Reclamation of the Pontine Marshes*

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THE Pontine region (in Latin, *Ager Pométinus*, from the name of the ancient Volscian city of Sessa Pométia), known more commonly in the past as the Pontine Marshes, is situated in the southern part of Latium, and has been famous from remote times. During recent years, the attention of the civilised world has been directed to it, owing to the extensive reclamation works

still, as regards its greater part, a shallow marine gulf, Monte Circeo being then an island. Later in the quaternary period it became transformed into a lagoon, as a result of upheavals, which were more pronounced near the sea than at the foot of the Lepines. Hence the greatest depth of the lagoon was in the interior and followed a line roughly parallel to the mountains. Alternating subsidences and upheavals doubtless took place afterwards, the natural appearance of the region being repeatedly changed during prehistoric ages and perhaps also during historic times. Climatic variations, affecting the flow of the water-courses and the humidity of the whole region, also came into play. To-day the rainfall is less than 800 mm. in the coastal district, increasing to about 1 metre at the base of the Lepines and to still more on their slopes.

Without going in detail into the characteristics of the Pontine region, it may be pointed out that this may be divided into three parts:

(1) *The coastal region*, which extends from Nettuno to Terracina. This is characterised by long chains of dunes of recent origin, 20 metres or more in height and more or less fixed by vegetation. The dunes separate the sea from long, narrow coastal lakes, the Lake of Fogliano, the most northern, having an area of 4.65 sq. km. and that of Paola,

FIG. 1. Map showing the Pontine region in 1933.

1. Borgo Bainsizza	7. Borgo Grappa
2. Borgo Podgora	8. Borgo Pasubio
3. Borgo Piave	9. Borgo Vodice
4. Borgo Carso	10. Borgo Montenero
5. Borgo S. Michele	11. Borgo Hermada
6. Borgo Isonzo	12. Borgo Faiti

which have completely transformed its traditional aspect.

The region lies to the south of the volcanic Latium Hills and occupies the space between the Lepine Mountains—a range composed essentially, like the Central Apennines, of secondary limestones and hence of Carsic structure, and about 1,500 metres high (Monte Semprevisa, 1,536 metres)—and the Tyrrhenian Sea. Close to the sea is the isolated Monte Circeo, with a structure analogous to that of the Lepines. Towards the end of the tertiary and the beginning of the quaternary periods, the whole territory, with an area of about 750 sq. kilometres, must have been

the most southern, an area of 3.9 sq. km.; in between come the smaller lakes of Caprolace and Monaci. These lakes probably represent ancient creeks, which have become separated from the sea by the formation of the dunes. The two larger, exhibiting indentations on their internal shores, communicated with the sea through breaks in the line of dunes, but such breaks sometimes became filled in and so acted only intermittently. Moreover, being subject to seasonal changes of level, the lakes were surrounded by stretches of marsh. As will be indicated presently, work is in progress which will stabilise their configuration.

(2) *The region adjacent to the lakes inland* stands somewhat higher—20–25 metres and sometimes

* Translated from the Italian.

40 metres—and consists of sand, often of a chalky nature. According to some geologists, this region represents a series of cemented quaternary dunes, which were hitherto the undisputed domain of the Mediterranean scrub and of tall forests, with only limited clear areas.

(3) *The true internal region*, lying between the preceding and the foot of the Lepines, constitutes the marsh proper and corresponds approximately with the deepest part of the ancient lagoon. The hydrographical conditions of this region were very irregular and variable. Abundant Carsic springs at the base of the Lepines—such as those of Ninfa—fed comparatively large water-courses, the natural flow of which was hindered by the slight slope of the ground, by the chain of dunes, by the vegetation, etc.

