

THE RIVER PILCOMAYO.¹

THE river Pilcomayo has its source in the Bolivian mountain ranges, and traverses the virgin forests of the Gran Chaco in a south-easterly direction. For nearly two hundred years the idea of utilising this river for purposes of navigation has engaged the attention of the Governments of Argentina, Bolivia, and Paraguay, in order to provide the rich regions through which it passes with an easy means of communication, and to afford an outlet by water for the natural products of the fertile zones of the eastern part of Bolivia.

The author of the report before us, who is a member of the American Society of Engineers, was appointed by a syndicate of capitalists in 1905 to conduct an expedition for the purpose of studying the navigable condition of the river, and reporting as to the possibility of rendering it fit for the passage of boats.

The exploration party consisted, besides the chief, of two assistants, a land and forest expert, storekeeper, and twenty-five men. They took with them for the purposes of transport twenty-two mules, forty-one horses, sixteen oxen, and five boats. Twenty-two bullocks were also taken for food. The expedition occupied four months.

The country traversed appears to be sparsely inhabited by Indians who, on the whole, are friendly. A colony has been established at Buena Ventura, about 560 miles up the river, which contains thirty families of colonists, with a total population, including servants, "intruders," and squatters, of 1000 souls. There are also in the district some Roman Catholic mission stations.

The river Pilcomayo discharges into the Paraguay, the depth at low water at its junctions being about 10 feet, and above this for sixty miles there are no soundings less than 19½ feet. At 120 miles the depth decreases to about 7 feet; at 150 miles there was barely 3 feet. At about 317 miles from its mouth the river is lost for ten miles in a marshy tract of country, through which there does not exist any defined channel. Beyond this tract, which constitutes an immense horizontal plane extending to "distances unknown," at 327 miles from the mouth, the river again assumes a defined channel with a depth of from 10 feet to 12 feet. This channel was explored up to the Argentine boundary at El Hito, 677 miles from the mouth. The width varies from 100 feet at the lower end, where the course is well defined, to 300 feet in the upper part.

In the lower part of the river the water is brackish and unfit to drink, owing to a number of salt springs, and in the upper river it is turbid and of a reddish colour.

To render this river navigable for barges carrying twenty-five tons and drawing 4½ feet of water, over a length of 670 miles, or about 100 miles beyond the colony of Buena Ventura, the commission advised the construction of three cuts or canals, one to avoid the marshy district and the two others two porous districts in the upper length, these cuts to have a bottom width of 33 feet with 5 feet depth of water; the construction of seventy-three locks and dams; the regulation of the channel and clearance of obstructions. The amount required to carry out these works is estimated at a sum equal to about one million of English money.

CRETACEOUS FERNS.²

THE author states that he approached the subject of palæobotany as a layman whose earlier training had been mainly in physics and mathematics. He set himself to collect such fragmentary remains of fossil plants as the Lower Cretaceous rocks of his neighbourhood afforded, with the intention of making an intensive study of the several genera. This first instalment of his results deals mainly with a single genus of Mesozoic ferns, to which Dunker in 1846 gave the name *Hausmannia*. The fronds of this genus are characterised, in some species, by

¹ "The River Pilcomayo from its Discharge to Parallel 22° S., with Maps of Reference." By Gunnar Lange. Pp. 124. Translated from the Argentine Original. (Buenos Aires: The Meteorological Office Press, 1906.)

² "Beiträge zur Flora der unteren Kreide Quedlinburgs." Teil i., Die Gattung *Hausmannia*, Dunker, und einige seltenerer Pflanzenreste. By Prof. P. B. Richter. Pp. iv+27+plates. (Leipzig: W. Engelmann, 1906.)

the possession of a bi-lobed lamina not unlike that of the leaves of the maiden-hair tree (*Ginkgo biloba*), while in other forms the lamina is divided into several linear lobes, and bears a resemblance to the leaves of *Baiera*, an extinct genus of the Ginkgoales. It is, however, with the recent Indian and Malayan fern *Dipteris* that *Hausmannia* exhibits a more than superficial resemblance. Despite the unfavourable nature of the Quedlinburg rocks from the point of view of preservation of detail, Prof. Richter's industry has been rewarded by an accumulation of material which has enabled him to add considerably to our knowledge of this well-defined genus of ferns. He has instituted, on what appear to be adequate grounds, a few new species. The flora of Quedlinburg is characterised by a preponderance of ferns, which are said to form 80 per cent. of the whole; no trace of Angiosperms has been found; Conifers and Cycads are rare; while ferns are represented by the Gleicheniaceæ, Matonidium, Laccopteris, Clathropteris, *Hausmannia*, *Weichselia*, and a few fragments of the common Wealden species *Onychiopsis Mantelli*. It would seem that in these fossils we have the relics of a vegetation which flourished in a situation favourable to ferns. Ferns undoubtedly played a more prominent part in the composition of Mesozoic floras than in the floras of the present, but it is unlikely that the Quedlinburg flora as a whole was composed almost entirely of these plants to the exclusion of Lower Cretaceous Gymnosperms which are recorded from other localities.

Prof. Richter's contribution does not throw any fresh light on the nature of the sporangia of *Hausmannia*; he has, however, demonstrated a striking resemblance in habit to recent species of *Dipteris* as regards the slender rhizomes and long leaf-stalks. The author is disposed to regard the affinity between this northern Lower Cretaceous type and the Malayan *Dipteris* as rather less close than has been assumed by Prof. Zeiller and by the reviewer. In the absence of well-preserved sporangia, the question of degree of relationship cannot be settled; but the account given of such fragments of fossil ferns as were accessible to the author of this monograph seems to strengthen the view that the *Dipteridinae* were abundantly represented in the northern hemisphere in the latter half of the Mesozoic era. In age the flora is considered to be rather younger than Wealden, and is compared with the Urganian flora of Greenland as described by Heer. It is difficult to draw a conclusion as to geological age from the small number of types so far described, but in our opinion the Quedlinburg plants might fairly be classed with the Wealden floras of northern Germany, England, Belgium, and many other regions.

Prof. Richter has done good service to palæobotany by his thorough and scientific researches, and one may express a hope that other amateurs may follow his example and devote themselves with equal energy and success to the detailed study of the fossils of a single district.

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PROBLEMS OF APPLIED CHEMISTRY.¹

THE science and art of the engineer are intimately interlaced with those of the practical chemist. The practical, as distinguished from the scientific, chemist possesses sufficient knowledge and experience to see to the working of machines and to minor repairs without calling in an engineer, save in difficult or complicated cases. In former times the chemical manufacturer learned his trade, both on the chemical and the engineering side, as far as it was indispensable, but he learned it simply "by rote," as the saying goes. To be sure, this never took place without large sums of money being thrown away, either in the form of misshapen or faulty apparatus and machinery, or of spoilt chemicals, and so on. And this happened to the unstudied "practical man," who, through family connections or by mere chance, had stumbled into chemical manufacturing, as well as to men who had studied the science of chemistry, and who desired to apply the knowledge thus gained to the execution of some well-known process, or to the working of some laboratory in-

¹ Abridged from a discourse delivered at the Royal Institution on Friday, March 15, by Prof. George Lunge, of Zurich.