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Naparima rocks, this may be held to be true generally of the oceanic beds. We have to assume therefore a shallower sea and a greater quantity of muddy sediment in this area than in that to the south of Naparima Hill (*See* my Section in Journal of the Geological Society, 1892, p. 522).

From Mr. Wilson I received some additional samples of a hard sandstone which appear to have come from a lower depth than the Orbitoides bed, some 220 feet deep These contain fossils but not in a determinable condition, and the rock is so hard that there is no means of extracting them I believe, however, that these rocks are the very base of the tertiaries or top of the cretaceous. I consider therefore, that the rocks at the Marbela Mine represent the equivalent in time of the whole Naparima series and extend downwards from the Miocene inclusive to the Eocene and top of the cretaceous. They were however deposited in a shallower sea than the true oceanic beds and one wherein the conditions varied somewhat from those.

During the cretaceous period the Amazonian and Orinocan region was occupied by sea as shown by Karsten (Geognostische Verhältnisse des westlichen Columbien), while at the same time a portion of the Atlantic Ocean was occupied by land. As explained in my papers ("Growth of Trinidad" and "Geological Connexions of the Caribean Region,") the sediments of which the rocks of Trinidad are composed were up to the end of the cretaceous period derived from the land which existed to the north and north-east. But upon the close of the cretaceous period and the gradual rise and filling up of the Amazonian and Orinocan region, the sediments now came from the west and south west inaugurating the period of asphaltic and carbonaceous deposits which probably continued throughout the tertiary period.

The origin of the carbonaceous substances is to be found in the vast quantities of vegetable matter brought down by the rivers from the continent of South America. This matter being of a slightly greater specific gravity than water, is subject to the laws which govern the removal and deposition of sediment or clastic material. Now one of these laws is that material of like specific gravity and of like fineness or coarseness of grain or dimensions of the component parts is deposited together and apart from dissimilar materials. Hence the vegetable matter brought down by the rivers was deposited in layers banks or strata becoming interstratified with other sedimentary materials as the process of sedimentation and deposition went on. Chemical changes supervened which converted the vegetable tissues into the forms in which we now find them, namely Lignite, Asphalt, Manjak and Petroleum.

P.S.—Basing my opinion on the theory expounded above, I predicted two or three years ago that petroleum would be found in the deltas or sedimentary formations at the mouths of tropical rivers. The prediction has already been verified in the cases of Nigeria and Tampico.

85.—Preliminary notice of a discovery of Fossils in the Tamana District, Trinidad.

By R J. Lechmere Guppy.

Mr. P. W. Jarvis of the Colonial Bank, has been kind enough to furnish me with some samples of fossiliferous rock from Machipur near Montserrat in the Tamana district. These samples are an indication of the richness of that locality in fossils, and no doubt many remarkable and interesting deposits will be found in the district. The present collection contains corals so highly altered by fossilization as to be scarcely determinable. They are like some of those described by P. M. Duncan from West Indian localities, and better specimens may hereafter be found admitting of specific determination Most of the specimens are a coral limestone, and in the interstices of this is found a calcareous sandy deposit containing numerous foraminifera polyzoa and echinoderm remains, none of which are in a state for identification except one foraminifer, namely *Amphistegina*, and this occurs abundantly, but of small size. The most interesting fossil is a crab, of which I append a description. Among molluska there is an olive and a concentrically-ribbed bivalve which might be a Venus, but the hinge and interior are not visible. A small imperfect bivalve seems to be a *Limea*.

Ranina cuspidata.—New Species.

The Carapace is rather evenly convex and the general contour is almost circular, antero-lateral angles being formed by four flattened acute spines pointing outwards beyond the general outline of the Carapace. These spinose projections are somewhat similar to the foliaceous expansions of *R. palmarea* from which they differ in pointing outwards instead of forwards. The median portion of the Carapace is formed by a round carina which is separated off by moderately deep grooves from the lateral portions, thus dividing the back into three parts, the median part bearing a single row of distant, low, but acuminate tubercles; and each lateral portion two rows of similar tubercles somewhat irregularly arranged. The length of the specimen is about 5 centimetres by $4\frac{1}{2}$ centimetres in extreme width.

A specimen of *Ranina* collected by me from the Naparima rocks was described by my friend Dr. Henry Woodward, F.R.S., in 1866, under the name of *R. porifera*, (Jour. Geol. Soc., Vol. XXII, p 591.) Dr. Woodward gave a list of all the species of Ranina then known to him, eleven in number, of which ten were fossils from tertiary deposits, and the remaining one is a living species found in Japanese and Eastern seas. I am not aware of any additions having been made to Woodward's list. I am unable positively to allege that our present species is different from that described by Woodward, inasmuch as in the latter the superficial characters of the Carapace are preserved whereas in the present specimen the shell has disappeared. *R. porifera* also lacks the frontal margin so that we do not know what the form

of it was, while in *R. cuspidata* the frontal margin is almost perfect. Further, the dorsal surface of *R. porifera* is free from tubercles.

The occurrence of *Ranina* in the tertiary rocks of Trinidad is another fact to be added to those noticed in my Paper on the "Geological Connexions of the Caribean Region," showing the probable connexion by sea between the Caribean Sea and the Pacific Ocean at a former epoch.

