

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES

PUBLISHED BY

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47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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OUR PRESENT KNOWLEDGE OF THE HIMALAYAS.¹

THIS was the subject of an able paper read at Monday's meeting of the Royal Geographical Society, by Col. H. C. B. Tanner (Indian Staff Corps), who for many years has been one of the officers of the Indian Survey, most of his time having been spent in various parts of the Himalayas from north-west to south-east. The paper was illustrated by a large number of admirable drawings by the author, which afforded an excellent idea of the physical and picturesque aspects of this great mountain system.

With regard to avalanches, Col. Tanner stated that they play a great part in the conformation of the topography, — a greater part, indeed, than is generally supposed, — and this factor has not received the attention it deserves at the hands of geologists.

"I became acquainted," he said, "with four distinct kinds of avalanche, which, perhaps, are called by distinctive names by mountaineers, though I have been unable to ascertain them. The first, and the most common, is the precipitation of a mass of new snow from slopes which, from their steepness, are unable to retain more than a limited quantity of snow on them. They occur generally in winter and in early spring, and are the cause of the results just described. The second kind of avalanche is a descent of *old* snow, which is loosened by the heat of the sun. They may be heard throughout the summer and autumn, and are dangerous from the unexpected and irregular manner in which they slide off. The sportsman and traveller should guard against them by intelligently placing his camp in some sheltered spot out of their reach. This class is not usually of any great extent or weight, but such avalanches are of constant occurrence. The third kind can only be seen when the mountains are of peculiar formation or structure, and are really ice and not snow avalanches. They are of very constant occurrence in some localities, more particularly where small glaciers are situated high up on the crest of mountains, and are gradually pushed over the edge. In Lahaul, in the company of a friend, we watched the face of the well-known Gondla cliffs from the right bank of the Chandra River, and saw a number of these ice-falls, which came down every few minutes, filling the air with the noise of the loosened rocks and ice-blocks. The fourth kind of avalanche is one that I have only once seen, and have never known described. It is very curious, being the movements of billions of snowballs, which, in a stream a mile or half a mile long, I saw slowly wind down the upper part of an elevated valley in the Gilgit-Dareyl Mountains. I was after *Ibex* at the time of the occurrence, and was watching a herd of these animals, when I became aware of a low but distinct and unusual sound,

produced by a great snake-like mass of snow winding down one of the valleys in my front. It occasionally stopped for a moment, and then proceeded again, and finally came to a rest below me. I found this curious movement of snow was produced by countless numbers of snowballs, about the size of one's head, rolling over and over each other. The torrent-bed was full of them, — an accumulation formed by numerous similar freaks of nature. I am quite unable to account for such an avalanche as the one now described. How does it originate, or by what process is the snow rolled up into these innumerable balls?"

Col. Tanner made some interesting remarks on the subject of the line of perpetual snow. "Various authorities," he stated, "lay down such a line with great assurance; but for myself, I find that circumstances of position, of climate, and of latitude, play so great a part in the position of this line that I am unable to define it even approximately. No sooner in one locality, or during one particular season, have I settled, to my own satisfaction, the line of perpetual snow, than I presently have been obliged completely to modify my views on the subject. On p. 124 of the 'English Cyclopædia,' vol. v., I read that snow lies 4,000 feet higher on the northern than on the southern side of the Himalayas. On p. 281, vol. x., of the same work, it is stated that the snow-line on the northern slope is at 19,000 feet, which I should have been inclined to say is 1,500 or 2,000 feet too high. In Gilgit, during the end of summer, I found masses and fields of snow at 17,200 feet; and they extended down the northern slope certainly 2,000 feet, or even more, below that altitude. In Kulu, which has many degrees of latitude less than that of Gilgit, avalanche snow lies in valleys above 8,000 feet throughout the year after a good winter snowfall; but during the past spring, following a very mild winter, I found no snow at all at 8,000 feet. There had been no avalanches, and even in June, at 14,000 feet, snow lay only in patches. I think, that, in determining the snow-line with greater precision than has been done hitherto, scientific men should ascertain those altitudes on which perpetual snow lies on flat places in the position where it first falls, and should neglect the occurrence of a snow-field where it may have been protected from the sun's rays by its occurrence on the north face of a mountain. From memory I can state that there are a considerable number of typical localities which would help out such an inquiry. There is a peak (without a name) about thirty miles north of Gilgit, with rounded summit, which, though only 17,500 feet high, is covered with a cap of perpetual snow."

