

ing my remonstrances. I followed, but when halfway across the snow-film broke away, I slipped down with a jerk and pulled Zurfluh after me. Fortunately Lauener had not yet left the rocks, and he supported us for a second, till, driving our axes into the ice, we recovered our footing. Shortly afterwards we reached the bergschrund, in the very spot where we had previously crossed it, an admirable example of the skill with which Zurfluh had piloted us down in the fog and blinding snow. Cautiously we made our way over the chasm, for it was of great width, and the snow-bridge was very soft and insecure. Yet we went as rapidly as we dared, for this was the most likely place for Zurfluh's hypothetical avalanche, whose immediate fall the heavy and continuous snow had rendered by no means improbable. We reached the other side without accident, and glissaded or tumbled rapidly down the snowfields in no further anxiety about our safety. We avoided, however, the broad crevasses which we had crossed in the morning, where everything was frozen, keeping under the cliff, though at some slight risk from falling stones and ice. Having quickly passed over the glacier we soon reached the moraine, every stone of which was now disintegrated and lay loose upon the ice. Tumbling wearily down these, and execrating the natural laws which produce moraines, we reached at last the solid ground, and in due course arrived at the Abricolla châlet once more.

How welcome now seemed its filthy interior! There, safe from snow, rain, and wind, we sat round the fire, drank some mulled wine, and (for the first time for more than twelve hours) ate a hearty meal and began to feel more easy in mind and body. The cold or the jolting had broken the spring of my watch, but I guessed the time of our expedition to have been between 12 and 14 hours. Nothing, however, would persuade our honest host that we had reached the top. 'I know that mountain well enough,' said he, 'and in such weather as this it is impossible.' I could only reply, 'Si monumentum quæris, circumspice' (alluding to our cairn), an observation of which I fear he did not quite catch the drift.

EARLY ASCENTS OF THE ORTELER SPITZE. By F. F. TUCKETT, F.R.G.S.

THE earlier attempts to ascend the Orteler Spitze are detailed with considerable minuteness by Schaubach ('*Deutsche Alpen*,' B. IV. pp. 19-26), and in the second volume of the '*Mittheilungen des Oesterreichischen Alpen-Vereines*,'

Herr Pegger, our immediate predecessor,* has appended to his personal narrative a short account of previous expeditions; but as both these works are comparatively unknown to English readers, I venture to think that a brief outline of the results of former attempts may not be without interest.

The summit of the Orteler was reached for the first time on the 27th September 1804, by a famous chamois-hunter named Joseph Pichler, with two natives of the Ziller Thal, at the instigation of the Archduke John. They were only able to remain four minutes on the top, or just long enough to obtain a barometrical observation, the accuracy of which is, however, more than doubtful, as by comparison with Glurns it gave for the peak a height of 14,412 French or 15,360 English feet! Herr Gebhard, an officer charged with the investigation of the topography of the Ober-Vintschgau, was prevented by indisposition from accompanying the expedition, but in the following year, with indefatigable zeal, he effected the ascent no less than three times. He seems, however, to have left no account of his adventures—at least I have been unable to meet with or hear of any.

More than twenty years passed by during which we hear nothing more of the Orteler Spitze, but on August 20 21, 1826, it was again ascended by the Austrian officer of engineers Schebelka, with Pichler for leader, and Fidel Timel of Sulden, Johann Brunner of Gamphof, and Michael Gamper of Agums as subordinate guides. 'The attack was first made from the side of the Sulden Thal whence Gebhard's attempts were made, but enormous masses of ice barred all further progress at about five-sixths of the height of the mountain, and the original route from Trafoi had in consequence to be selected.' From the concluding words of this statement, which I extract from Schaubach, it would appear that Pichler had started from Trafoi on the occasion of the first ascent, but why he afterwards adopted the Sulden Thal as his starting-point when accompanying Gebhard is not explained. Be this as it may, Schebelka and his companions slept on the night of August 20 in a ruined hut, which is probably the one referred to in more recent narratives as situated near the summit of the wood between the Orteler Glacier (Unter Trafoier Ferner) and the Tabaretta Thal. Quitting this at 4.30 the next morning, they gained the summit at 3.30 p.m. Here they found the remains of Gebhard's pyramid, but in the interval since its erection the

