

By the end of the Eocene an era of change had commenced—change which has transformed the face of Europe—nay, of regions of far greater extent. Prior to this there were neither Alps, nor Pyrenees, nor Carpathians, neither Caucasus nor Himalaya—nay, I know not where to stop among the great mountain chains of Southern Asia. But restricting ourselves for the present to the Alps, we find the existing chain everywhere fringed with enormous masses of sandstone and puddingstone occasionally more than 7,000 feet thick, which to a very large extent were not deposited in the sea, but are the detritus and the spoil of mountain regions occupying in the main the position of the present Alps. The details of the Swiss Miocene, which are closely related to the physiography of the chain, must be reserved for the next lecture, so that I will now only say that all through the Miocene age the district between the Alps proper (the region of crystalline rocks, limestone, and slate) on the one side, and the Vosges and Schwarzwald on the other, was receiving detritus; the land sinking, especially parallel with the Alps, but the sea being on the whole driven back, until at last the newer material as well as the old began to be folded up, and the Miocene, like the Eocene, was closed by another period of mountain-making. The effects of this have been various. North of the Eastern Alps they have been comparatively slight, but they were considerable in the Western Alps, and at a maximum over the Swiss lowlands. There, as in the Rigi and the Speer, the deposits of the Miocene deltas have been uplifted some 6,000 feet above the sea, with which once they must have been nearly level, and for a very considerable distance the Eocene masses have been bent or thrust over their edges. The Alps, subject to minor modifications, were then left to the action of Nature's carving, to the heat and cold, rain and rivers, snowfall and glacier.

THE MUSTAGH PASS.

ITS FIRST PASSAGE BY A EUROPEAN TRAVELLER.

THE ordinary road from Cashmere to the Khanates of Central Asia, Kashgar and Yarkand, leads over the Karakoram Pass, 18,550 feet. It was this pass that was crossed by Sir Douglas Forsyth's mission, and on it Mr. Dalgleish was lately murdered. Some distance further W. in the same chain rises the great peak known as K 2, the second in height of mountains as yet measured, overlooking the ice-wilderness of the Baltoro Glacier, itself over thirty miles long,* and fed by numerous tributaries, each as large as the Mer de Glace. This greatest of glaciers in the temperate zone was visited and partially mapped many years ago by Colonel Godwin Austen, of the Indian Survey, who brought away many interesting sketches of its peaks, but failed to reach the passes

* The length of 61 miles, given in some geography books to the Central Asian glaciers, is got by unfair measurement and by disregarding watersheds, as if one measured the Aletsch Glacier from the Bell Alp to the lower end of the Grindelwald Glacier.

that traverse it. These have of late years, owing to changes in the glaciers, fallen into disuse.

Last year Lieutenant Younghusband determined to crown a very adventurous journey from Pekin over the Gobi Desert to India by reopening the Mustagh Pass. The following account of his adventure is from the July number of the 'Proceedings of the Royal Geographical Society.' The two most remarkable points in it, perhaps, are the feats of the ponies, which, even more than in the Caucasus, seem to take naturally to ice, and the knowledge displayed by the traveller's native companions of the rudiments of mountaineering.

General Walker, late Surveyor-General of India, suggests that K 2 should be called Mount Godwin Austen. It is hardly yet conclusively proved that the peak has no native name, if not on the south, on the north side of the range, whence it seems to be conspicuous. Colonel Godwin Austen will, should his name be officially affixed to K 2, find himself in strange company. Two neighbouring peaks, of 25,660 and 26,470 feet respectively, are known as Masher-Brum and Gusher-Brum. The latter name, according to Colonel Godwin Austen, is equivalent to the Peak of Sunset. Mustagh, being translated, is Ice Mountain.

D. W. F.

We take up Lieutenant Younghusband's narrative at the point at which he approaches the Karakoram range.

