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III
**THE MARINE MIOCENE DEPOSITS OF
NORTH COLOMBIA**

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This paper is offered as a preliminary note on the Miocene section of northern Colombia, concerning which a more complete discussion will be furnished later. The section is the somewhat incomplete series occurring near Puerto Colombia at Tubera Mountain, Usiacuri, and neighboring points.

Its aggregate thickness at Tubera Mountain is near 2800 feet, which has been divided into a number of horizons, or stages, some of which are fossiliferous. In the following tabular outline they are designated by letter:

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| T,—Top of section, not locally represented..... | 2,650 feet |
| S,—Soft, medium-grained sandstone at the top of Tubera Mountain | 450 " |
| R,—Soft yellowish sandstone at Tubera village, containing numerous fossil Mollusca..... | 350 " |
| Q,—Sandstones and shales..... | 350 " |
| P,—Fossiliferous gray, sandy shale, northwest slope of Tubera Mountain | 400 " |
| O,—Sandy shales and soft incoherent sandstone with feruginous layers | 400 " |
| N,—Gravelly sandstone, hard in part, with species of Turritella, Spondylus, and other forms..... | 550 " |
| M,—Blue or gray shales..... | 50 feet |
| soft shaly sandstone, and pebbly beds, conglomerate, etc..... | 250 " 300 " |

Total, 2800 feet
January 31, 1927

The most fossiliferous stage is "M", of which a brief account will be given here on account of its special position and faunal character.

Beneath "Stage M" there are clay shales, sandy shales and hard cherty beds occurring near Las Perdices and other points, the thickness of which is not known beyond a few hundred feet. It contains a few species of Mollusca, bone fragments and scales of fishes, sponge spicules and numerous species of Foraminifera.

Dr. G. Dallas Hanna has made a preliminary examination of these shales and has offered the following notes:

"The shales contain a very considerable number of fossils, the groups being represented about as follows in order of abundance: (1) Radiolaria; (2) Diatomaceæ; (3) Foraminifera; (4) Sponges; other organisms are scarce. There has been pyritization to a considerable extent and many of the chambers of the fossils are filled with iron sulphide. A great many of the diatoms have been replaced entirely and internal casts of the frustules are abundant. *Coscinodiscus* was the only genus definitely identified in this group. Many of the genera and some of the species of Radiolaria are the same as have been found in the famous deposit on Barbados Island¹ and which Payne² has put definitely in the Miocene. Some of the genera are: *Stylodictya*, *Histiastrum*, *Stylosphæra* and *Eucyrtidium*. Foraminifera are scattered rather sparingly through the mass of the material, the common genera being: *Globigerina*, *Orbulina*, *Lagena*, *Truncatulina*, *Cassidulina*, *Nodosaria*, *Anomalina*, *Frondicularia*, *Plectofrondicularia* and *Bolovina*. It is believed that these organisms offer a means whereby a definite correlation can be made with strata of known age elsewhere. This preliminary examination indicates that the formation lies very close to the base of the Miocene, if, in fact, it is not the lowermost part of the sediments of that period."

"Stage M" is in part a coarse pebbly sandstone, often forming conglomerate near the base, and quite fossiliferous, including many heavy-shelled species and littoral forms not found higher up in the section. Some of the slaty pebbles at the base have been perforated by boring molluscan species, which fact, taken together with the character of the fauna itself, shows this horizon to have been deposited near shore, and the character of the pebbles indicates that the shore formations were such as have been described for underlying rocks.

¹ See Ehrenberg, Fortsetzung der mikrogeologischen Studien als Gesamt-Uebersicht der Mikroskopischen Paläontologie gleichartig analysirter Gebirgsarten der Erde, mit specieller Rücksicht auf den Polycystinen-Mergel bei Barbados. Abhand. k. Akad. Wissensch. Berlin, 1875 (1876), pp. 1-226, pls. 1-30.

² *Liostephania* and its allies. London, 1922, p. 21.

From the foregoing statements it would appear that "Stage M" rests unconformably upon these formations, but as to whether the latter group may not also be a part of the Miocene series has not hitherto been known. "Stage M" is believed to be older than any other similar group of the Miocene in Colombia, and since it is found at Punta Pua east of Cartagena, and at other places still more distant, its occurrence is not local, and its fauna is characteristically littoral, as already stated.

This stage is undoubtedly older than the Gatun group as found at the spillway of the Canal, though probably not older than some of the beds placed in the Gatun group by other writers. In Costa Rica Olsson has described Miocene beds thought to belong to the Gatun group, but older than those occurring near Gatun. They may be contemporaneous with "Stage M" of the Colombian section, and if so, both should also be correlated with the Cercado stage of Santo Domingo (Maury), which is probably older than the Gatun group of the Canal Zone.

Some of the more characteristic species from "Stage M" are included in the following list:

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| <i>Antigona caribbeana</i> n. sp. | <i>Cypraea henekeni</i> Sowerby |
| <i>Arca veatchi</i> Olsson | <i>Conus molis</i> Brown & Pilsbry |
| <i>Arca</i> rel. <i>chiriquiensis</i> Gabb | <i>Architectonica gatunensis</i> Toula |
| <i>Arca</i> (<i>Scapharca</i>) <i>auriculata</i> Lam. | <i>Natica cuspidata</i> Guppy |
| <i>Cardium</i> (<i>Trachycard.</i>) <i>lingualeonis</i> | <i>Natica guppyana</i> Toula |
| Guppy | <i>Mitra henekeni</i> Sowerby |
| <i>Cardium</i> (<i>Laevicard.</i>) <i>dalli</i> Toula | <i>Strombus pugiloides</i> Guppy |
| <i>Glycymeris jamaicensis</i> Dall | <i>Strombus gatunensis</i> Toula |
| <i>Glycymeris lloydsmithi</i> Brown & Pilsbry | <i>Terebra</i> rel. <i>haitensis</i> Dall |
| <i>Mactrella</i> (<i>Harvella</i>) <i>elegans</i> Sow. | <i>Terebra bipartita</i> Sowerby |
| <i>Pitaria cercadica</i> Maury | <i>Terebra gatunensis</i> Toula |
| <i>Raeta gibbosa</i> Gabb | ³ <i>Turritella abrupta</i> (Spieker) |
| <i>Spondylus bostrychites</i> Guppy | <i>Turritella altilirata</i> Conrad |
| <i>Spondylus</i> cf. <i>gumanomocon</i> | <i>Turritella planigyrate</i> Guppy |
| Brown & Pilsbry | <i>Petalocochus domingensis</i> Sowerby |
| <i>Venericardia brassica</i> (Maury) | <i>Serpulorbis papulosa</i> Guppy |
| | <i>Carcharodon</i> cf. <i>rectus</i> Agassiz |

³ Spieker has described as a variety of *T. robusta* Grzy. a form which he calls var. *abrupta* from the Zorrillos formation of Peru. (See Johns Hopkins University Studies in Geology, No. 3, 1922, p. 85, Pl. IV, fig. 6.) The Colombian species is probably identical with this, which can be distinguished from *T. robusta* Grzy., not Gabb (= *T. supraconca* Hanna & Israelsky, 1925).