

had iron rings to my belt through which the cord ran. Rebot, who was last in the line, was thrown clean out of the avalanche; he was carried during the descent towards one of the sides of the stream. He was the only one of us who escaped unhurt. Thus, when we stopped in our descent, two only were tied to the rope, B. and Bennen—the very two who perished.

3. The congealing of the snow happened by pressure. The fore part of the avalanche stopped first, and the rest was forced against it. The circumstance I can least understand is the sudden fall in the temperature of the air after the accident. I can give no estimate of it, but it was intense.

4. The bruises Bevard, Nance, and I sustained were slight, but our feet were severely frost-bitten. Bennen has been accused of rashness in this unfortunate accident. It is not the case. He was misled by the total difference of the state of snow in a winter ascent from what is to be met with in summer.

THE GRANDES ROUSSES OF DAUPHINE. By WM.
MATHEWS, JUN., M.A.

WHEN I had the happiness of standing on the summit of the Mont Pourri with my friend the Rev. T. G. Bonney, in August 1862, and of gazing upon the noble panorama of the Dauphiné Alps from that admirable point of view, our attention was attracted by a vast mass of glacier-clad mountain standing out by itself to the west of the main chain. We subsequently identified it as the Grandes Rousses, and when we drew up our programme for the campaign of 1863, we resolved that the ascent of its highest peak should be one of our first expeditions.

The district is so imperfectly represented upon all the maps hitherto published, that it was important to us to obtain some more trustworthy information, and I spent a day in Paris at the end of last July for the purpose of consulting the manuscript map of the French Government at the *Dépôt de la Guerre*. By the courtesy of the authorities I was permitted to inspect not only the Dauphiné sheets, but also those of the Maurienne, the survey of which had just been completed, and to make a rough tracing of them, which has formed the groundwork of the map accompanying this paper.

The Grandes Rousses is not a single peak, but a mountain range about eight miles in length, running NNE. by SSW., and steeper on the western than the eastern side. On the former it presents a lofty wall of crystalline rock, supported by projecting buttresses which rise out of a shelf of glacier rest-

ing upon a lower rocky wall. At the base of the latter is a narrow and nearly level tract, dotted with small lakes, west of which the country again falls rapidly. The whole of this side of the mountain is in Dauphiné, and most of the streams which flow from it find their way into the Olle, and thence into the Romanche below Allemont. On the eastern side the slope is



MAP OF LES GRANDES ROUSSES, SHewing MR. MATHEWS' ROUTE.

less rapid, and the glaciers are consequently more considerable. Of these the largest and most northerly is in the Maurienne, the remainder belong to Dauphiné.

According to the French engineers, the chain of the Grandes Rousses culminates in four principal peaks. The first or north

peak, situated on the boundary line between Dauphiné and the Maurienne, is 3,473 metres, or 11,395 feet above the sea, and the second or south peak is exactly the same height. The two remaining ones are still more to the south, and of inferior elevation.

Our travelling party consisted of my friend Mr. Bonney, my brother George and myself, with our guides, Michel Croz and Joseph Basile Simond of Chamouni. After spending a few days very pleasantly amid the charming scenery of the Grande Chartreuse, we crossed the Grésivaudan to Allevard, and on the afternoon of August 4 walked up to La Ferrière, where we found tolerable quarters at the little inn of M. Jourdan. As our baggage included a theodolite and mercurial barometer, as well as a couple of aneroids and several smaller instruments, in addition to the usual personal luggage of mountaineers, it was necessary to secure considerable extra assistance in the way of porters, and we engaged a son of Jourdan's to take charge of the theodolite, and another man to carry provisions.

On the morning of the 5th we quitted the village at 4.30, and ascended the beautiful valley of the Breda to the Sept Laux, reaching the fisherman's hut at 9.45, after about four and a half hours' actual walking. Our barometer observation gives 7,179 English feet for the height of the col, which agrees tolerably well with 7,144', a previous determination of Professor J. D. Forbes.

The next point in our route was '*La Grande Maison*,' a chalet near the head of the valley of the Olle, where we expected we should have to sleep. From the Col of the Sept Laux a very steep descent of 3,000 feet leads into the valley near Le Rivier, which is much lower down than the Grande Maison. Anxious to avoid an unnecessary descent, as well as a great detour, we availed ourselves of the services of a native whom we found at the Cabane, who volunteered to take us straight to La Grande Maison over the intervening mountain ridge. We accordingly detached one of the porters from the party, and sent him down to Le Rivier, to get more provisions and carry them up to the Grande Maison, where we should await his arrival. After a halt of an hour we started off again, under the direction of our new guide, and after descending to the lower lake, we climbed up a quantity of stones and shingle to a gap in the ridge immediately to the east of it, which we reached at noon. This ridge is called by Bourcet '*Roche de Billian*,' and we may therefore call the gap the Col de Billian. We spent an hour upon it very pleasantly in taking our mid-day meal, observing the barometer, and studying the

