For Departmental use.

Survey of India.

DEPARTMENTAL PAPER—No. 3.

EXTRACT FROM

"THE NEW MAP OF ITALY"

"SCALE 1 : 100,000"

BY

LUIGI GIANNITRAPANI.

(Translated from the Italian by Major W. M. Coldstream, R. E.)

PUBLISHED UNDER THE DIRECTION OF THE SURVEYOR GENERAL OF INDIA.

Dehra Dun:

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PREFACE.

It is believed that these extracts from Signor Luigi Giannitrapani's description of the new Italian 1 : 100,000 map will be of special interest to the Survey of India which has been occupied for some years in solving problems in connection with the new 1-inch and $\frac{1}{4}$-inch maps of India, almost exactly similar to those dealt with by the Italians.

Like ourselves the Italians have taken advantage of modern methods of reproduction to print their maps in colours, and they have adopted much the same colouring for details as we have. In one important point wherein they differ from us, namely in showing towns and villages in black, we have recently followed in the same direction, so far as our degree sheets are concerned.

Like ourselves the Italians have been much exercised over the difficult questions of shading and hachuring; opinions will differ as to the merits of the system of shading, the hills that they have adopted, but it is interesting to note that they, like us, have discarded hachuring in favour of shading, although they have not yet introduced a layer system for any of their topographical sheets.

The familiar arguments against the use of double lines for road symbols have led the Italians to show all their roads by single lines; they have led us to introduce the single line for cart-tracks but have not affected the symbols for main roads which are rare in India as compared with Italy. The Italians have also gone further than we have in the amount of road information they show, *e.g.* widths and gradients.

While we are beginning to question the suitability of our type it is worth noting that Signor Giannitrapani is particularly pleased with the Italian lettering, which, with the exception of the curious running hand for hill names, is not unlike ours and was probably adopted for the same reason that ours was, namely facility of reproduction. It is doubtful whether the lettering of the Italian maps, although clear and prominent, is entirely satisfactory; unimportant names may

perhaps be considered too prominent and although aesthetic qualities are not essential, the Italian lettering will probably not generally be considered pleasing to the eye.

It will be noticed that the black circular tree symbol of the old Italian maps has been replaced by a green diagonal ruling; we may be forced by the introduction of layers to use a somewhat similar green ruling on our degree sheets.

The use of a blue stipple instead of a solid blue wash on water areas was found necessary by us for the same reasons as Signor Luigi Giannitrapani gives in the foot-note on page 6. The stipple has another advantage not mentioned in the note, and that is its permanence. The fugitive nature of a solid blue printing is apparent on some of our experimental sheets and may be noticed on old copies of Ordnance Survey maps on which the blue has changed to a dull green.

The great importance the Italians attach to examination of nomenclature and their method of showing the population of towns and villages are of interest. It is possible that as India is developed we may have to follow the Italians in these directions.

Most other great countries reproduce their topographical maps by engraving, and it is only with the maps of countries like Italy and French Africa which are photographed, that our topographical sheets can fairly compete. The opportunity Signor Luigi Giannitrapani gives us of detailed comparison is therefore all the more welcome. The difference in general appearance between the Italian 1 : 100,000 map and the Indian 1 : 63,360 map is marked, but it is evident that the Italians and ourselves have been influenced by the same reasoning and have solved the same problems generally on the same lines.

18th February 1913. W. M. COLDSTREAM, MAJOR, R.E.

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In 1875 the Italian parliament passed a law, introduced by the then Minister of War in consultation with the Finance Minister and the President of the Council, which prescribed the publication of a complete map of Italy on the $\frac{1}{100{,}000}$ scale, to be prepared from the original surveys of the kingdom on the 1 : 25,000 and 1 : 50,000 scales.

For the representation of the ground on this map which was to be of the highest quality then obtainable, it was agreed to adopt the system of line shading with modified zenithal illumination, combined with contours at 50 metres vertical intervals. The roads were to be shown by double lines, and classified on the basis of their administrative denominations (as national, provincial, etc.).