'The Sarpo Laggo river flows down from the glaciers of the Mustagh Pass through a valley from a half to one mile in width. After ascending it for a few miles, we came in full view of the great peak, K 2, the second highest mountain in the world, 28,250 feet in height. We could see it through a break in the mountains rising up straight, bold, and solitary, covered from foot to summit with perpetual snow. The upper part, for perhaps 5,000 feet, was a perfect cone, and seems to be composed almost entirely of ice and snow, the accumulation of ages. The lower part was more precipitous, but not too steep to throw off the snow altogether, while at the base was a great glacier formed by the masses of snow which fell from its sides. It was a magnificent sight, and I could scarcely tear myself away from it. But we had some way still to go, as we had to push on beyond the Suget Jangal camping-ground for fear of meeting Kanjuti robbers, for the path from the Shimshal Pass, which leads to Kanjut, joins in there. Suget Jangal is the last spot where fuel can be got, so we collected a pony-load, and pressed on till we neared the foot of the great Mustagh Glacier, where we bivouacked for the night.

'Early next morning we started off to tackle the glacier, and here our real difficulties began, for after passing along for half a mile between the glacier and the mountain side, we found the way blocked by the ice, and we could neither get our ponies round the obstacle by climbing the mountain side nor by taking them on to the glacier. So they were sent back to the end of the glacier to wait till I had explored ahead with the guides. We plunged into the middle of the glacier, clambering about, often on all fours, amongst a jumbled mass of moraine and ice, passing cliffs of clear transparent ice and caverns composed entirely

of ice, with icicles 20 and 30 feet long hanging from the roof. It was a most curious and beautiful sight. We ascended the glacier for a couple of miles, and then saw it stretching ahead for many miles more. The guides thought it would be impossible to drag a caravan of ponies up it, and I decided on sending them back by the Karakoram Pass to Leh and going on over the Mustagh Pass with three men, as I had also to take into consideration that our supplies would be running short. But on returning to the caravan I found that one of the men, who had been exploring the opposite side of the glacier, had found a way, and was gallantly leading the ponies over it, though they were knocking and tumbling about in a fearful way. Their legs were getting cut to pieces, and the loads were falling off every five minutes. It was cruel work for them, for they had no chance of keeping their footing on the slippery ice, which was usually only covered over with a thin coating of gravel. However, as a start had been made, I determined on making a renewed effort to bring them up the glacier. But they very soon got exhausted, so we halted for the day, and I then went off again with the guides to explore a route for the next day. We kept on up the east edge of the glacier, marking with small cairns the route which was best for the ponies to follow, and returned to our bivouack after dark, thoroughly exhausted, for it is terribly hard work walking over those glaciers, and the rarity of the atmosphere at these great elevations adds to one's distress.

At daybreak the following morning we started again, leading the ponies up the route we had marked out; but a mile from the point where our previous exploration had ended, we were confronted by another great glacier rolling down from the left. The guides set off to explore it while I remained with the ponies, as my boots were worn out, and my feet so bruised I could scarcely bear to put them to the ground. The men returned after a time with a look of despair and said they could find no possible way for the ponies to get over the glacier, but they said: "You have a try, Sahib; perhaps by your *ikbal* (good fortune) we may find a way." "All right," I said, and we started off back again for some distance, and then struck off right into the centre of the glacier, and ascended a prominent spot on it, from which we could get a good view all round. We were in the middle of a great sea of ice, for the glacier was four or five miles broad, and composed of pure white ice broken up into a mass of needle points, and great glaciers came rolling down the mountain sides like clotted cream pouring out of a cream-jug. From the point on which we were standing I could see a thin line of moraine extending right up the main glacier. We got on to this and followed it up for a long way, and, to our great relief, found it would be quite possible to bring the ponies up it and get them on to the smooth snow in which the head of the glacier is buried. On our return journey we nearly lost our way, and were wandering for some time in the dark before we managed to find it. We held a consultation of war that night as to which pass we should attack, for there are two leading out of the valley we were ascending. The old Mustagh Pass to the west had been out of use for thirty or forty years, on account of the accumulation of ice upon it, in consequence of which

a new pass had been sought for, and another more to the east had been found. This latter pass had been in partial use up to ten years ago. No European had, however, crossed either of them, but Colonel Godwin Austen in 1862 came very near the summit of the new pass from the southern side, when he was obliged to turn back on account of bad weather. One of my guides had at one time taken ponies across it. I decided, therefore, to send on a couple of men to reconnoitre the new pass the next day, while the remainder of us brought on the ponies up the glacier.

