such a construction will be exceedingly glad that so experienced a man as Mr. Lloyd lends his assistance in so disinterested a way to an establishment which we trust cannot fail to exert a powerful influence on the progress of scientific Biology.

We are further informed that Dr. Dohrn has already received considerable presents for the future library of the Zoological Station. The celebrated firm of Engelmann, Leipzig, has sent all works published by it on biological topics, and which had not yet formed part of Dr. Dohrn's private library. The value of these books exceeds 100%. Besides this Vieweg, of Brunswick, has sent all that he has published on Biology. Theodor Fischer, of Cassel, the well-known publisher of the magnificent "Palæontographica," has also made very liberal grants. Others are promised. We trust our English publishers will not hesitate to send their publications on biological topics as soon as application is made by the administration of the Station.

The entrance of these books, and of whatever goods may be sent to the Station, is freed from any duty by the Italian Government. Dr. Dohrn hopes to obtain in short time, from a great steamboat company, free transport for all the objects sent from England to the Station.

On all these and other points we hope to give more full and special information at the beginning of next month, when the Committee for the Foundation of Zoological Stations in different parts of the World, will publish its Report to the British Association.

ON ALPINE MAPS

MR. LESLIE STEPHEN says that the Alps are the playground of Europe, and he is not far wrong; but the majority of the boys who frequent this playground are acquainted with only a very few of its nooks and corners, and not a single one of them can pretend to know the whole of it. The Alps are not likely to be thoroughly explored for several generations yet to come; and I doubt not that it will be possible for men half a century hence to spend their ten or twelve seasons in the Alps, and still to find at the end of their time valleys which have not been described or even visited.

The Alps are very imperfectly known, and they are still more imperfectly mapped. A complete map of the entire chain of the Alps is yet wanting. I mean one embracing the whole of the land between the Mediterranean on the south and Munich on the north, and from the valley of the Rhone on the west to the frontiers of Styria and Hungary on the east. I believe it is correct to say that there is no map in existence on a scale of $\frac{1}{500,000}$ of nature (or on nearly so large a scale) which contains the whole of the above indicated regions; and even the scale of $\frac{1}{500,000}$ is much too small to permit justice to be done to the intricacies of the chain. So long as the Alps remain divided between several countries it is not likely that we shall possess a complete map of them upon an uniform scale; and as it is improbable that boundaries will be rearranged for the formation of an Alpine State, and more so that private individuals will be enterprising enough to meet the want, it is in the highest degree unlikely that a complete map of the Alps will be produced within many years. Nevertheless, materials for a complete map are rapidly accumulating; the greater part of the chain has been surveyed with considerable accuracy; and the attention of the reader is now invited to some of the more important of the maps which have been, or are being, produced after these surveys.

The Swiss Alps have been surveyed with a thoroughness which leaves little or nothing to be desired. The Government map of Switzerland, on a scale of $\frac{1}{1,000,000}$ of nature, in 25 sheets, besides possessing in a most remarkable degree the essential qualities of accuracy and clearness,

has, regarded as a whole, a unity and perfection which place it far in advance of any other maps of mountainous countries with which I am acquainted. I have carried it in hand over a large part of Switzerland; and whilst I have never been able to detect anything more than trifling inaccuracies, I have been continually filled with admiration for the consummate ability displayed even in its most minute details, and for its almost faultless expression of every variety of mountain form. It would be a poor compliment to it to say only that one can distinguish upon it slopes from precipices, jagged ridges from rugged ground, and the "ice-falls" of the glaciers from the gentle undulating snowy slopes of the upper regions. One can do much more than that. When its conventional methods of expression have been mastered (and it must always be remembered that line engraving is necessarily conventional), the peaks detach themselves from the valleys and soar aloft, and the mountaineer sees the Alps before him with all their marvellous diversity of architecture; nay, more, he can fix his line of assault, and will say, "Here, if anywhere, the summit may be gained."