interesting features of the Grandes Rousses. I find the height of the col to be 8,028', or about 850' above that of the Sept Laux. The descent turned out to be rough, troublesome, and circuitous, and it was three o'clock before we reached the Grande Maison, a chalet with so high-sounding a title, that we were scarcely prepared for the miserable and filthy hovel by which we were greeted. It may be doubted whether, after all, we had saved any time by our short cut, but at any rate the absent porter did not bring up the provisions until two hours after our arrival. The idea of passing the night at the Grande Maison was unanimously scouted, and by the advice of the local guide, whose engagement had now terminated, we crossed the valley and ascended the gorge of La Cochette to the upper chalets of the same name, where we arrived at 6.

I cannot recommend this resting-place to any future travellers. The alp upon which it stands is only a sheep pasture, and is consequently incapable of affording the luxury of milk to the tired and thirsty mountaineer. Moreover, the building is so small that only a portion of our party, in addition to the numerous Provençal shepherds who lived in it, could find sleeping-room inside. Bonney disposed of himself under the eaves, and my brother and I extemporised a mattress out of a pile of wood adjoining, where we should have doubtless spent a tolerable night but for a heavy shower of rain, which lasted about two hours, and drove us crouching to the door for shelter. Happily, the sky cleared again: at the first glimpse of dawn we left our beds, took a hasty breakfast, and at 4.10 on the morning of the 6th turned our backs without regret upon the chalet of La Cochette.

A walk of about half an hour brought us to the Col du Couard at the head of the valley of Vaujany, where we placed our knapsacks upon the backs of two porters, and sent them down to Allemont with instructions to engage a carriage to take us to Bourg in the evening. We continued ascending the valley of La Cochette until we reached one of the small lakes, I believe the Lac de la Sasse, where, judging that we were nearly abreast of the northern peak of the Grandes Rousses, we turned to the east to the foot of a very steep glacier, which flowed through a gorge in the lower wall of rock, from the more level névé above. Michel was soon at work cutting steps in the ice, which was exceedingly hard, a proceeding which consumed a great deal of time, as many more steps were necessary than we had any idea of from below. When the slope abated a little we found a moraine upon our right, and made straight running for it, in order to avoid the labour of

step cutting, which we were speedily forced to resume by a rather startling incident. A number of outlying blocks, resting upon a higher part of the slope showed symptoms of unsteadiness, and in a few seconds about a dozen of them began to slide, and dashed down the ice with frightful velocity before our very faces. Selecting a safer line of ascent we at last reached the névé, and gained the moraine at its origin near the base of the peak, from which it was separated by a narrow belt of snow. We reached this point at 7.40, and halted at once for breakfast. An observation with Bonney's aneroid makes it 9,754' above the sea.

At 8.30 we started again, and crossed the snow to the foot of the northern peak, whose summit we gained at 10.15, after a fatiguing and rather difficult climb up steep and broken rocks, which recalled to our minds the ascent of the last cone of the Grivola. We now looked down upon the extensive glaciers clothing the eastern flank of the mountain, of which that belonging to the Maurienne was the most striking, and descended in graceful sweeps towards the valley directly from our standing place. This glacier would certainly afford the easiest and most natural route to the summit, to gain which, by the side on which we had mounted, involves a labour altogether disproportionate to the height. I believe it flows into the Vallon d'Arves, but the small lakes shown in the plan, to the north of it, communicate with the Olle, which winds round the northern extremity of the chain.

Our eyes were quickly diverted from the Grandes Rousses to the magnificent and almost boundless mountain panorama by which we were surrounded. The more distant portions of the Pennine and Graian Alps were concealed by clouds, but Mont Blanc, the Pourri, and the Grande Casse were immediately recognised and welcomed as old acquaintances, and south of the latter we distinguished the Dent Parassée, the peak terminating on the south the glacier de la Vanoise. In the south-east, and very near at hand, rose a remarkable group of peaks, one of which is the highest point of the range of alps that separates Dauphiné from the Maurienne. These are the Aiguilles d'Arves, three precipitous pinnacles of secondary rock, almost devoid of snow and glacier, the two highest of which, when seen from certain points of view, have been fancifully compared to a nutcracker. These, according to the French engineers, are respectively 11,513' and 11,529' in height. On the manuscript map the former is decorated with a triangle and the letters 'Sig¹,' from which I presume we may gather that it has been ascended, and as certainly that the higher peak has not. I

strongly recommend the latter to the attention of the Alpine Club.