In regard to reproduction it was decided to print the whole map in black, not that the great advantage of using colours was forgotten, but because the technical difficulties to be faced at that time in colour printing were so great that the idea had to be abandoned. The system adopted was a process of electro. photo-engraving on copper, invented by General Avet, which was then in use at the Military Geographical Institute.

When all details had been worked out, the execution of the map was put in hand, and in 1878, soon after the promulgation of the law relating to it, the first sheet was published.

It was necessary to proceed methodically with the laborious work of the original survey of the country, so that it was only in 1900 that all the sheets of the kingdom were published, (excepting those of Sardinia, for in that year the sheets of our second most important island were only just surveyed).

But, in a period of 35 years, like that which had elapsed between 1875 and 1910, so rich in extraordinary progress in every field of human activity, the technical and artistic standard of cartography had naturally changed greatly; the resources of the graphic art had expanded to such an extent that it became out of the question to retain the original process of reproduction. Indeed our 100,000 map, while it represented much valuable work of a very high standard for the time of its inception, twenty years later no longer responded to the growing exigencies of public requirements and to the new standard of technical cartography. The authorities at the Military Geographical Institute and the public as well had already realised the drawbacks involved in a map printed only in black; drawbacks which showed themselves especially in a want of clearness and in the impossibility of showing all the information which the increasing use of the map rendered, if not necessary, certainly desirable. In the meantime, whatever the ultimate style of the map was to be, they endeavoured to remove its defects and more especially to increase its clearness by substituting mezzotint shading for vertical hachures in the representation of relief.

Here it may be as well to discuss the vexed question of vertical hachures and shading which has for long troubled cartographers, and which, since the Military Institute is in favour of shading, has been recently resuscitated by a question in Parliament. It is true that, if one considers a map merely from the artistic point of view, line-hachuring appears the more suitable method because it is more pleasing to the eye, and because, by varying the thickness of the lines and their spacing, all the best effects of mezzotint shade can be obtained. Moreover even the smallest elevation can be indicated by hachuring, which if shown by mezzotint does not always reproduce clearly, since the depth of the shade, which varies with altitude, is necessarily weak for low elevations; but in considering the topographical map, one must not be guided solely by artistic standards, and it is necessary to bear in mind the practical requirements which the map has to satisfy both in peace and war.

In order to show up the lettering over hachuring, it must be heavy and large and therefore an encumbrance, causing loss of clearness. Contours, items of the greatest importance, are followed with difficulty in a hachured map; this hinders a thorough appreciation of the ground such as is necessary for war purposes. With the adoption of shade, the lettering shows up prominently to the eye, the contours are distinct and easy to follow, and the ground features show up in their general

lines. Shading has also this very great advantage over hachuring; it reduces the time, and therefore the cost, of preparation*. On the above grounds it was decided to abandon the old methods in the representation of relief, and to adopt mezzotint hill shading.

The first attempts disclosed difficulties of a conflicting nature, and led to the preparation of a few experimental sheets in colours which were shown in 1895 at the second National Geographical Congress held in Rome, and were much appreciated at the time. Without entering into technical details of printing, it is sufficient to say that the system of reproduction followed in these specimens only allowed of a limited number of copies being printed; it had therefore to be abandoned, and it became necessary to undertake new studies with the object of discovering some system of reproduction in colours that would allow of a large number of copies being printed without excessive expenditure.

It was reserved for Colonel Gliamas, the then head of the Photo process branch at the Military Geographical Institute, and today the Director General of the same, to solve the difficult problem by inventing and applying a process of chemical photo-engraving by means of which, from an original representation of the relief of the ground done in chalk mezzotint, an engraved copper plate can be obtained to yield impressions of the shading without losing the brilliancy of the original.