Speaking of the Himalayan glaciers, Col. Tanner stated that the most extensive and the most picturesque he has seen are in the Sat valley, which drains the southern face of Rakaposhi Mountain in Gilgit. Three great glaciers come down into this valley, and dispute with the hardy mountaineers for the possession of the scanty area of the soil. Here may be seen forests, fields, orchards, and inhabited houses all scattered about near the ice heaps. The only passable route to the upper villages in this valley crosses the nose of the greatest of the three glaciers, and threads its way over its frozen surface. This glacier is cut up into fantastic needles of pure green ice, some of which bear on their summits immense boulders. About half a mile from its lower end or nose, Col. Tanner found an island bearing trees and bushes, and at one place above this a very considerable tarn of deep blue-green water. The glacier had two moraines parallel with each other, and both bearing pine trees; and, from the highest point Col. Tanner reached, he fancied he saw the ice emerging from the *névé* at its source, far away up the slopes of Rakaposhi. In this glacier the pinnacles, wedges, blocks, and needles of ice were of the most extraordinary appearance, and the whole formed a weird and impressive view which he can never forget. Though the largest glacier Col. Tanner has ever approached, it is very small indeed when compared with those described by Col. Godwin-Austen in a locality not very far from the Sat valley. Insignificant though it is, it was more than Col. Tanner could take in during his visit of two days' duration. It struck him at the time of his inspection that the peculiar stratified appearance of the ice needles, which in the case of the Sat glacier is very strongly marked, must have been caused by the different falls of avalanche snow on the bed of *névé* at the source of the glacier.

¹ From *Nature* of April 30.

The lowest glacier Col. Tanner has seen in the Himalayas is one that reaches the foot of the range near Chaprot Fort in latitude $35\frac{1}{2}^{\circ}$, in Gilgit. It is formed of beautiful clear ice, and has no dirt. In Kulu and Labaul (latitude 32°) glaciers do not come down below 12,000 or 13,000 feet, and all are very dirty; and in Sikkim (latitude 28° or 29°), without having visited the glacier region himself, Col. Tanner would say that the lowest limit reached by the Kinchinjanga group must be considerably higher, perhaps by 2,000 feet or even more. The smallest mountain he has ever met with, capable of giving rise to a glacier, is one on the Gilgit-Dareyl range, whose height is 17,000 feet; and in this case the mass of ice formed is of very inconsiderable size. Of the glaciers round Mount Everest and its great neighbors, we know next to nothing; and the little we have learned is derived from the itineraries of native explorers, who, of all classes of travellers, seem the least capable of furnishing trustworthy information regarding any subject lying at all outside their actual angular and distance measurements. But with his telescope, when employed on the survey of the Nipal boundary, Col. Tanner has gazed long and earnestly at the icy regions at the foot of Everest, and Peak No. XIII., where the glaciers extend over a very large area.

With regard to our actual knowledge of the Himalayas, Col. Tanner thinks that perhaps our botanical knowledge is far ahead of other branches of science. Many eminent botanists have been at work for a long time past, and of late Dr. Duthie has been allowed to travel on duty into tracts not before visited by any one possessing the requisite knowledge. It is likely that Dr. Duthie's museum at Saharunpur will, within a moderately short time, become an almost complete depository of the chief vegetable products of the Himalayas. The geologists, Messrs. Blandford, Edwin Austen, Richard Strachey, Stoltzka, and Lydekker, have been pretty well over those tracts open to Europeans, and are now well acquainted with all the leading features of their branch of science presented by the mountains of Kashmir, Kumaon, Kangra, and Sikkim. Ornithology has found many votaries, and the birds of these mountains are now probably all or nearly all known, though the late Capt. Harman, only a few years back, discovered a new and handsome pheasant in the extreme eastern end, either of Bhutan or Thibet. The mammals, Col. Tanner supposes, are all known, though one, at least, the Shao, or great stag of Thibet, has not even been seen by any European, and the famous *Ovis poli* has been shot by not more than two or three sportsmen.