The soil varies in character throughout the region, being rich in humus and fertile in the lowest parts, where it is mixed with detritus of volcanic origin, mostly clayey and marly in the higher areas, and sandy and hence little suited to farming near the sea. The region is said to have been well cultivated and thickly populated in the Volscian age (twenty-four inhabited centres are spoken of, the largest being Pometia). The destruction of the Volscian State and its subjection to Rome, together with the abandonment of the drainage schemes, in which the Volscians must have been highly expert, and possibly also climatic changes, resulted in desolation. Actually, however, there is little exact knowledge of the conditions of the region in the pre-Roman epoch, but in early Roman times the marshy areas must have been very extensive. Attempts at reclamation date back to the end of the Roman Republic. Others were made during the Empire, in the Middle Ages by enterprising pontiffs like Martin the Fifth, and in modern times, under Leo the Tenth, Sixtus the Fifth and Urban the Eighth, who made appeal to the experience of Dutch engineers. The most impressive endeavour was that made at the end of the eighteenth century on the initiative of Pius the Sixth, but the main drainage canal, constructed over a length of about 30 km. parallel to the Appian Way, and fed by lateral channels, proved inadequate to drain the whole of the marshy area. This area, including land boggy only at times, amounted to 370 sq. km. Napoleon caused the problem to be studied again by well-known hydraulic engineers, such as Fossombroni, but failed to find time to give effect to the projects elaborated.

It is not possible to give here the history of the successive efforts made in the nineteenth century or of the earlier ones of the present century, which, like the splendid work of Pius the Sixth, led only to a partial and temporary solution. The more the problem was studied, the more complex it

appeared. The drainage question was, indeed, the first, but not the only one, demanding solution, as it led naturally to the sanitary problem—the struggle against malaria and the creation of the conditions for healthy existence. There was also the agrarian problem, comprising preparation of the soil for its immediate utilisation, population and colonisation, and installation of roads and other means of communication. All these issues required simultaneous resolution, and this was the aim of the law of Integral Reclamation (*Bonifica integrale*), which concerned Italy as a whole, but

FIG. 2. Mount Circeo and scrub country.

found in this region its greatest and most complete application. The whole of the work involved was entrusted to the Opera Nazionale dei Combattenti.

The drainage problem was met by creating three systems of canals, which partly utilised existing water-courses. The waters of the more northern portion of the plain flowing from the Lepine Mountains—the so-called *high waters*—were conveyed to the sea by a direct route, mainly by an extensive collecting canal (the Mussolini Canal), which is 27 km. long and is the most important drainage work yet accomplished. This is able to deal with a flow of 450 cubic metres per second and flows, under suitable control, into the River Astura. *The middle waters* flow into another

large collector and pass to the sea through old water-courses, the principal of these being the Martino River (the work of Pope Martin the Fifth) and its tributaries the Cicerchian and Nocchian 'ditches', which have been re-organised. The low waters flow partly into the Pia water-course, which is still in good order, and partly are collected by a network of channels and led to the Fiume Sisto (named after Pope Sixtus the Fifth), the bed of which has been widened and deepened. In all, 1,756 km. of canal have been excavated and renovated. Other work has resulted in the drainage

and manuring, particularly with phosphates, have been necessary. Great difficulty has been encountered in the destruction of the thick Mediterranean scrub, consisting of deep-rooted trees, and both fire and dynamite have been employed to get rid of the roots. For tilling, use has been made of powerful multiple ploughs of the Fowler type. The so-called Terracina Forest, containing most of the tall trees, has been preserved for inclusion in a national park, which takes in also part of Monte Circeo.

The whole plan of reclamation outlined above

FIG. 3. The new city of Sabaudia.

of many wells and stagnant pools throughout the scrub zone—the so-called *Piscine*. Operations on a still larger scale are in progress with the object of keeping the coastal lakes within definite bounds. A number of difficult technical problems are here involved. Work on Lake Fogliano, which is well stocked with fish, is already well advanced; its bed is being deepened, its banks made up and the marshy margins dried, and permanent connexion with the sea is being established. Development of Lake Paola and of the district of Sabaudia on its shore is likewise proceeding. Work on the two smaller intermediate lakes is also under way; in the case of Lake Caprolace, certain areas around it are below sea-level, and have needed special means for drainage.

The reclaimed lands were not as a rule ready for immediate cultivation. In most cases deep tilling

was, as already mentioned, put into the hands of the Opera Nazionale dei Combattenti at the end of 1931. The average daily number of workmen employed was 13,500, board and lodging being provided for them by the creation of two large villages, as well as a number of smaller settlements.