‘Early in the morning the reconnoiters set out, while we followed as soon as we had loaded the ponies. Our difficulties were not so great this day, and in the evening we halted on the glacier. Towards dusk the two men returned from the new pass and said it would be quite impossible to get ponies down it, and that it would even be difficult for men, as masses of ice had formed. They said the best thing to be done now was to leave the ponies where they were, under the charge of three men, and set off with the rest over the old Mustagh Pass to Askoli, the first village on the other side, send back supplies from there for the ponies and men left behind, and collect a number of coolies to try and make a passage for the ponies over the new pass. Things were getting critical now, for supplies were running short, and where we then were no fuel could be obtained, and the ponies could only feed on some few scraggy weeds which we could see across the glacier on the mountain side. So, if on the morrow the pass should prove impassable, our fate would probably be a hard one, as provisions would scarcely last out till we could get back to an inhabited spot again.

‘It was an anxious night that, and it was also a very cold one, for we were sleeping out in the middle of the glacier with a horribly cold wind blowing down it, and we only had just sufficient fuel for cooking purposes, and could not afford to keep a fire going for a moment after our evening meal was cooked.

‘Next morning, while it was yet dark, we started for the pass, leaving everything behind, except a roll of bedding for myself, a sheepskin coat for each man, a few dry provisions, and a large tea-kettle. The ascent to the pass was quite gentle, but led over deep snow in which we sank knee-deep at every step. We were now about 19,000 feet above the sea-level, and quickly became exhausted. In fact, as we had got near the summit, we could only advance a dozen or twenty steps at a time, and we would then lean over on our alpenstocks, and gasp and pant away as if we had been running up a steep hill at a great pace. It was most tantalising, for the top looked so near, and the slope was so easy, that it seemed as if we could run up in no time. But it was not till midday that we reached the summit, and then on looking about for a way down we could see none. Huge blocks of ice had fallen from the mountains which overhang the pass, and had blocked up the path by which travellers used formerly to descend from it, and the only possible way now of getting to the bottom was by crossing an icy slope to a cliff, which was too steep for a particle of snow to lodge on it, even in that region of ice and snow. From this we should have to descend on to some more icy slopes which could be seen below.

‘ Nobody spoke as we looked down that pass, and I waited anxiously for the next move. I could not give an order to go ahead, for I felt incapable of going first myself. I heard them asking each other who should go first, and at last Wali—the finest fellow that ever stepped—quietly took an axe, tied a rope round his waist, and, giving the end of it to us, told us to follow him.

‘ We had first to cross the icy slope : it was of smooth ice and very steep, and about thirty yards below us it ended abruptly, and we could see nothing over the edge for many hundreds of feet. As Wali hewed the steps we advanced step by step after him, leaning back against the slope, all the time facing the precipice and knowing that if we slipped (and the ice was very slippery, for the sun was just powerful enough to melt the surface of it) we should roll down the icy slope and over the precipice into eternity. Half-way across, my Tartar servant Drogpa, who had been born and bred in the heart of the Himalayas, gave up, saying he was trembling all over and could not face the precipice, so I sent him back to the ponies, which he afterwards brought round by the Karakoram Pass.

‘ After a time we reached *terra firma* in the shape of a projecting piece of rock, and from here began the descent of the cliff. We had to let ourselves down from any little ledge, taking every step with the greatest possible care, as the rock was not always sound ; and once a shout came from above, and a huge rock, which had been dislodged, came crashing past me and as nearly as possible hit two of the men who had already got some way down.