With regard to the work of the survey, Col. Tanner stated that the maps of Kashmir and Gilgit, without being free from error, are of the greatest use to a large class of officials. Incomplete though they may be, they were not brought up to their present state without taxing to the utmost the endurance of a hardy set of men. Adjoining Kashmir to the eastward comes Kangra, with its subdivisions of Kulu, Lahaul, and Spiti. Kangra had once been roughly surveyed prior to the arrival there of Col. Tanner's party, who are now at work on a very elaborate contoured map, which will take a long time to complete, owing to the intricacy of the detail demanded. Between Kangra and Kumaon occur various native states whose territories are being surveyed on the scale of two inches to one mile, also contoured work, resulting in very elaborate and trustworthy, though somewhat expensive, maps. Eastward of Kumaon, Nipal stretches along our border for some five hundred miles till Sikkim is reached; and eastward again of Sikkim comes Bhutan, and various little-known and semi-independent states which lie on the right bank of the Sanpo River. Nipal marches with the Kumaon border for many miles, and advantage was taken of the existence of the trigonometrical stations on the Kumaon hills to extend our knowledge of the adjacent topography of Nipal, and this was done about four years ago with some little result. The more prominent peaks in Nipal within a distance of about one hundred and sixty miles were fixed trigonometrically, and some slight topographical sketching was done. From the trigonometrical stations near the foot of the lower hills, both in the North-West Provinces and in Bengal, trigonometrical points have lately been fixed, and some distant sketching done in Nipal, for five hundred miles between Kumaon on the western, and Sikkim on the eastern, extremity of this kingdom; and, again, from the trigonometrical hill stations

along the western boundary of Sikkim more points and hazy topography of Nipal was secured. This very meagre topography, sketched from very great distances, comprises all the geography of Nipal other than the sparse work collected by Col. Montgomerie's explorers, or by explorers trained to his system who have worked since his death. All the existing data, whether trigonometrical, distant sketching, or native explorers' routes, are now being combined, as far as the often conflicting and contradictory materials admit. The resulting map of the country, though at most little better than none, is all we have to expect until some of the strictures on travelling in Nipal are lessened by the Nipal Government.

The whole of the Nipalese border, which marches with British territory for some eight hundred miles, is jealously guarded, and no European is allowed to cross it, except when the Resident of Kashmir, or his own personal friends, are permitted to proceed by a certain and particular route, between the military station of Segowli and Katmandu. Sikkim flanks the eastern boundary of Nipal, and the, until lately, indefinite western boundary of Shutan. British Sikkim is a small tract, which has twice been surveyed on suitably large scales. Independent Sikkim, which contains Kinchinjangee, one of the highest mountains, and some famous passes, — the Donkhya, visited by Sir Joseph Hooker and a few others; and the Jelap, where our forces, under Gen. Graham, have lately been employed, — was surveyed in reconnaissance style by Mr. Robert, an energetic and hardy assistant of the Survey of India Department. The sketch-map obtained by this gentleman is complete, and similar in character to that of Gilgit by Col. Tanner, and to that of Nari Khorsam and Hundes by Mr. Ryall. It does not pretend to any exhaustive detail.

Our knowledge of Bhutan, or, rather, our ignorance of it, is about on a par with that of Nipal; but in Bhutan we have the valuable information left by Capt. Pemberton, who forty-three years ago traversed the greater portion of the country from west to east. Besides Pemberton's work, Col. Godwin-Austen, while he accompanied Sir Ashley Eden's mission to the court of the Deb Raja in the year 1863, executed a route-survey in western Bhutan. The engineer officers who were attached to the military force at Pewangiri also did some little topographical sketching; and beyond this we have distant sketching and trigonometrical work, as in Nipal, which also has yet to be combined with the route-surveys of native explorers, some rather recent, and some of greater date. The difficulties which are presented to further researches in the direction of Bhutan geography seem unlikely to diminish. Our knowledge, then, of Bhutan is as unsatisfactory as that of Nipal. Eastward of Bhutan occur those numerous semi-independent hill-states which sometimes, when necessity presses, own allegiance to Thibet, and at others assert their complete freedom from control. Col. Tanner himself has sent in two maps of this region derived from native sources, and both upset maps previously accepted, and it is highly improbable that we have any but the most rudimentary and vague knowledge of the course of the Sanpo below Gyala Sindong, and not even that of the course or limits drained by the Dibong. Col. Tanner then referred in some detail to the great rivers that have their sources in the Himalayas, and concluded by giving some advice to tourists as to the best routes to take.

BANANA PRODUCTION.

THE banana industry, which, according to the "Handbook of the American Republics," was only commenced in 1883, is becoming more and more important every day. The bananas, which grow spontaneously in the tropical countries, have been from that date an article of commerce. Formerly they were planted in the coffee plantations to shade the young trees and shelter the grains from the wind that would sweep down the unmaturing berry. The fruit of the banana was used to fatten pigs, or grew without any cultivation in the mountains and plains, thus going to absolute waste. Bananas principally come from the British West Indies, Cuba, Honduras, Costa Rica, Nicaragua, Guatemala, British Honduras, Colombia, Hawaiian Islands, and Salvador.

The lands chosen for the production of the bananas are those