production from the Devonian lime has been unsatisfactory in Indiana because of the non-permeable character of the reservoir rock. The only important production from this horizon in the region is in the Martinsville pool in Clark County, Illinois, about 25 miles west. The oil discovered in the Indiana field is of 47° gravity and yields 56 per cent gasoline on straight distillation.

A second pool of importance has been developed near the town of Francisco, and about 6 miles east of Princeton, in Gibson County, Indiana. Mann and Huber of Evansville, Indiana, following the recommendations of Gail F. Moulton in a private report, drilled a new test north of some older small wells, and found 150 barrels initial production. Since that time, three other wells have been completed, the best of which produced 150 barrels per day, on an average, for the first two months after being put on the pump.

The production in the Francisco pool is obtained from a Chester sand, which, according to the correlations of the Indiana Geological Survey, is the Sample sand. This sand is reached at a depth of 1,400 feet, and produces a heavy oil of about 28° A.P.I. gravity.

The oil sand is very open and continuous in this field, a condition not generally found in this part of the country. The fold on which the production is obtained is likewise somewhat more pronounced than any others which have yet been described for the general region. The principal operating difficulties are to keep from ruining the wells by drilling too deep into water, and to separate the oil when water is produced with it.

Four new wells are now producing, and four more drilling. The present production of this pool is more than 300 barrels, or more than one-eighth of the total for the state of Indiana.

The Vigo-Sullivan County pool together with the Francisco pool are principally responsible for the increase in production in Indiana this year.

GAIL F. MOULTON

STATE GEOLOGICAL SURVEY, URBANA, ILLINOIS

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MARINE EOCENE DEPOSITS ON THE EAST SLOPE OF THE VENEZUELAN ANDES[1]

Dr. N. H. Darton, of the United States Geological Survey, recently collected on the east slope of the Venezuelan Andes specimens of a dark-colored partly crystalline limestone that carries Foraminifera of Eocene

[1] Published with the permission of the director, U. S. Geological Survey, and of the director, exploration department, Sinclair Consolidated Oil Corporation.

age. This material was collected half a mile southeast of the village of Masparito, or about 12 miles east of Calderas, in the state of Zamora (U. S. Geol. Survey locality 1/1189). On Jahn's geologic map of Venezuela[1] this locality would fall almost due north of Barinas near the eastern edge of the area mapped as schist and gneiss. This Eocene limestone is a thin bed lying near the base of a thick series of shales overlying a quartzite. Additional float material was collected on Rio Arana, west of Calderas. The collection of float limestone also contains specimens of a dark-colored Carboniferous *Productus*-bearing limestone that in gross features is surprisingly similar to the Eocene limestone. So far as known, this record, which is made available through the kindness of Dr. A. C. Veatch, is the first one of Eocene deposits in the drainage basin of the Orinoco. The float material also establishes the presence of Carboniferous limestone in the Venezuelan Andes. Heretofore, Carboniferous beds have not been reported north of Peru and the Amazon Valley in eastern Brazil.

The Foraminifera include a "*Nummulites*," a stellate "*Orthophragmina*," and a *Lepidocyclina*. The megalospheric form of the *Lepidocyclina* belongs to the subgenus *Pliolepidina* and represents *L. panamensis* Cushman[2] or a very similar species. Vaughan[3] suggests that *L. panamensis* is a synonym of *Pliolepidina tobleri* Douvillé,[4] which is based on material from Trinidad. Douvillé has never published figures showing the shape and exterior of *tobleri* and, therefore, it is not entirely recognizable. *L. tobleri* is the monotype of *Pliolepidina* Douvillé. When this name was first proposed in 1915 "*Pliolepidina* sp." was the only species assigned to it. In Douvillé's 1917 paper there is no indication that *Pliolepidina tobleri* is the "*Pliolepidina* sp." of 1915. Strictly speaking, the status of *Pliolepidina* was not fixed until the 1924 synonymy was published.