During the first year—to October 1932—10,500 hectares were reclaimed and made ready for cultivation, in the second 14,100 and in the third about 17,000. The total agricultural land thus made available by the end of 1934 exceeded 41,500 hectares. In addition to the actual ploughing, etc., this necessitated the construction of houses and other buildings for the new colonies, and the creation of a network of roads, etc., so as to render the region fitted for permanent occupation.

All this has involved revolutionary changes,

since, until a few years ago, the Pontine region had no stable population. The section of coast from Nettuno to Terracina was, perhaps, one of the longest tracts of desert coast in the whole peninsula. A few hamlets (*casali*) existed along the Appian Way, and two or three in the remaining territory. From remote times the region had had a transitory population engaged in wood-cutting, production of charcoal, and raising cattle, sheep and pigs. This population lived in the most primitive huts, which contained only a single apartment and had a small, low door, with no other opening. The contents consisted of a hearth built of a few stones, beds, and a few essential articles of furniture. Such huts were found especially in the forest clearings (*lestre*), sometimes in groups of three or five or more, and occasionally in villages with a hundred or more inhabitants. This population came from the villages of sub-Apennine Latium (Filettino, Trevi, Veroli, Alatri, etc.) and spent eight or nine months in the region (October–June).

The huts have now almost entirely disappeared, and separate farmhouses, of two or three different types, are being built at regular intervals in the newly reclaimed area. As is natural in an agricultural district, the populace is a scattered one. On an average, 10–12 hectares of land, with house, are allotted to each family, the area being increased twofold on the poorer soils. Each farmhouse comprises living rooms, with stables below for the larger cattle. Small accessory buildings contain a furnace and accommodation for pigs and chickens, and a well and drinking troughs for the cattle are also supplied, together with implements, chemical fertilisers, etc. After a certain period of tenancy, the farms will pass into the possession of their occupiers. During the first three years, ending with the year 1934, about 2,450 farmsteads were built, the colonisation proceeding from north to south and from the coastal districts inland.

At certain points, chosen for ease of access, centres known as boroughs (bearing the names of battle-sites) have been instituted. Of these boroughs (*borghi*), which include a bureau of agricultural control, a health station, sometimes a school, a church, etc., twelve had been formed by the end of the year 1934. In view, however, of the vast extent of the area colonised, more important urban centres were also required to provide public services, business establishments, hotels, hospitals, places of entertainment, etc. The first of these, Littoria, was commenced on June 30, 1932, on the site of the former Quadrato, and was inaugurated on December 18 of the same year. The second, Sabaudia, situated in a magnificent position on the inner shore of Lake Paola, was begun on August 5,

1933, and officially opened on April 15, 1934. In October 1934, the first stone was laid of the third urban centre, Pontinia, in the farthest inland and lowest region, near the Appian Way, and in a zone where the work of reclamation has only just been begun; this was to be ready for occupation in April, 1935. Two further urban centres, Ausonia and Aprilia, are already projected.

Population of the agricultural districts of the Pontine region has been accompanied by that of the coasts, where seaside resorts have been developed. Among those already built are Foce Verde—to serve the Cisterna country—and Littoria. Under construction is Sabaudia Beach, which will be connected with the main centre by a bridge over Lake Paola at its narrowest point. During the past summer a seaside colony entertained 400 children from the families of the farmers of the Pontine region.

As regards the population of this region, it should be pointed out that the occupants of the new settlements are derived, not from the district that formerly supplied its temporary inhabitants, but from distant, over-populated parts of Italy: Friuli, Vicentino, Polesine, Ferrarese, etc. Admission to the colonies has been rigorously controlled, preference being given to the families of ex-service men and, among these, to the more numerous.

Whereas, in the past, the Pontine region had only a single road for wheeled traffic—the old Appian Way—and a few tracks and bye-ways, the whole of the colonised portion is now traversed by a fine network of roads (416 km. up to the end of 1934), adequate to meet the requirements of the new conditions and arranged according to a pre-determined plan.

The mainstay of agriculture is corn, which has cropped well during the first three seasons in the Littoria district. Tree-fruit is also being grown and, in the south, horticultural produce—notably tomatoes, in the district between Terracina and Circeo. The lower slopes of Circeo and the environs of Terracina have been noted from ancient times for their vines. Beet-growing has commenced and the installation of a sugar factory at Littoria is projected. Attention will, however, probably be devoted mainly to corn, of which Italy is greatly in need.