The Gliamas system, repeatedly subjected to exhaustive tests, proved the best for every kind of map, both on account of its rapidity and its low cost in comparison with other processes, and it was therefore adopted in 1905 for the reproduction of the maps of the Institute generally. The use of colours could then be introduced without further investigation, and, from the end of 1905 till today, quite 200 sheets of the provisional map have been published. In these sheets the ground is indicated in brown for the hills, in light green for the plains, in deeper green for the cultivated land and the contours are brown, water is in blue, roads, houses and writing are in black.

But it was not possible to reproduce all the sheets of the 100,000 maps in colour editions at once, because for the outline each sheet required an impression from a special plate which was prepared from the old fair sheet before the hachures had been drawn on it †. These special outline plates only existed for about 200 sheets, so that for the remaining 77 sheets it was necessary to redraw the

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* It is reckoned that a clever draftsman requires 6 months to hachure a 100,000 sheet, while only about 1 month is required for shading.

† These outline plates served for the edition of the 100,000 map without hills, much in demand for its clearness.

outline for a coloured edition. The great cost and time required for this work stopped the provisional edition of the map at the 200 sheets above mentioned, but this inconvenience led to happy consequences since it brought about the commencement of an entirely new map.

The "Provisional" map had several inherent defects. First of all, the prints which served for the outline sheets, being pulled in lithographic ink, had afterwards to be worked on in Chinese ink for the necessary additions, so that they were not homogeneous, and this resulted in defective reproduction. Then again the defects of the old 100,000 map were of course retained in the Provisional map, for instance, the roads were classified according to their administration rather than their width, and the large size of the writing encumbered the sheets and spoilt the relief of the ground features. The last defect was particularly felt, and there could be no better proof of this than the orographic sheets shown at the Turin exhibition from which the lettering was omitted, and on which the features stood out in relief in a way they do not do on the complete sheet. Hence the coloured edition of the map, while it represented an advance in technical map reproduction, did not mean an advance in general cartography. The wide modern use of topographical maps has greatly increased the demand from the public and has led to changes combined with greater fullness of detail especially in regard to the roads, cultivation, water forms etc.

It was considered that owing to the changes which had taken place since 1875 in all parts of the country, but more particularly in some, a more strict and methodical revision was rendered necessary than that to be obtained by bringing up to date the old sheets of the 100,000 map, which had not been surveyed on a uniform system.

Thus for certain regions where the surveys had been executed on the 50,000 scale, new surveys on the 25,000 scale were required, and everywhere a complete revision of the nomenclature on a uniform system was called for.

Already, before 1908, the complexity of Italian topography had led the Institute to investigate and prepare for a new type of 100,000 map to respond to modern requirements, so that having completed its investigations and obtained the sanction of the higher authorities, the Institute could in that year start the great work of which the first attempts have been exhibited at Turin.

The following are the main features of the new task:—

i. A general systematic revision of the original surveys of the country.

ii. A general revision of the topographical names in order to obtain the necessary precision in nomenclature.

iii. A graphic representation of the country, of the maximum clearness combined with the maximum amount of information regarding topographical and satistical details.

How these principles are applied in practice, and how this great work undertaken by the Geographical Military Institute is proceeding will now be set forth.

The basis of the new map is supplied by general revision of the larger scale surveys methodically and consistently executed. This is carried out on the original plans, scale 1 : 25,000, and on them effect is given to the changes due to natural forces and to the works of man. At the same time any errors, (they are generally very small), that have been made by the first surveyors are corrected. It is also necessary to enter all the additional information required for the new map *e.g.*, the widths and gradients of the roads, the limits of woods etc. The work progresses, but results, owing to the high standard of accuracy aimed at, are necessarily slow. On an average, only the country covered by a dozen 100,000 sheets (about 200 sections on the 25,000 scale), are dealt with annually. The surveyor's sections together with all the information collected are subjected at the Institute to an accurate examination in respect to the road classification, topographical detail, the uniformity of the nomenclature etc. Under this system, not previously in force, the uniform quality of the compiled map is assured.

