The Meridian of France.

THE well-known French journal, *Revue Scientifique*, has published in the issues of September 8 and 22 two admirable articles on the meridian of France by a very competent authority, Col. Perrier.

As an introduction, Col. Perrier passes briefly in review some of the larger geodetic operations, including those of the Survey of India. "Aux Indes c'est à la ténacité et à la science des premiers directeurs du 'Trigonometrical Survey,' le Colonel Lambton . . . le Colonel Everest et de tous leurs successeurs que l'on doit le bel arc de 21° d'amplitude." It may be noted that Lambton's proposal for the measurement of this arc took shape in 1802; he died in 1823, "worn out by incessant toil under a tropical sun."

The meridian of France has a history that goes back more than a century earlier. It is associated with the names of Picard (1669), the Cassinis, La Caille, Laplace, Legendre, Delambre, Méchain, Biot, Arago, and others, who have permanent niches in the temple of geodesy. But "la méridienne de France, si souvent remaniée et remesurée," perhaps the most famous of arcs, is also the most unfortunate.

After more than 250 years of effort one might expect that this arc, which passes through Paris and traverses France from north to south, would consist of permanently marked and accurately fixed points, and that the reductions of the geodetic and astronomical calculations would have been published in a definitive form. "Par une singulière infortune aucune de ces conditions n'est réalisée," and Col. Perrier explains why. The principal cause of this state of affairs is the extreme slowness with which the operations were carried out, a slowness due to want of funds. The second cause of the present imperfect state of the triangulation, and of its records, is the effect of successive wars in damaging the northern portion of the chain.

In the seventeenth and eighteenth centuries the operations were not only undertaken on the initiative of the Académie des Sciences, but were also carried out by the Academicians themselves. But from early in the nineteenth century the arc was rightly made to serve the purposes of cartography, and the direction of the work passed to the Dépôt de la Guerre and, in 1887, to that efficient body, the Service Géographique de l'Armée.

Picard's arc of 1669-70, between Amiens and Paris, was about 150 kilometres long; its great interest consists in the fact that the value of the degree derived from it was used by Newton in 1682. The Cassinis prolonged the chain to Dunkerque and Collioure and, misled by faulty observations, propounded the notion of a prolate spheroid. In 1739-40 Cassini de Thury and La Caille revised the arc; and in 1792-98 Delambre and Méchain again revised it and extended it to Barcelona. In 1817 a commission under Laplace reported upon the triangulation and the construction of a cadastral and topographical system to be based upon it, and made recommendations which, unfortunately for France, have never been carried out.

The meridian of Delambre and Méchain was recognised as obsolete and inaccurate a hundred years ago; but, from that time until 1870, geodesy in France

underwent a gradual eclipse. In 1845 the Dépôt de la Guerre was of opinion that geodesy had said its last word. In 1860 Great Britain proposed to France to re-observe the cross-Channel connexion between the triangulations of the two countries. It appears that, on the French side, officers were employed on the work who were totally new to it, and Col. Perrier states that the comparison between British and French methods and instruments was greatly in favour of the British.

The subject began to revive about 1870, the authorities having decided that another revision of the arc should commence in the spring of that year. But then came the Franco-Prussian war. The re-measurement was taken up again in July 1871 and was finished in 1892.

This "new meridian" of France, finished in the field thirty years ago, has suffered from many of the misfortunes that attended its predecessors. Its execution and its reduction were always much hindered by want of money. The Service Géographique had always more on hand than its resources enabled it to carry through effectively. Apart from work in Algeria and Tunis, and elsewhere abroad, the re-measurement of the "arc of Peru" in 1899-1906 caused much interference with the work at home; so the reduction of the meridian of France went to the wall. Various volumes have been published, by the late General Perrier, by Defforges, and by Bourgeois, but the publication is far from complete. The final reduction of the triangulation was in hand in 1913-14, and on August 2, 1914 was about two-thirds finished. "Bien entendu, à l'armistice, on en était toujours au même point."

But, by this time, a great part of the northern section of the chain had been destroyed, as a result of the War; the greater part, that is, of the trigonometrical stations between Laon, Amiens, and Dunkerque. This work is now being carried out again for the fifth time. The operation will not only serve to complete the geodetic chain, but will enable the second and third order triangulations required for the detailed mapping to be extended over the devastated area.

Here we touch the question of the "cadastre," which appropriately enough is discussed by M. Ch. Lallemand in another article in the same journal (September 22). In spite of the great eminence of those Frenchmen who have dealt with the matter, from the days of Delambre and Laplace to the present time, the cadastre and large-scale maps of France are in a worse state than the geodesy; and, from various causes, chiefly the perpetual want of funds, the state of the surveys of France will not bear comparison with those of the British Isles.

The history of the meridian of France serves to point the moral that, in geodesy, provisional measures undertaken for the immediate utilisation of results, with the object of saving money, inevitably lead to confusion and disorder, and finally to the expenditure of a larger sum than the sound and methodical execution of the work would have originally entailed.

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