* The narrative of Mr. Tuckett's ascent was published in a former number, from which want of space caused the exclusion of this article.

summit had increased in height three *klafter* (18·67 English feet). A storm unfortunately coming on obscured the view, and compelled them to beat a precipitate retreat. At one a.m. they reached the first trees, 'still two-and-a-quarter hours above the hut,' a statement which seems inexplicable, unless the darkness of the night or their excessive fatigue rendered their progress extremely slow. Finally, it was not till 10 a.m. on the 23rd that they returned to Trafoi.

The next and best-known ascent was effected by Professor Thurwieser in 1834, and is minutely described in the 'Zeitschrift des Ferdinandeums, 3 Bändchen, Innsbruck, 1837,' pp. 89-163. I have not been able to consult the original publication, but a detailed résumé of the paper is given by Schaubach, from which I extract the following particulars.

Pichler, now 70 years of age, with his son Lax and Michael Gamper, acted as guides. The party left Trafoi at 2.30 on the afternoon of the 12th of August, and following the path to the Heiligen drei Brunnen, thence ascended the 'Bergl,' the spur or buttress partially clothed with wood, to which allusion was so often made in my last paper. In the hut at its summit, which was reached at 6 p.m., they took up their quarters for the night at a height of 6,327 Paris or 6,743 English feet. A start was effected about four o'clock on the morning of the 13th. 'A ridge descending from the Orteler to the Trafoi Thal separates the summit of the "Bergl" from the lower Orteler Glacier, (Unter Trafoier Ferner) which pours down on the right. This ridge had to be climbed round in order to reach the upper portion of the glacier where its surface is more level.' From this passage it would appear that Thurwieser and his companions attacked the Orteler from the W. instead of on the side visible from Trafoi, which has been selected by succeeding mountaineers. Whether he merely followed in the track of Schebelka is not stated, but I think we may presume this to have been the case, as the same guide (Pichler) led on each occasion. At 5.15 the lower Orteler glacier was reached, and 'the first of the four sections of the ascent was thus successfully accomplished.' The ice was at first almost concealed beneath the masses of débris which had fallen from the cliffs of the Orteler on the left, but soon became purer. Proceeding upwards, at first in a southerly and then in a south-easterly direction, the glacier was found to be more and more dislocated, and considerable difficulty was experienced in forcing a passage. This obstacle surmounted, a more level portion was reached, which was, however, intersected by long and wide crevasses. The course was now altered, and they made straight for the cliffs of the Orteler itself, which were

reached, not without difficulty, at 7.30, after two-and-a-quarter hours' walk over the glacier. The second division of the ascent was thus accomplished, and the height was found to be 1,200 Paris (1279 English) feet above the hut, or 7,527 Paris (8,022 English) feet above the sea. The rocks above appear to have proved formidable, but thanks to the skill of the gallant old Josele, and the discovery of a couloir whose upper and lower portions are known as the 'Schneerinne' and 'Untere Schneerinne,' a sort of elevated gully was reached, very steep and only about two or three *klafter* (12 to 19 feet) broad, called by Thurwieser the 'Obere Schneerinne.' At nine o'clock, after a short halt, the travellers proceeded upwards, over a succession of perpendicular rocky steps named 'Wandln,' from twenty to sixty feet in height, and divided by intervals named 'Stellen,' which proved scarcely less troublesome. Finally, at 11.7, the edge of the upper 'Orteler Ferner' was reached, after a scramble which had now lasted four hours. Its inclination is stated to be 60°—65° (?) and its surface consisted of soft snow overlying névé, beneath which was hard ice. Some steps had to be cut, but after traversing a short portion of the ice a level stony tract was reached falling away in perpendicular precipices on the SW., and from which the snow had disappeared. The altitude was found to be 10,700 Paris (11,404 English) feet. A little further on the glacier (névé) was again entered upon, and at 11.19 they stood upon its first elevation or plateau. Here the giants of the Oetz Thal were descried over the ridge to the N., but the dome-like form of the névé still concealed the summit of the Orteler, and it being impossible to proceed straight in the direction in which the latter was supposed to lie, a detour was made to the right. The heat and light reflected from the brilliant surface, and the increasing inclination of the latter, proved too much for poor old Pichler, who was therefore left behind after pointing out to his companions the route to be followed. The leadership was now assumed by a certain Strimer, of whom no mention had previously been made, but who appears to have been on the summit before, and is probably the same man as the one previously spoken of under the name of Gamper. The crevasses though not numerous were of enormous dimensions, but at length the goal appeared in sight, and they stood at the foot of the wind-heaped snowy arête whose north end formed the actual summit. Here a bergschrund all but brought their farther progress to a stand, but it was at length successfully traversed and the arête ('Schneide') attained. This was blown up by the wind into a mere knife-edge, along

