THE NEW "MERIDIENNE DE FRANCE"

General BOURGEOIS, Member of the Institute of France and of the Bureau des Longitudes, presented to the Académie des Sciences, at its meeting held on 20th January 1930, a volume recently issued by the Service Géographique of the Army dealing with geodetic and astronomical work in France.

This quarto volume, which is issued in two parts, contains 440 pages and 26 plates. It is entitled: *La nouvelle Méridienne de France, Observations et calculs complémentaires*, and forms the third volume of the Records of the Service Géographique of the Army.

In presenting this first volume to the Academy, General BOURGEOIS made the following communication:—

"In 1870, at the instigation of Captain François PERRIER, it was decided that, solely in the interests of science, a new meridian should be measured between Dunkerque and Perpignan, to replace the chain established by DELAMBRE and MÉCHAIN at the end of the 18th century.

"The Dépôt Général de la Guerre began this work shortly after 1871, and the Service Géographique of the Army, which succeeded it in 1887, brought it to a satisfactory conclusion in 1895.

"Begun in 1885, the publication of reports was steadily continued so that by 1902, the entire geodetic part of the work, including a compensation by isolated figures, had been dealt with in three pamphlets, which together form Volume XII of the Records of the Dépôt.

"The presentation of the astronomical observations and the discussion of the results as a whole yet remained, and these were to form the subject of a final pamphlet which was already far advanced when the war broke out in 1914.

"After an enforced interruption of several years, it became possible to continue this work when hostilities ended; but at that time a new situation had arisen:— a wide breach had been opened in the chain to the northward of Paris.

"In March 1918 the wave of German invasion in Artois and Picardy had broken on the crests which are surmounted by the masonry station marks of the primary chain of France. In the course of the artillery duels at the front several of these marks were razed to the ground, but more serious still, the actual marks accurately indicating the geodetic centres had disappeared in the churning up of the ground.

"Thus it became necessary to reconstruct the part which had been destroyed. The Service Géographique undertook this restoration without further delay; it was carried out with the greatest care and certain improvements were made in the previous lay out, particularly by the measurement of an intermediate base near Albert (Somme). The chain was re-established at the end of 1927.

"Advantage was taken of this delay, however, to remake the compensation combining the figures into large groups in such a way as to cause the four geodetic bases measured along the meridian to enter therein.

"All the calculations having been completed the Service Géographique then proceeded with the printing of Volume III of its Records, the volume which is the subject of this memorandum. This volume not only deals with everything concerning the restored segment but is also the complement of the preceeding publications.

"Thus it contains the details of the astronomical observations taken at twenty-eight stations connected directly with the chain, and which are spread out from Dunkerque to Rivesaltes. At each of these stations the latitude, one azimuth and, in certain cases, a difference of longitude, were determined.

"These twenty-eight stations may be divided into three categories. Six of them, selected in the neighbourhood of Paris, were used to check the latitude and the azimuth which the Commission de la Carte d'Etat Major had adopted in 1817, under the Presidency of LAPLACE. Although, strictly speaking, a single station would have been sufficient for the purpose, it was considered desirable to employ several stations, connected with the Panthéon by a special triangulation, in order to make certain that local attractions were negligible at the point of departure.

"Besides these stations, at which observations were made with a large type BRUNNER meridian circle, nine others of the same precision located at intervals of about 100 kilometres, together with the Panthéon, divide the Meridian into the same number of geodetic arcs forming parts of the whole.

"Finally we were led to establish thirteen other stations in the "Massif Central", in addition to those provided for in the original programme. After the completion of the provisional calculations, I found that there was a sort of break in the geoid in the vicinity of the Auvergne Mountains. From the comparison of the astronomical elements with the geodetic results it appeared that the mean curvature of the meridian section changes abruptly, so that, when passing from north to south of the central plateau, it gives the impression of two ellipsoids of quite different form joined together near the mean parallel. Having decided to make a more careful study of this curious anomaly, I had supplementary observations made in 1906 and 1907, with a prismatic astrolabe and with a theodolite fitted with microscopes, throughout the mountainous region in the centre of France, which, while improving the earlier results, confirmed my first conclusions. The study of this interesting area has barely been taken up, but it deserves to be continued more carefully.

"I should add that the calculations of the chain had been made not only on the so-called "Ellipsoid of the Carte de France", which was determined by DELAMBRE, but on a surface of reference deduced from more recently measured geodetic arcs. We adopted CLARKE's 1880 ellipsoid, which was used as early as 1882 by the Service Géographique for drawing up the final maps of Algeria and Tunis.

"Taking these modifications into consideration, several very interesting comparisons were then made between the elements common to both the old and the new systems, from which it appears that the measurements of DELAMBRE and MÉCHAIN were of an accuracy which is remarkable for those days.

"To sum up, Volume III exhausts the question. Thanks to its publication

all the results connected with the Meridienne are available to geodesists, such as observations at more than 100 stations of the first order and at numerous astronomical stations, measurement of four bases, compensations, list of coordinates, etc. Further the fact should be noted that this work was spread over a period of nearly seventy years if the determinations made by Yvon VILLARCEAU, which date from 1862, be taken into account.

"It should be remembered that the Meridienne de France constitutes the backbone of the new French triangulation. It is to be the basis of all geodetic determinations which are to be used for the geometric description of our territory. I am pleased to be able to state that the Service Géographique is actively engaged in extending the system which it has undertaken to restore. The chains of the first order have already been re-established throughout the entire area lying to the eastward of the fundamental meridian; the parallels of Amiens, Lyon and Avignon have been extended to the frontier and the meridian of Lyon, which extends from Belgium to Marseilles, has been completed. The detailed triangulation sheet, the first work on which dates from 1898, has been greatly extended in the course of recent years, particularly in the Northern and North-Eastern Departments, which will soon be entirely covered by the new triangulation".