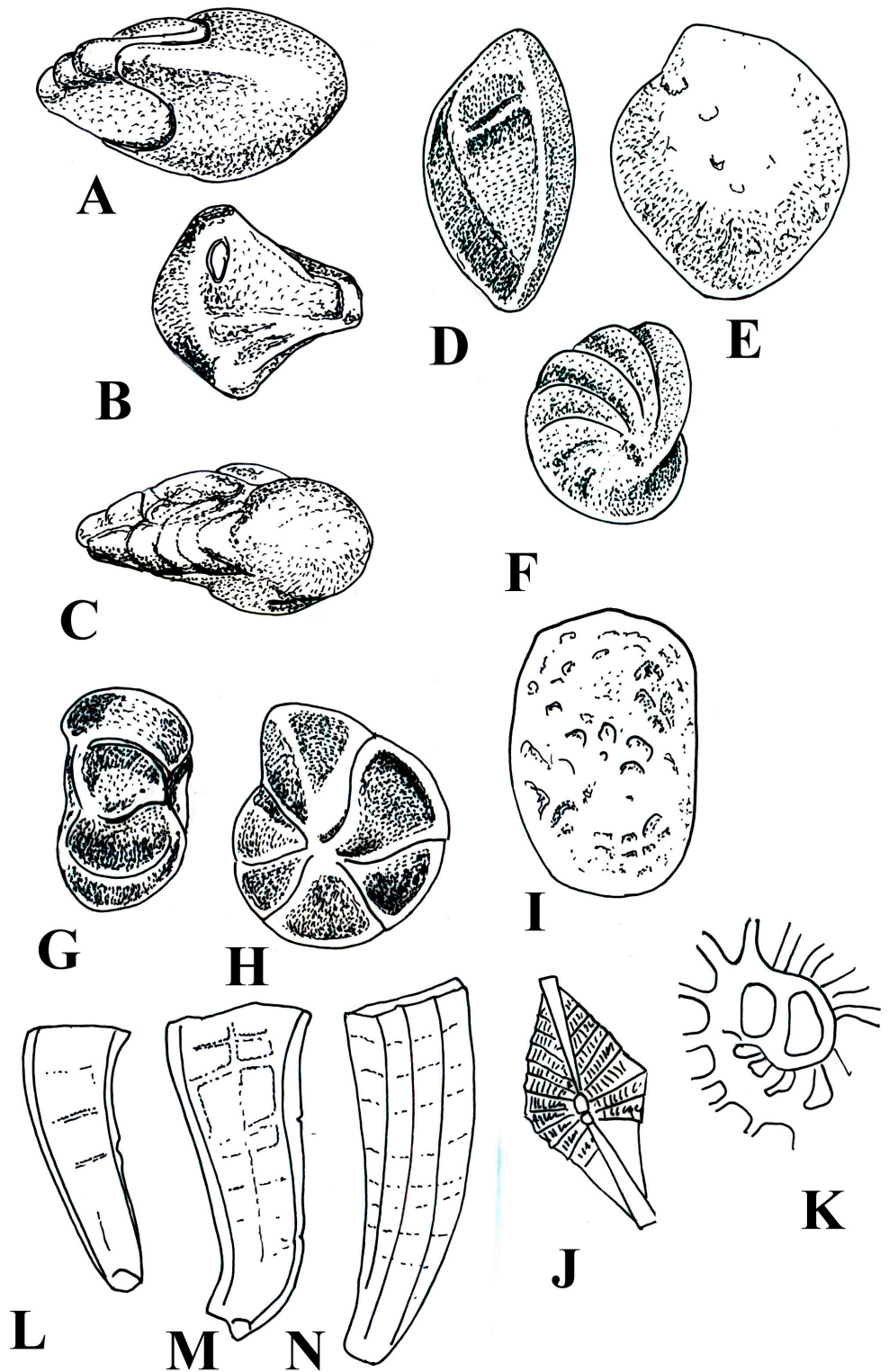
Throughout its geologic history, this territory also experienced great cataclysms that brought rocks to the surface that had lain many kilometers deep. These forces elevated the serpentinites, formed the island of Cuba, and shaped the Sierra del Grillo mountains as well as the landscape that today surrounds the area where the town of Madrugá is

situated. Long before European colonizers arrived, aboriginal natives lived in these lands, and long before humans occupied Cuba, plant-eating mammals as large as bears had arrived from South America. These ancient mammals included the giant Caribbean ground sloths *Megalocnus*, *Parocnus*, and many others, which disappeared as recently as 4,200 years ago. At the beginning of the twentieth century, the famous Cuban naturalist Carlos de la Torre y Huerta, who took his vacations in Madruga, found fossil remains of these animals in the Sierra del Grillo.

After the hills of the Sierra del Grillo formed, acidic rain-water penetrated into the pores and cracks of these rocks and opened caverns of different magnitudes under the surface. Water accumulated underground in those caverns, and today those waters are extracted by means of wells. In prehistoric times, near the caverns in the mogotes (steep-sided residual hills of limestone or marble) small rodents that lived there were hunted by large predatory owls such as *Ornimegalonyx*, the Cuban giant owl. Also present in that early Eden were beautiful birds such as *Ara tricolor* (Cuban red macaw), and ancient woodpeckers.

The area near the Sierra del Grillo has produced water as well as petroleum, and its springs of sulfurous water are also known for their medicinal properties. Madruga's complex pre-history has left a legacy of fossil and geologic treasures that have transformed the area into an excellent site for scientific tourism.

— Yasmani Ceballos Izquierdo & Tracy Lee Ford



Marine fossils from Madruga: A-C) Late Cretaceous foraminifers, Bulimina madrugensis; D-E) Eponides vanbelleni, in peripheral and dorsal view; F) Valvulineria madrugensis in dorsal view; G-H) Gyroidina madrugensis in ventral and peripheral view; I) Coleites reticulosus in dorsal view; J) Vaughanina cubensis; K) Late Cretaceous Operculina bermudezi, early chambers of a megalospheric specimen; and L-N) the Late Cretaceous rudist bivalves, Biradiolites, a few centimeters in length. Art ©Tracy Lee Ford. Used by permission.