The effect of the whole map is as satisfactory as its details. The junctions of the sheets are admirably effected and are scarcely perceptible,* the relief of the hills gradually augments from the lowlands upwards, and the *massifs* are projected—as it were embossed—with astonishing power; whilst the great features of the country (such, for example, as the upper valleys of the Rhone and of the Rhine) are depicted so clearly that a single glance is sufficient to fix them indelibly upon the memory. As a work of art (irrespective of its other merits) this map has extraordinary excellence, and, taken as a whole, I believe it to be perfectly unique.

There were special maps of several of the Swiss cantons before the great survey was undertaken, but the map in 25 sheets is the first general official map of Switzerland that has been produced. It is drawn with what is termed *oblique light*—that is to say, with the light proceeding from the left-hand top corner to the right-hand bottom corner; and this treatment (which the Swiss Staff maintain with reason is the natural and the only effective system possible for a mountainous country) is employed consistently through all the sheets. A great part of the artistic effect of the map when the sheets are joined together is due to this treatment. The system of *central light*, which is sometimes adopted for maps, does not answer for a mountainous country; for it is evident, if it is employed in a map with numerous sheets, that each sheet becomes isolated from the surrounding ones, and unity of effect is impossible.

The claims of the draughtsmen and engravers of the Swiss map are deserving of especial recognition. It could not have been produced in its wonderful perfection unless every person employed upon it had been devoted to the work, and possessed of rare ability. But I believe that the reason of the extraordinary uniformity in the excellence of its parts, and of the unity of the whole, is found in the fact that the entire drawings and plates (and a great part of the survey†) were executed under the direction of a single head, namely, that of General Guillaume Henri Dufour.‡ The map is popularly and properly termed the "Carte Dufour."

The Swiss are keenly alive to the value and uses of good maps, and since 1869 have commenced a great one, which, in its dimensions at least, dwarfs the Carte Dufour

* For an example of the admirable way in which these sheets will join together, the reader is referred to a map of the Canton Uri, issued by the Swiss Statsbureau in 1867, which is composed of portions of four of the sheets of the Dufour map.

† The triangulation was commenced at the end of the last century by the cantons, and in 1828 was taken into the hands of the Confederation. The triangles of the first order were brought to a conclusion in 1840. The first sheet appeared in 1845, and the last one in 1864. In connection with the survey the names of Bétemps, Coaz, Mohr, and Colonel Siegfried should be mentioned. The last-named gentleman is, since 1864, director of the Topographical Bureau.

‡ Born 1787; entered the Federal Staff 1817; Colonel 1827.]

to insignificance. The map of which I now write, when complete, will be in 546 sheets. The portion comprising the plains and the Jura will be on the large scale of $\frac{1}{350,000}$, but the Alpine portion will be upon a scale of $\frac{1}{500,000}$. As yet only 26 sheets are published. The large scale of this map admits of the introduction of details which would have overcrowded the Carte Dufour, and there is, indeed, scarcely anything omitted from it which could be inserted. Even the erratic blocks of the Jura are laid down. The rivers and torrents are printed in blue ink, the lettering and outline of the map is in black, and there is a third printing, in red, for contour lines. Originally it was intended to have had a fourth printing, in green, for the sake of the forests; but the idea was abandoned from considerations of expense. The engraving of the lowland portion of this map is of the most exquisite character, and the Alpine portions (which are lithographic) are extraordinary examples of drawing on stone. The published sheets have not, however, the relief which is such a picturesque feature of the Carte Dufour, and which makes that map so popular and so valuable for educational purposes. Notwithstanding this, the larger map will be found to be incomparably the more useful of the two. The contour lines are laid down on the Alpine portion at a height of 30 metres (= 100 Swiss feet), and on the lowlands at a height of 10 metres above one another. One can therefore determine at a glance the height of any point upon mountains, glaciers, or snow-fields, within a few feet; whilst the largeness of the scale renders it invaluable for purposes for which the Carte Dufour could not be employed.