which it was necessary to pass. On the side overhanging Sulden there was a *corniche* formed by the action of the west wind. Finally, at 12.36 they stood on the highest point—a snowy pyramid with sharp angles elevated from 26 to 32 feet above the dome-like expanse of névé stretching away to the N. and NW. The barometer gave a height of 12,044 Paris (12,836 English) feet, whilst the thermometer indicated + 4° Réaumur or 41° Fahrenheit, a temperature which rendered the halt on the summit extremely agreeable. There was not a breath of air, and the party were able without inconvenience to dispense with their coats.

At 1.30, Lax having been previously despatched to look after his father, Thurwieser 'followed with Strimer.' At two o'clock they rejoined the Pichlers, who had lighted a fire close to the foot of the upper névé at a spot the height of which was found to be 10,739 Paris (11,445 English) feet. Halting here till 2.42 they then proceeded down the 'Wandln,' slightly varying the route selected in the morning, and reached the lower Orteler Glacier at 5.12 and the hut on the 'Bergl' at 8.15. The next morning the Heiligen drei Brunnen were reached in one hour, a *Dankmesse* was performed in the little chapel, and the whole party then returned in high spirits to Trafoi.

In all the expeditions which have just been described the actual summit was attained, but no one, I believe, had since succeeded in getting beyond the foot of, or at most half-way up, the final snowy arête or Kanm until we once more planted our bâtons on its highest wreath.

The upper Orteler Ferner was reached by a party from Prad (including a girl of sixteen) and the 'Grat' itself by Dr. Von Ruthner and Herr Karner on the 25th August 1857 (see 'Eine Ersteigung der Ortelerspitze,' Mittheilungen der k. k. geog. Gesellschaft, 2. Jahrgang, 1858), by Herr Specht of Vienna in 1860, by two Irish gentlemen, Messrs. R. Jacobs and J. Walpole (who were so unfortunate as to be benighted and have to camp out on the glacier) in 1861, and by Herr Egid Pegger of Innsbruck on the 29th July 1863. Anton Ortler of Gomagoi and Josef Schöpf of Beidewasser seem to have generally acted as guides on these occasions; and, so far as I have been able to ascertain, the latter appears to have given entire satisfaction to his employers, whilst the former is spoken of in more doubtful terms.

I will conclude this historical sketch with a notice of the last-named expedition, which is briefly described by Herr Pegger in the second volume of the 'Mittheilungen des

Oesterreichischen Alpen-Vereines.' The party, consisting of Herr Pegger and the guides Josef and Alois Schöpf of Beidewasser and Franz Hofer of Tartsch, left Trafoi at five p.m. on the 24th of July, and followed the route taken by Thurwieser as far as the summit of the wood on the 'Bergl,' which was reached at 6.30 and a bivouac at once organised. A start was effected the next morning at 3.30, and proceeding across some slaty slopes and up a talus of débris from the northern cliffs of the Orteler, they stood at four o'clock at the commencement of the long snow slopes with an inclination of 38° , above which commences the steep 'Pleis,' which constitutes the main difficulty of the expedition. At this point the weather suddenly changed, and a fearful storm came driving across from the opposite side of the valley. They had just time to cross a small glacier and reach an overhanging rock before the tempest burst upon them, and as it was followed by steady rain nothing remained but to make the best of their way back to Trafoi, which was reached in an hour and a quarter.