To the right of the Aiguilles d'Arves, we looked upon a rolling sea of lower summits, and across them in the far away distance to the towering Viso, and then turned southwards to gaze upon the most beautiful portion of the panorama, the magnificent cluster of the high Alps of Dauphiné. To gain this view had been one of the principal objects of our ascent, nor were we disappointed. Immediately opposite to us was the lofty range dividing the waters of the Romanche from those of the Vénéon, commencing on the left with the Meije or Aiguille de Midi de la Grave, the second peak of Dauphiné, a mountain crowned by a score of steep and shattered pinnacles, and streaming with noble glaciers. The central portion of the range was occupied by the Râteau, and it was terminated on the right by the immense snow-field of the Mont de Lans, which we traversed a few days after. Beyond this gigantic outwork we had glimpses of the more central summits of the group; the gap between the Meije and the Râteau disclosed the Pelvoux, the Crête de l'Encula and the Pic des Ecrins, while on the right of the Râteau appeared the well-known form of the Allefroide.

While Bonney was making outline sketches of the most interesting portions of the panorama, my brother and I set up the barometer and theodolite. At 11.45 the height of the barometer, reduced and corrected, was 509.26m. with an air temperature of 5.0 cent. Comparing this with the mid-day observations at St. Bernard, Aosta, Geneva, Turin, and Grenoble, and taking the mean, we get

3,472m. or 11,391 English feet,

only one metre less than the determination of the French engineers.

The theodolite was placed with its optic axis about two feet above the summit, and we took with it the azimuths and altitudes of the most interesting points in sight. Anxious to ascertain whether the French engineers were correct in attributing to the south peak an elevation exactly equal to that of the one we were standing on, I brought the cross wires of the instrument to bear upon to the top of the former. The reading was $-0^{\circ} 5'$. The horizontal distance being 2,000m., the corresponding vertical is 2.9m., which is reduced to 2.64m. by correcting for curvature and refraction. Deducting the fraction for the height of the theodolite, we arrive at the conclusion that the south peak is 2 metres lower than the other. This result cannot be regarded as finally established until the reciprocal

observation has been performed from the other peak. It must, however, be borne in mind, that as neither peak had previously been ascended, and consequently no signals erected upon them, some amount of uncertainty must attach to the measurements of the French engineers.

We left the summit at 12.10, after nearly two hours of perfect enjoyment. When about half-way down the rocks we discovered a snow-filled couloir, down which we glissaded, saving much time thereby, and crossing the glacier considerably to the south of our line of ascent, we hit upon the lower rocks at a point where they were quite free from difficulty. They were gay with the golden flowers of the Alpine poppy, a plant said to be frequent in Dauphiné, but which I had never seen before. At 2.30 we were seated by the pretty little lake of Balme Rousse, overlooking the valley of Vaujany, where we rested half-an-hour to bathe and enjoy the scenery. We then commenced the descent to Allemont, in which I believe we should actually have saved time by going round by the Col du Couard. We were prevented from getting down to Vaujany itself by a range of steep precipices, which cut us off from the opposite side of the valley, and as our route was crossed by a number of lateral ravines, we were constantly walking up and down hill in succession, which at that time of day was extremely fatiguing. The valley of Allemont, with its picturesque villages, embosomed in walnut groves, came at last into sight, but it was ten minutes to seven before we reached La Fonderie, and found the carriage waiting to drive us into Bourg, where the fatigues of the day were soon effaced by the comforts of the Hôtel de Milan, and the admirable cuisine of M. Martin. I should be wanting in justice if I did not bear testimony to the excellence of this inn, the moderation of the charges, and the anxiety of the proprietor to provide for the comfort of English travellers.

It may be gathered from the preceding description, that the ascent of the Grandes Rousses is an expedition that may be strongly recommended to Alpine travellers who are visiting Dauphiné, but if I were to repeat it, I should approach the peak from St. Sorlin d'Arves by way of the north-eastern glacier, and I should endeavour to descend directly upon Bourg, by the Granges of Huez.

Table of Heights calculated from Barometric Observations made in the Dauphiné Alps. In Illustration of the Papers of Messrs. Bouney and Mathews.