There is also at the present time a third map of Switzerland being produced at Berne, which is a reduction of the Carte Dufour. This is upon the scale of $\frac{1}{550,000}$, and will be in four sheets. Two sheets are already published, a third is complete so far as Switzerland is concerned, but is awaiting details of the Italian Alps, and the fourth sheet is scarcely commenced. The engraving of this map is not less admirable than of those which have been already enumerated; and as it will be sold at 10 fr. for the four sheets, it will be one of the cheapest, if not the very cheapest, copperplate map ever produced.*

There are, therefore, existing or in progress three maps of the Swiss Alps, each of which may be adopted with confidence as a basis for other maps; but if we pass to the French, Austrian, or Italian Alps we shall find a great inferiority in the materials at our command. The French Alps have been, perhaps, better surveyed than the Austrian, and the Austrian than the Italian; but all these countries are destitute of maps possessing anything like the perfection of the Swiss ones.

The survey of the Etat Major, for the great map of France in 258 sheets (subsequently extended to 263 sheets, in consequence of the annexation of Savoy), was commenced very many years ago, but there are about 20 sheets still remaining unpublished, and almost all of these belong to the Alpine part of the country. Sheet 189, published in 1866, is indeed the only one yet issued which embraces any very lofty peaks; and this one contains the whole of the so-called Pelvoux *massif*, which includes numerous splendid mountains ranging in height from 3,700 to 4,100 metres. The principal triangulation may have been performed, for aught I can say to the contrary, with the utmost precision; but there is in the engraved sheets of the Alpine portions of the map a general want of the intelligent rendering that is found in the Carte Dufour, and such inexactness in the topographical details that one's confidence is shaken in the whole work. I cite by way of example the *massif* of the Meije (3,987 metres),

the highest mountain in the Alps which remains unascended. The glaciers and its ridges, both on the north and on the south sides, are very inaccurately represented, and upon the spot are scarcely recognisable; and in other places, even where attention has manifestly been paid to details, the work is very devoid of character, and has been freely generalised. One can only conclude, in regard to these matters, that the engineers either considered that details of the upper regions were of no importance, or else that they were ignorant of the meaning of the things which they regarded. No sheets have been published to the south of No. 189, and thus the greater part of the department of Hautes Alpes, and the whole of the departments of the Basses Alpes and of the Var (to say nothing of Nice) remain unmapped. It is, I believe, chiefly on account of the want of good maps that so few persons travel for pleasure in this beautiful corner of France. The means of communication are good, and living is cheap, but it is rare indeed to meet with a tourist anywhere; and the solitary pedestrian is likely to be mistaken by the natives (as I have been several times) either for a pedlar selling images of the Holy Virgin, or for a dealer in looking-glasses.*

The range of Mont Blanc, which partially reverted to France in 1860, was until quite recently one of the worst mapped portions of the entire chain.† Upon the annexation of Savoy, Captain Mieulet, of the Etat Major, was set to work to connect this part of the new territory with the great map of France. But before Mieulet's work was reduced, and indeed almost before his survey was completed, the range was mapped by an amateur, and the honour of first presenting to the world an accurate plan of the most important part of the greatest chain of mountains in Europe was secured by an Englishman. Mr. A. Reilly (the English amateur to whom I refer) in 1863 determined trigonometrically no less than 200 points, and in the winter of 1863-4 reduced his work to shape, and presented his map to the English Alpine Club. Its publication was immediately resolved upon, and in 1864 Mr. Reilly went over the ground again to correct his work. In June 1865 his map was published at the cost of the Alpine Club, in chromo-lithography, upon a scale of $\frac{1}{500,000}$ under the title of "The Chain of Mont Blanc." In the mean time it had been represented in Paris that it would be a great advantage for Captain Mieulet to extend his work beyond the frontiers, and he accordingly carried his survey as far as Courmayeur. A special sheet on the scale of $\frac{1}{400,000}$ was promptly engraved from the materials he accumulated, and was published in 1865 by order of the late Minister of War, Marshal Randon.‡ This map, however, included the central portion of the chain only, and Mr. Reilly's map remains, I believe, the only trustworthy complete map of the whole of the chain that is in existence.