The concentrically-ribbed bivalve referred to in the foregoing Paper is probably *Venus blandiana*, Guppy, (Proc. S. A. Trin., 1873, page 85, Pl. II, F. 8; Geol. Mag. 1874, Pl. XVII, F. 8). It is said by Dall (Florida Fossils, Part VI. page 1277) to be like his *Cytherea strigilina*, but I do not know that species. It is like *V. versatilis*, Dolf., Faluns of Touraine (Journ. Conch. 1888, Pl. XII. F. 4).

Explanation of the Plate.

Tertiary Fossils, Trinidad.

Fig. 1.—Ranina cuspidata—Machipur Tamana, Trinidad.

Figs. 2–3.—Orbitoides dispansus—Bontour Point, Naparima, Trinidad.

„ 4–6.—Orbitoides dispansus—Marbela Manjak Mine.

Extract from the Experiment Station Record U. S. A.

86.—America's amazing agricultural advance.

Statistics of agricultural wealth production, value of farm property, and of population engaged in agriculture during the years 1870 to 1908, inclusive, are presented and discussed in this article.

The increase in value of farm products is shown by the statement that "in the 20-year period between 1870 and 1890 the gain was only $500,000,000; in the 30-year period between 1870 and 1900 the gain was only $2,800,000,000; whereas in the 8-year period from 1900 to 1908 the gain was $3,300,000,000, or $500,000,000 more than for the 30 years from 1870 to 1900." In 1907 the value of farm products raised was $7,412,000,000, the value of all farm property $28,077,000,000, and the number of people engaged in or dependent on agriculture 11,991,000. The great increase in wealth production is attributed to the rapid growth in scientific farming.

87.—Agricultural Research—Methods reviewed.

In a preface to a recent issue of the Experiment Station Record (U. S. A.) the Report of the Commission on Agricultural Research is Editorially reviewed; and the following paragraphs are reproduced here as they contain very valuable suggestions:—

"(1) The development of research effort has not been symmetrical and logical. Adequately trained men have not been provided in sufficient numbers to expend in the way of capable investigation the entire amounts of national and state appropriations that have been applied to agricultural research. This is one of the reasons why the more difficult agricultural problems have so largely remained untouched. . . .

1. Ranina Cuspidata. 2-6. Orbitoides Dispansa.

Section XV.—MISCELLANEOUS.—*Continued.*

"(2.) Many persons nominally holding research positions have been investigators only in name, for their time and energy have been absorbed by other duties. . . .

"(3.) The persistent and widespread promotion of popular education and of public good will has unquestionably had a profound, and not always immediately healthful, influence on the extent and character of . . . agricultural research. . . .

"(4.) The urgent and natural call for results that would produce an immediate and favourable reaction upon the public mind has not only brought about an era of the diffusion, rather than of the acquisition, of knowledge, but has, quite generally, led to the study of problems admitting of prompt conclusions, more particularly problems of a business character directly related to financial benefit, rather than those that are fundamental.

"(5.) As one result of the close association of scientific inquiry and popular education a true conception of real and efficient research has not been fully maintained in the minds of all those engaged in the work of agricultural investigation. The effect of such a situation upon the progress of agricultural knowledge is obvious."

Among the recommendations which in the judgment of the commission, "should guide in the promotion, organization, and prosecution of research in agriculture" and which are regarded "as essential to bringing about the conditions that all friends of agricultural progress desire to see established," are the following:—

"(1.) Every effort should be made to promote the training of competent investigators in agriculture both in the agricultural, and, so far as practicable, in the non-agricultural, colleges and universities, and their training should be as broad and severe as for any other field of research.

"(2.) The progress of agricultural knowledge now demands that agricultural research agencies shall deal as largely as possible with fundamental problems, confining attention to such as can be adequately studied with the means available.

"(3.) The work of research in agriculture should be differentiated as fully as practicable, both in the form of organization and in the relations of the individual investigator, from executive work, routine teaching, promotion, and propaganda, and should be under the immediate direction of an executive trained in the methods of science who should not be hampered by other duties of an entirely unlike character.

"(4.) The investigator should be free from all coercion whatever. In reaching his conclusions he should be equally free from the prescription of received opinion and the temptation to exploit his results for the purpose of obtaining future support.

"(5.) Any research agency charged with a single main line of investigation should be so organized that it may employ within itself all necessary processes in any branch of science. The co-operation of any or all of the departments of an Experiment Station on a single problem, when necessary, should be a fundamental requirement."

The report of the Standing Committee of the association on station organization and policy dealt with several of the matters discussed in the Commission's report, but in a somewhat more specific way. Like those of previous years, it was to a large extent based upon the concensus of opinion of station men as to the most practicable means of securing the highest efficiency in station work.

The report points out certain defects of administrative organization which still prevail to some extent and defines the functions of administration as related to research, as follows:—

"(*a.*) To help to determine in advance whether the proposed research is profitable and altogether advisable from the standpoint of the public, whose representative for the time being the administrative officer must be.

"(*b.*) To assist in determining what lines of experimentation are calculated to throw profitable light upon the problem.

"(*c.*) To help determine whether the work is best carried on by one individual representing a single line of inquiry or by two or more working in conjunction, and if the latter, to secure in advance a complete understanding as to mutual duties, rights, and responsibilities. Upon all these points the judgment and the point of view of the administrative officer is not only likely to be broader but certain to be freer from personal bias than is that of the professional investigator.