The profound transformation brought about in Southern Latium by the Pontine reclamation is felt also in adjacent districts, especially in the Lepine towns, the relations of which with the plain below date from the earliest times. The new condition of things has also had an important consequence from the administrative point of view, as it has determined the creation of a new province—the ninety-third in Italy—which

embraces a vast region reaching, towards the south, to the River Garigliano and having Littoria as its capital.

The new province of Littoria has an area of 2,100.3 sq. km. and a population now approaching 200,000. The capital, Littoria, is a city constituted

almost exclusively of offices, business houses, places of assembly, scholastic establishments, hospitals and the like, etc. Its fixed population is only 2,500, but, like Sabaudia, it has been planned with a view to extensive development in the future.

To Sir Charles Vernon Boys on his Eightieth Birthday

Why does Sir C. V. Boys elect
To do the things we least expect,
And always choose a task that seems
More suited to the land of dreams:
A problem other men would shirk,
Yet solve the task, and make it work
By means that *no one* else employs?
The answer is: Boys will be Boys!

What made him buy an Otto bike—
Two wheels abreast—a thing to strike
Terror in any rider's soul,
Yet somehow manage to control
Its actions and avoid a spill,
And—using his uncanny skill—
Delight in a precarious poise?
Again we say: Boys will be Boys.

Why snatch a bullet in its flight,
Lit by a single spark so bright
That on a photographic plate
The fleeting shadow seemed to wait—
With wake and bow-wave primly set—
All posing for their silhouette—
And leave a picture of the *noise*?
Because, of course, Boys will be Boys!

Why did his bold, untrammelled thoughts
Conceive the scheme of fusing quartz,
Using an arrow, as it fled,
To draw a microscopic thread,
And from the fusion to "unreel"
A gossamer more true than steel,
Which every Physicist enjoys?
The fact is this: Boys will be Boys.

What made our friend so seeming rash
As to pursue a lightning flash
By lenses rapidly revolved,
And even get the problem solved—
Both of its speed and structure—by
A photograph "which cannot lie"?
That gave a thrill that never cloys,
And showed us still, Boys will be Boys.

To weigh the earth—to check the Therm—
Explain the logarithmic term—
To build with bubbles, and maintain
The opal colours in their train!
These are his pleasures, these his ploys
(Where skill with mind and Truth alloys)
For which, in Science, as in Toys,
We thank our stars, Boys *will* be Boys!

R. A. S. P.

Obituary

SIR GEORGE CORY

SIR GEORGE CORY, who died on May 7 at seventy-two years of age, had spent forty-four years of his life in South Africa. He received his scientific training at King's College, Cambridge, where he took honours in the Natural Sciences Tripos in 1888. After holding various academic appointments in the schools of Grahamstown, which is in the Eastern Province of Cape Colony, he was appointed professor of chemistry in Rhodes University College in 1904, and occupied the chair with great distinction until his retirement with the title of professor emeritus in 1925.

Cory was undoubtedly a good teacher and was beloved both by his colleagues and his students, whom he could, and did, inspire with his own enthusiasm. Indeed, some of his men have done extraordinarily well, but the truth is that though his heart was in his work, his real interest in life lay elsewhere. As a consequence of this, no scientific discoveries of any great value can be placed to his credit. He had neither the temperament nor the vision for chemical or physical research, and as

Rhodes College was off the beaten track, there were no chemical souls with whom he could commune.

Cory was really an antiquary. Very soon after his arrival at Grahamstown, where much of the early South African history was enacted, he realised, as indeed did others, that records of the doings of the 1820 settlers and of others would soon be lost if an attempt was not made to collect them. While others talked, Cory acted. He never took a holiday, but spent all his spare time in trudging over the country, covering great distances, enduring much physical discomfort, to carry on his self-imposed task. All interested in South Africa know that his "Rise of South Africa", in six volumes, was practically completed some little time ago. For his work in this and in other but similar directions, Cambridge awarded him the honorary degree of D.Litt. in 1921, and when he was knighted in 1922 he came to England, which he had not seen for more than thirty years, and did further historical research. He was awarded the gold medal of the Royal Empire Society in 1933.