The Venezuelan *Lepidocyclina*, like *panamensis* and *tobleri*, has an unusually large nucleoconch, or embryonic shell, which in vertical sections appears rectangular and is composed of one or several chambers, depending on the plane of the section, one of which generally is extraordinarily large. A microspheric form, assumed to represent the same species, is more abundant and larger. Its test is very thick, and many lateral cham-

[1] Alfredo Jahn, *Esbozo de las formaciones geológicas de Venezuela* (1921), 108 pp., map (1:2,000,000), Caracas.

[2] J. A. Cushman, *U. S. Nat. Mus. Bull. 103* (1918), pp. 94–95, pl. 39, Figs. 4, 6.

[3] T. W. Vaughan, *Bull. Geol. Soc. Amer.*, Vol. 35 (1924), pp. 796, 797.

[4] H. Douvillé, *Compt. Rend. Acad. Sci.*, Vol. 161 (1915), pp. 727–28, Fig. 34; *Compt. Rend. Acad. Sci.*, Vol. 164 (1917), pp. 843–44, Figs. 5–6; *Mem. Soc. Géol. France*, N. S., Vol. 1, Mem. No. 2 (1924), pp. 43–44, Figs. 34–35.

bers are piled one on top of the other in vertical series. In both forms rather slender pillars, which may not reach the surface, lie between the lateral chambers.

Precisely the same couple of megalospheric and microspheric forms, both of which are very striking, are found together in the Caribbean coastal region of Colombia in beds that are considered of middle Eocene age. H. Hodson[1] records similar macrospheric forms from an unnamed locality in the Maracaibo basin. Tobler[2] has described a remarkably similar couple (*Lepidocyclina [Pliolepidina?] luxurians* Tobler) from southern Sumatra. This species is very similar to specimens from Venezuela and Colombia, but the pillars are less developed. Douvillé, and H. Hodson following Douvillé's suggestion, thought that these specimens with relatively enormous nucleoconchs might be monstrosities, but, as they have now been found on the Pacific coast of Panama, at many places in Colombia, in the Maracaibo basin, on the east slope of the Venezuelan Andes, in Trinidad, and in Sumatra, it is safe to assume that the development of these unusual nucleoconchs is a normal character. Many of the Colombian specimens on which the peripheral flange is broken off have a nucleoconch that is almost as wide as the entire umbonal part of the test.

The type material of *L. panamensis* is represented by Figure 6 of Plate 39 in *Bulletin 103* of the United States National Museum. It was collected near the mouth of Rio Tonosi, Los Santos Province, on the Pacific coast of Panama (U. S. Geol. Survey station 6586*e*). This locality probably represents the middle Eocene beds that extend far up the valley of Rio Tonosi. These beds and upper Eocene deposits in Chiriqui Province, Panama, carry the only Eocene mollusks, still undescribed, that have so far been collected between Peru and Lower California. A microspheric form at the type locality of *panamensis*, incorrectly identified by Cushman as *L. duplicata* Cushman, resembles the microspheric forms associated with the *panamensis*-like megalospheric form in Colombia and Venezuela. It is doubtful whether any of Cushman's other localities for *panamensis* can be accepted. According to Vaughan,[3] the "*panamensis*" from U. S. Geol. Survey station 6523 (recorded as 6512 in text; Pl. 39, Figs. 1–3, 5, Pl. 42), which represents an upper Eocene limestone 2 miles north of David, Chiriqui Province, Panama, is the macrospheric form of *L. duplicata* Cushman, the type specimen of which is from this locality. It has not yet been possible to confirm Cushman's record of *panamensis* from U. S.

[1] H. Hodson, *Bull. Amer. Paleont.*, Vol. 12, No. 47 (1926), pp. 27–28.

[2] A. Tobler, *Eclogae Geol. Helvetiae*, Vol. 19, No. 1 (1925), pp. 269–74, Pl. 8, 1 fig.