At 4.45 on the morning of July 29 they once more stood at the entrance of the 'Pleis.' The latter is a very uniform glacier or broad ice-filled couloir, some 2,000 feet in length, with an inclination of 35 to 45° , and usually consisting in autumn of hard slippery ice (*glatt-eis*) which in the present instance was still covered with snow. In a quarter of an hour the 'Burgstall,' an isolated ridge of rock cropping out from the 'Pleis,' was reached, and a halt of similar duration called to put on the *steigeisen* or crampons. Keeping close to the rocks on the right, up slopes which increased from 38° to 42° and finally to 45° (when a few steps had to be cut), they gained at 6.45 the summit of the 'Pleis.' The height of this spot is about 9,000 Vienna (9,334 English) feet, and its position is just at the commencement of the upper Orteler Glacier. This latter appears to have presented no difficulties, and at 9.15 the party stood on the final arête of the Orteler, twenty *klafter* (124 English feet) distant from and about eight feet below the actual summit.

Herr Pegger states that since Thurwieser's visit the arête and the summit had much changed, and that the latter appears to have become about three *klafter* lower, and to have shifted about four *klafter* farther to the E., to judge from the position of the pole which had been there since 1834. After working along the arête for some distance, the travellers were reluctantly compelled (apparently by the want of proper axes) to abandon the attempt to gain the highest point. Unfortunately, great masses of cumuli lay on all the surrounding peaks, and the view

was therefore almost entirely concealed. How long they remained is not stated, but by 5 p.m. they were once more back again at Trafoi.

It will be seen by a comparison of this account with the narrative of Thurwieser that the upper Ortler Glacier or névé was reached by the northern instead of the western face of the mountain; and I believe the other recent ascents have taken place in this direction, which was discovered by Anton Ortler of Gomagoi, and adopted for the first time by Dr. von Ruthner and Herr Karner, in 1857. An attempt made on the same day from the Sulden Thal by Herr H. Wolf, a geologist, accompanied by Führer of Gomagoi and other guides, proved unsuccessful, but the party reached a height of 11,000 (Vienna) feet, and Herr Wolf attributes his defeat to the unfavourable weather alone.

ON REGELATION. By EDWARD SCHWEITZER.

PROFESSOR HELMHOLTZ, the distinguished German philosopher, has lately published a lecture 'On Ice and Glaciers,' in which he endorses, with one single exception, all the views of Professor Tyndall on the formation and motion of glaciers.

The property that two pieces of ice, when brought into contact, will freeze together, was first discovered by Faraday, and designated 'regelation' by Tyndall, at the suggestion of Dr. Hooker. This property Tyndall applied to explain the formation and motion of glaciers. By numerous experiments Tyndall has satisfactorily proved that ice cannot stretch, but breaks at the slightest tension; that it can be moulded into any shape by pressure, and that hence pressure and regelation account for the formation of glaciers, and fracture and regelation for their motion. These are the fundamental principles on which the formation and motion of glaciers are based, and are fully acknowledged as such by Professor Helmholtz; but with respect to the cause of regelation itself, he differs from Faraday and Tyndall, and accepts the theory of James and William Thomson. Since the discussion on this question, which lies at the bottom of the whole glacier theory, has thus been renewed, it may be worth while to give a brief account of the present state of the controversy.

Faraday refers the cause of regelation to the contact action of ice and water, an explanation that seems both simple and satisfactory. It is known that, in chemical operations, contact exerts a considerable influence. A concentrated solution of