‘ At the bottom of the cliff we came to another steep ice-slope. We tied together every scrap of rope we had, and every turban and waist-band, and then let Wali down by this on to a small piece of bare rock which showed through the ice. As he went down he cut steps in the ice. He then seated himself firmly on the rock while we tied the other end of the rope on to a rock above.

‘ Then each man let himself down hanging on to the rope. One man in doing so slipped, fell over on his back and slid down at a frightful pace, still, however, clinging to the rope with one hand, which was fearfully cut by the friction.

‘ Then came the last man : he was the slave I had released at Yarkand ; and how he got down has been a puzzle to me then and ever since. He tied the end of the rope round his waist, and then with the aid of an alpenstock which he used in a most dexterous way, and the steps which had been hewn for him, he came gradually down ; and as he advanced we pulled in the slack of the rope at the bottom end, so that if he fell we could pull him up sharp. In this way we got down two more stages of the ice slope. Then came a piece where there was no suitable halting-place within the length of the rope. Luckily, however, it was less steep, and we were able to get down it by hewing steps. And at last, just as the sun set, we reached the bottom. As I looked back at the pass it seemed utterly impossible that any man could have got down such a place.

‘ Our troubles were not yet over though, for we were now on a snow-field at the head of a glacier, and all round us were great mountains

covered with snow and ice, so we had to trudge on over the snow and glacier till after eleven at night. We frequently met with crevasses, down which one of the men fell, and as he was the last was not missed for some little time. Ordinarily we should have thought twice before going so recklessly over this glacier, but we were now so utterly tired, and so overjoyed, too, at having got over the difficulties of the pass, that we pushed along in a sleepy, careless way, perfectly unmindful of the dangers of the road, till at last we came upon a dry spot where there were a few weeds. We collected these, lit a fire with the aid of them and a couple of alpenstocks, cooked some tea, and then rolled ourselves up in our wraps behind a rock and slept as only those can sleep who have done eighteen hours' continuous work of such a description as we had had to do that day. At daybreak next morning we were on our legs again, and after a few hours' travelling emerged on to the great Baltoro Glacier, which was explored by Colonel Godwin Austen in 1862 when making the Kashmir Survey and described by him in a paper read before the Geographical Society. We travelled all that day, and for two days more till we reached Askoli, a little village situated on the Braldo river, where it was most refreshing to see the trees and cultivated lands which surround it. I immediately set to work to collect supplies and coolies, and when this was done sent off one party with supplies for the men and ponies I had left behind on the other side of the pass, and then started myself with another party of coolies to try and force my way back by the new Mustagh Pass.

'I ascended the Punmah Glacier, but was brought to a standstill opposite the camping-ground of Skinmang, three days' march from Askoli, by a glacier which had rolled down from the pass. We had managed in some fashion or other to get over a good many glaciers in the passage of these mountains, but this one was the most unnegotiable of them all, for in the last four or five years the mass of ice had greatly accumulated. There were great blocks of ice as big as houses tumbled about, one on the top of the other, in such utter confusion that we could not get a footing on it at all.* We were obliged therefore to turn back to Askoli. I had given orders for the party with the ponies that if I did not reach them by a certain date after they had received the supplies they should make their way to Leh by the Karakoram, under the charge of the Ladakhi servant Drogpa, who had gone back to camp from the old Mustagh Pass. So when the coolies who had taken the supplies returned to Askoli, and brought me news of the safety of the party with the ponies, I started off for Skardo and then through Kashmir to Rawalpindi, which I reached on November 4, just seven months after leaving Peking.

'Drogpa with the ponies arrived seven weeks later, having come round by the Karakoram Pass route, where they had been attacked by robbers, and where also three ponies died from fatigue and exposure. Poor Liu-san, the Chinaman, too, arrived completely knocked up by the hardships he had had to go through.'

* I understand from the author that these obstructions were the result of ice-avalanches which had fallen from overhanging glaciers.—D. W. F.