[3] T. W. Vaughan, *Bull. Geol. Soc. Amer.* Vol., 35 (1924), p. 796 N.

Geol. Survey station 6587, another locality near the mouth of Rio Tonosi, from which Vaughan[1] recorded middle Oligocene corals. There are two sets of *Lepidocyclina*-bearing beds in this region, and the one carrying a species that externally resembles *L. gigas* Cushman and *L. forresti* Vaughan may represent the same horizon as 6587. Cushman also doubtfully recorded *panamensis* from the Culebra formation and Emperador limestone, but these records were not based on sections. In Panama *panamensis* probably is confined to middle Eocene beds instead of occurring in "lower, middle, and upper Oligocene deposits"[2] or in "Oligocene?",[3] as Vaughan was led to believe.

L. duplicata Cushman,[4] which is found in the upper Eocene limestone of Chiriqui Province on the Pacific coast of Panama, also is a *Pliolepidina;* at all events the macrospheric form identified by Vaughan as representing *duplicata* is a *Pliolepidina.* This species instead of *panamensis* may be a synonym of *tobleri.* So far as the development of pillars is concerned, the macrospheric form of *duplicata* resembles the East Indian *luxurians. L. duplicata,* the type of which is a microspheric form, is the type by original designation of *Multicyclina* Cushman.[5] Inasmuch as the development of several layers of equatorial cells toward the periphery, which was regarded as the characteristic feature of *Multicyclina,* is found in many species, this name has been disregarded. *Multicyclina,* based on a microspheric form, seems to be a synonym of *Pliolepidina,* which was based on a megalospheric form. It is apparent that under different conditions this situation could be a fruitful source for nomenclatorial dispute.

In tropical America species of *Pliolepidina,* similar to the one collected on the east slope of the Venezuelan Andes, are found in both middle and upper Eocene deposits. The Point Bontour beds on the island of Trinidad that carry *L. tobleri* are of upper Eocene age,[6] though they were first called "Stampian" by Douvillé. They also carry a stellate "*Orthophragmina,*" *Cisseis asteriscus* Guppy, a group that so far as known occurs only in upper Eocene deposits in America, but in Europe it also is found in the middle Eocene. Stellate "*Orthophragminas*" have been found in the float material

[1] T. W. Vaughan, *U. S. Nat. Mus. Bull. 103* (1919), pp. 207, 555.

[2] T. W. Vaughan, *U. S. Nat. Mus. Bull. 103* (1919), p. 555.

[3] T. W. Vaughan, *Bull. Geol. Soc. Amer.,* Vol. 35 (1924), p. 797.

[4] J. A. Cushman, *U. S. Mus. Bull. 103* (1918), p. 96, Pl. 39, Figs. 1–3, 5, Pl. 41, Figs. 2–4, Pl. 42.

[5] J. A. Cushman, *U. S. Nat. Mus. Bull. 103* (1918), p. 96.

[6] See G. D. Harris, *Johns Hopkins University Studies in Geology,* No. 7 (1926), pp. 101–4.

that Darton collected. Therefore, this *Pliolepidina*-bearing limestone is regarded as of upper Eocene age.

In view of the recognized Eocene age of this peculiar Pliolepidine form of *Lepidocyclina* at every locality in tropical America where confirmatory evidence is available, perhaps the assignment of the Sumatra beds carrying *luxurians* to the Aquitanian stage needs confirmation.

W. P. WOODRING[1]

U. S. GEOLOGICAL SURVEY, WASHINGTON, D.C.

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[1] Introduced by L. W. Stephenson.

CORRECTION

Through an editorial error made in the discussion by Charles E. Straub on the "Effect of Gravitational Compaction on the Structure of Sedimentary Rocks," which appeared in the August number of the *Bulletin*, the heading for the column in Table I on page 890 was made to read "Surface Dip per Mile." It should have been "Amount of Surface Dip."