The nomenclature examination merits description in detail in order that its scrupulous care may be appreciated.

The long discussion to which the particulars of our topographical map have given rise is recent, and the credit of arousing public interest and retaining it is due to the Italian Touring Club. The Geographical Military Institute, influenced by this discussion, and recognising the advantages of a liberal policy has made a new departure for an official department by associating with itself in its investigations, those of a private association like the Touring Club. A special commission was nominated and entrusted with the duty of adopting the nomenclature established by custom and applying it to the new map. To the labours of this commission are due the guiding instructions given to the staff for the examination of the nomenclature revision.

The three principles of this examination are:—to see that the name given to a place corresponds with its identity and that it is accurately transcribed; to check the descriptive names used on the map with the geographical facts; and, finally, to weigh the selection of alternative names, giving the preference to the historical and locality name rather than the proprietor's name which is liable to change.

The president of the Touring Club is warned beforehand of the particular sheets to be revised in the year and has a preliminary examination made, the results of this examination are communicated to the revisers, who are also supplied with a comparative statement prepared by the commission from the district nomenclature of the old surveys.

Provided in this way with copious material the revisers carry out their work by consulting local maps and documents, interrogating inhabitants and taking advantage of all other available sources of information. The results of their labours, compiled in a denomination statement for every name, eventually come before the commission.

It is plain, that with such a rational and scrupulously observed system as this, the nomenclature of the new map is brought to a uniform standard, and geographers can wish for no better Italian nomenclature. At the last National Geographical Congress, (Palermo, 1910), it was quoted as authoritative.

It may be mentioned, that although the map must be lettered throughout in Italian the local dialectal terms are retained for geographical features, etc.

Following the complete revision of the topography and nomenclature of its component sections, the 100,000 sheet is compiled in accordance with the new principles of cartography, which may be included under the following heads:—

(*a*) The ground surface and its vegetation.
(*b*) The works of man.
(*c*) The lettering.

The representation of ground features is executed in chalk mezzotint, with contours at 50m vertical intervals, as in the provisional coloured edition of the old map. The contours are printed in the same colour as the shading, in order that it may be impossible to confuse them with other detail, and the 250m contours are distinguished by being thickened; this greatly facilitates the interpretation of the map.

Line work, (hachuring), in the hills is reserved solely to indicate certain special characteristics and to make rocky broken slopes, gorges, masses and peaks of rock stand out conspicuously in contrast to the shading. A special conventional sign has been adopted to indicate the detritus along the foot of cliffs.

The conventional signs in connection with water are all in blue, and a new symbol has been designed to indicate a snow field. The water symbols differ from those of the provisional coloured edition of the old map, in that the beds of water courses and the surfaces of lakes and of the sea are not represented by a uniform flat wash but by a dotted tint. This particular, which at first sight seems of little importance, saves one printing and is a substantial economy in time and expense.*

* In the coloured edition of the old map, the blue line work was first printed and then the blue areas, less strongly. With the dotted tint the strength of the blue is weakened, so that it can be printed in the same impression with the line work

It will not be out of place to offer a few observations regarding the conventional signs for water-forms used by the Geographical Military Institute for the new map.

There are two distinct symbols for a river and a torrent which do not always represent such water courses quite consistently according to their classification. Thus, the conventional sign for a river restricted to one channel is not suitable for the effective representation of the upper course of a torrent, whilst the symbol allotted to a torrent with its ramifications in a wide bed is not suitable for the lower course of a torrent which does not differ much from the lower course of a winding river. However, the classification of water courses which, owing to their size, are generally shown on the topographical map as surveyed, does not seem to affect the question of their conventional signs, and results merely in the denomination T, (torrent) or F, (river), the delineation of the river being presented in its actual form. It would be useful in the case of the more important rivers to indicate the navigable portions of their courses by some symbol as is done on the 25,000 and 50,000 sections.