In accuracy there is probably little difference between these two maps. The French one is superior to the other in giving numerous altitudes, but the English one has the merits of greater clearness and picturesqueness. Mieulet, on his survey, discovered that the highest peak of the Aiguille de Trelatête was only 3,932 metres, whereas an altitude 1,000 ft. greater had been previously assigned to it. Reilly, on his part, demolished the Pointe des Plines, a fictitious summit, which he showed was identical with the Aiguille d'Argentière, although it had in former maps been laid down as a mountain separate and distinct. Both maps have especial merits, but the Englishman's, from being the work of an amateur, is the more remarkable of

* All of the Swiss maps are remarkably cheap. The sheets of the great map in 546 sheets will be sold at an uniform price of one franc each. The price of the Carte Dufour (which measures 3.50 metres wide by 2.40 metres high) was reduced about three years ago, by order of the Federal Council, from 100 to 40 francs, in order that it might be available for persons of small means. The whole of these maps can be procured from the bookseller Dalpé, of Berne, who is the agent appointed for their sale.

* Another proof of the rarity of travellers is found in the ignorance of the natives of all kinds of money except their own, and the traveller should well supply himself with napoleons and francs, to avoid loss by exchange.

† I do not of course in this remark include the Swiss portion of the range, nor the basin of the Mer de Glace. That renowned glacier and its tributaries were well surveyed by the late Prof. J. D. Forbes in the years 1842-50, and the resulting map, which was published in 1855, was, I believe, drawn on stone by Dr. Augustus Petermann himself.

‡ Under the title of "Massif du Mont Blanc, extrait des minutes de la carte de France, levée par M. Mieulet, Capitaine d'Etat Major."

the two, and notably illustrates how much a single unaided person may accomplish who makes his work a labour of love.

The condition of the Eastern Alps is even less satisfactory than that of the western part of the chain. The great French map will, doubtless, be completed sooner or later, and when it is finished the Western Alps will be fairly, although only fairly, represented. There is no immediate prospect of an equally perfect map being produced of the Eastern Alps. The map of Lombardo-Venetia, in forty-two sheets, on the scale of $\frac{1}{864,000}$, is the most important one which touches these districts; and it is as much inferior to the great French map as the latter is to the Carte Dufour. Those who are intimately acquainted with these regions point to its too great generalisation of details and to its want of character, and observe that it (like other maps published at Vienna), although meritorious for its day, is now behind the times. Sundry amateurs have done good work in recent years in correcting or laying down afresh several of the *massifs* of the Eastern Alps, and amongst these individuals none are more worthy of mention than Mr. Tuckett and Lieutenant Payer. In the summer of 1864, Mr. Tuckett, of Bristol, devoted some time to the exploration of the Orteler group, and subsequently published a paper in vol. i. of the *Alpine Journal*, entitled "Contributions to the Topography of the Orteler and Lombard Alps." This paper was accompanied by numerous outline sketches, and by a map. The latter, although roughly executed, gave, it is believed, for the first time with some approach to accuracy the positions and forms of the glaciers on the south side of the chain throughout the length of Val di Zebbru, with the basins of the Vitelli and Nagler glaciers, and the lower portions of those of Sulden and Forno. All these were more or less incorrectly laid down (when represented at all) or vaguely indicated on the Government Maps. Further topographical corrections in connection with the Southern Orteler Alps (the result of visits in subsequent years) were recorded by Mr. Tuckett in the 2nd vol. of the *Alpine Journal*. With the labours of Lieutenant Payer the readers of this journal are already acquainted.*

Of the Alps of Piedmont there is no map in existence upon which dependence can be placed. A survey is said to be in progress, which will be eventually worked out upon a mammoth scale, and this will afterwards be adopted as the basis for a reduction of more moderate size. Many years must elapse before either of these maps can be produced, and in the meanwhile the old Sardinian Government map will be almost the sole authority. The shortcomings of this map are notorious, and one wonders at the rare ability of the draughtsmen who were employed upon it in projecting mountains which do not exist. The case of Mont Tseran is one of the most flagrant instances, but others could be quoted scarcely less audacious. Mont Tseran is laid down on sheet thirty-seven of the Sardinian map upon the northern side of the valley of the Arc, not far from the source of the river, and is credited with an altitude of 4,045 metres. There is no important mountain upon the spot which it is supposed to occupy, and Mont Tseran may be considered to be absolutely mythical. The late Mr. Cowell demonstrated that the peaks in this neighbourhood do not anywhere approach the height of 4,045 metres,† and those who cross the Mont Cenis Pass by the old road can easily satisfy themselves that no great mountain occupies the ground whereupon Mont Tseran was located by the Sardinian surveyors.