Date 1864	Hour	Name of Station	Method	Barometer reduced and corrected	Air Temperature	St. Bernard, 2478.3 m.	Aosta, Carrel, 600 m.	Geneva, Planinour, 408 m.	Turin Academy, 285.24 m.	Grenoble, Demarchi, 215 m.	Means		Remarks
											Metres	English feet	
Aug. 4	h. m. 6.30 p.m.	La Ferrière, Auberge .	Mer.	687.15	20.5	931	m.	903	m.	m.	917	3,009	
" 5	10.15 a.m.	Col des Sept Laux .	"	593.43	17.8	2,173	2,181	2,190	2,210		2,188	7,179	7,144', Forbes
" 5	1.0 p.m.	Col de Billian .	"	576.10	16.0	2,424	2,435	2,450	2,470	2,454	2,447	8,028	
" 5	6.15 "	Châlet of La Cochette dessus	"	602.35	16.2	2,044		2,048			2,046	6,713	
" 6	4.45 a.m.	Col du Couard .	An.	589.35	11.0	2,240		2,228			2,234	7,330	
" 6	8.30 "	Top of moraine below N. P. of Grandes Rousses .	"	540.00	7.0	2,965	2,971	2,975	2,981		2,973	9,754	
" 6	11.45 "	Grandes Rousses, N. Peak	Mer.	509.26	5.0	3,449	3,457	3,475	3,496	3,482	3,472	11,391	3,473 m. Et.-Maj. Français
" 8	9.0 "	Gapin ridge leading to Grand Glacier .	An.	542.50	9.0	2,963	2,977	2,965	2,970		2,969	9,741	
" 8	11.15 "	Col de la Lauze, or de la Scille	Mer.	508.20	5.0	3,505	3,508	3,504	3,539	3,516	3,508	11,509	Turin result rejected
" 8	noon	Pic de la Lauze (compared with last station) .	An.	506.00	5.0						3,543	11,624	
" 8	2.30 p.m.	Peak called Jodri, on French map .	"	522.50	12.0	3,288	3,293	3,315	3,323		3,305	10,843	3,292 m. E. M. F.
" 10	10.0 a.m.	Plan des Cavalles ' Barraque' .	An.	600.00	18.0	2,116	2,136	2,142	2,143		2,134	7,001	2137 m. E. M. F.
" 10	3.0 p.m.	Col de la Casse déserte .	Mer.	508.35	6.5	3,494	3,506	3,523	3,518		3,510	11,516	
" 12	12.15 p.m.	Col des Cavalles .	"	525.90	10.5	3,168	3,187	3,195	3,210	3,205	3,193	10,476	3,128 m. E. M. F.
" 12	6.0 "	La Bélarde .	"	624.88	19.6	1,721		1,695			1,708	5,604	{ 5,669', Mar. 1860 (Turin) 5,791', Tuckett, 1862. 5,702', E. M. F.
" 13	noon	Col de Sélé .	"	519.08	7.5	3,274	3,282	3,285	3,312	3,299	3,290	10,794	{ 10,834', Tuckett, 1862. Boiling point
" 14	2.30 p.m.	Col de l'Echauda .	"	576.60	11.8	2,416	2,418	2,417	2,425		2,419	7,936	

The heights contained in the accompanying table refer, not only to the ascent of the Grandes Rousses, but also to the excursions described by Mr. Bonney. The larger part of the observations were taken with a mercurial barometer by Casella, the remainder with an aneroid by Negretti, belonging to Bonney, and another by Browning, belonging to me. The two aneroids were kept constantly compared with the mercurial barometer, and corrected accordingly. The calculations have been made by the tables of Delcros, based on the formula of Laplace. Considering the present imperfect state of our knowledge on the subject, I have not attempted to correct the air temperatures for the *horary equation*, but the effect of this inequality, in the midday observations, is very conspicuous in the table. The results agree remarkably well with the determinations of previous observers, except in the case of the Col des Cavalles, where the figures on the Government map must, I think, refer to a different point from that at which we made the passage.

WM. MATHEWS, Jun.

THE RANGE OF THE MEIJE, DAUPHINE.—By the Rev. T. G. BONNEY, M.A., F.G.S.

THE Alpine traveller, who has had the good fortune to obtain a clear view of the mountains of Dauphiné from one of the summits of the Graian or Tarentaise Alps, will doubtless remember that the range formed by the towers of the Pelvoux, Ailefroide, Ecrins, and Meije, is terminated by a vast sheet of snow, covering like a cloth a table-like mass of precipitous rock. This is the great Glacier du Mont de Lans, lying between the valleys of the Romanche and the Vénéon, with its tributary, the Vallon de la Selle. Before describing our excursion over it, I shall venture to add a few words to the account which I have already given of the Pelvoux district.* I compared the configuration of the mountains in the neighbourhood of that summit to an E, and resume the simile for one moment. From the NW. corner of this letter, a high ridge, starting from the Roche-Faurio, runs northward, dividing the Vallon des Etançons from the upper part of the

* 'An Excursion in Dauphiné.' The 'Alpine Journal,' vol. i. page 66. I may also refer to the paper on that district by my friend, Mr. Tuckett, vol. i. page 145, which contains an admirable account of the main mass of the Dauphiné Alps; and gladly take this opportunity of expressing my gratitude to him for much valuable information, communicated with his usual liberality.