We see another important natural feature clearly represented on the new map; woods, that in the old map were in black, and in its coloured edition were shown by small green circles scattered over the wooded area, are represented by a green ruled tint, which easily catches the eye.

But the most important and most striking innovations in the new map are those regarding the representation of the works of man. This is as it should be, if one considers the great importance that these works have assumed at the present day, in which the great development of civil life even in the most remote tracts, has resulted in the construction of buildings, roads and other public works.

The aspect and accessibility of the country have been transformed by this development, and the new map is designed to give the maximum amount of information that is practicable.

If we admit that the touring and military purposes of the map are of the utmost importance, it is necessary that the eye should take in the network of roads at a glance; and this is attained by printing them in red; but it is not sufficient, the map must reproduce with the greatest fidelity, the plan of the roads, with their bends and crossings and junctions. The old style representation of the roads by double lines does not satisfy this requirement while the single lines now adopted, do.

The most important characteristic of the roads, their widths, must also be clearly shown, and for this reason the old administrative classification has been abandoned; it gave no precise information, and a classification according to effective widths has been adopted. Under this classification the roads are divided into 4 classes (widths above 8 m; from 6 to 8 m; below 6 m; fit for wheeled traffic although

not regularly maintained, and of variable width). To each of these classes a separate symbol has been allotted, and other conventional signs correspond to the various types of more primitive communications, (mule-paths, foot-paths, etc.).

To complete the important information regarding roads, their gradients are shown, and the distances along the road to which the gradients refer are printed in black. Thus with widths and gradients no one can fail to be able to judge of the suitability for traffic of any particular route.

Coming to the conventional signs for railways, we note that the road bridges above and under railways, and level crossings have gained in prominence by being shown in red. Special symbols are provided for electric railways, distinguishing between the overhead and third rail systems.

The representation of buildings in general is the same as that of the old 100,000 map, except that some buildings are given special prominence, a symbol being allotted for an isolated house that bears a name.

Works for the storage or transport of water (aqueducts, tanks, fountains etc.), are given their relative importance and are printed in the same blue as water to render them more distinguishable.

We come now to the 3rd group of innovations those concerning the lettering, the nature of which has so much influence on the clearness and legibility of the topographical map in general. We note that the contour values are printed in the same colours as the contours and the shading, so that they cannot be mistaken for heights of points which are in black. These last are in sloping figures if they are approximate topographical values. The figures relating to the widths of roads are in red. Lettering relating to water, glaciers, snowfields etc., is in the same blue colour as the water, it is thus impossible to mistake it for other lettering.

All the other lettering is in black, but unlike that of the old 100,000 map, it stands out sharply, and is reduced, both in size and thickness of letters. The principle of giving the lettering size in proportion to the importance of the item to which it refers, is well observed; but this is done so as to improve the legibility of the map and not to interfere with the representation of the ground nor to reduce the appearance of relief. Another useful innovation in the new map is that by which the populations of towns of over 900 inhabitants are indicated. For towns of above 10,000 inhabitants the figures, printed in red show the thousands in round numbers, for other towns they show the thousands and hundreds.

I have mentioned how the systematic revision survey of the kingdom by the new method cannot extend to more than a dozen sheets annually. A second year is required for the correction of the original plans on the 25,000 scale at the Institute, and a third for the compilation and drawing of the 100,000 sheet. Thus three years are necessary to revise, design, print, and publish a sheet.

The new system was first applied in 1908 in Southern Italy, where it had not been possible to prepare the revised coloured editions of the old map, so that this year, 1911, the first sheets of the new map are being published. Since the work continues without interruption the directors of the Institute expect to have some 30 sheets published by the spring of 1912. There had been some doubts whether our Military Geographical Institute could cope with the very laborious task it had undertaken. It has however shown that it can do so, and may claim that it has known how to avail itself of every advance of the last 30 years in technical cartography and in the methods of artistic reproduction; nor has it failed to take advantage of the results of the labours of private individuals in its own sphere of work.