Several amateurs have endeavoured to reduce the Piedmontese Alps to a little order. Mr. Reilly (whose name has already been mentioned in connection with the chain of Mont Blanc) carried on a survey of the southern branches of the central Pennines in the years 1865-6, and

afterwards projected his work upon the scale of $\frac{1}{700,000}$. His map was published at the expense of the Alpine Club, and it is, I believe, the only one which at all fairly represents the southern side of Monte Rosa, the valleys of Valtellina, Barthelemy, and Tournanche, and the ranges which divide those valleys. Mr. R. C. Nichols has devoted several seasons to clearing up the topography of the Graians, and has from time to time communicated papers to the "*Alpine Journal*," some of which are illustrated by maps. But the full extent of his labours will not be known until a map is published, about which I have now a few words to say.

Some six or seven years ago the want of a general map of the Alps was a topic of conversation amongst those who habitually frequent those mountains, and ultimately a committee of the Alpine Club was appointed to superintend the production of a new map which was intended to rival the Carte Dufour in accuracy, and to comprehend the entire chain. The preliminary investigations quickly discovered that the plan must be modified, on account of lack of data; and it was at length determined to limit the scheme to the Central Alps, to the exclusion of the most eastern and western ones. Mr. William Longman, the eminent publisher, accepted the financial responsibilities, and Mr. Nichols was appointed editor.

This map will be in four large sheets on the scale of $\frac{1}{330,000}$, and is being engraved on steel. It is now in course of production at the geographical establishment of Mr. Stanford, and it promises to be one of the most minutely and beautifully engraved maps ever published in this or in any other country. Its sheets are somewhat larger than those of the Swiss map on the scale of $\frac{1}{250,000}$ and it does not extend quite so far to the north as the Swiss map, but in the south it embraces the important groups of the Graian Alps to the south of the Valley of Aosta, which include the Valleys of Locana, Cogne, Savaranche, Rhêmes, Grisanche, and the Tsère, with their peaks Tour de St. Pierre, Grivola, Grand Paradis, Grand Appareil, Aig. de la Sassièrre, Mont Pourri, and the Rutor. All of these valleys and mountains are not included in the Swiss map. In the west the boundaries of the two maps are identical, but in the east the English one extends 10 kilometres beyond Landeck, thus taking in the Orteler group, the Zufallspitze, the Adamello and Presanella (all of which mountains will be just without the range of the Swiss map), but stopping short of the Oetzthal group, and thus excluding a great part of the Tyrol, the Bavarian Alps, and everything beyond. The map is expected to be completed in about two years, but it is not at the present time sufficiently far advanced to permit of an elaborate criticism. I believe, however, that it will be found to be little or not at all inferior to the Swiss maps in finish of engraving, in its relief, and in its accuracy, but will hardly be so clear as they are, in consequence of the introduction of details which would have been sufficient for a map of four times its scale. Still its appearance will be welcome to those who travel amongst or who are interested in the Alps, and it is to be hoped that the scheme as at first propounded will one day be carried out to its fullest extent.

In the foregoing rapid survey of maps of the Alps it has only been possible just to glance at some of the principal ones; but this glance has, I trust, enabled the reader to understand that an unlimited amount of work remains to be accomplished before the Alps can be said to be thoroughly explored, and that a splendid field still remains open for the employment of superfluous energy of men who desire to distinguish themselves. The efforts of individuals are scarcely perceptible upon so vast an extent of country; but a body of zealous observers, spread over its various districts, might break the neck of the work in a few years, and render it possible to produce for the first time a map of the entire Alps upon a uniform scale.

EDWARD WHYMPER

* Papers have appeared from time to time upon Lieut. Payer's work in the pages of Petermann's "Mittheilungen."

† See "Vacation Tourists and Notes of Travel," London, 1861.