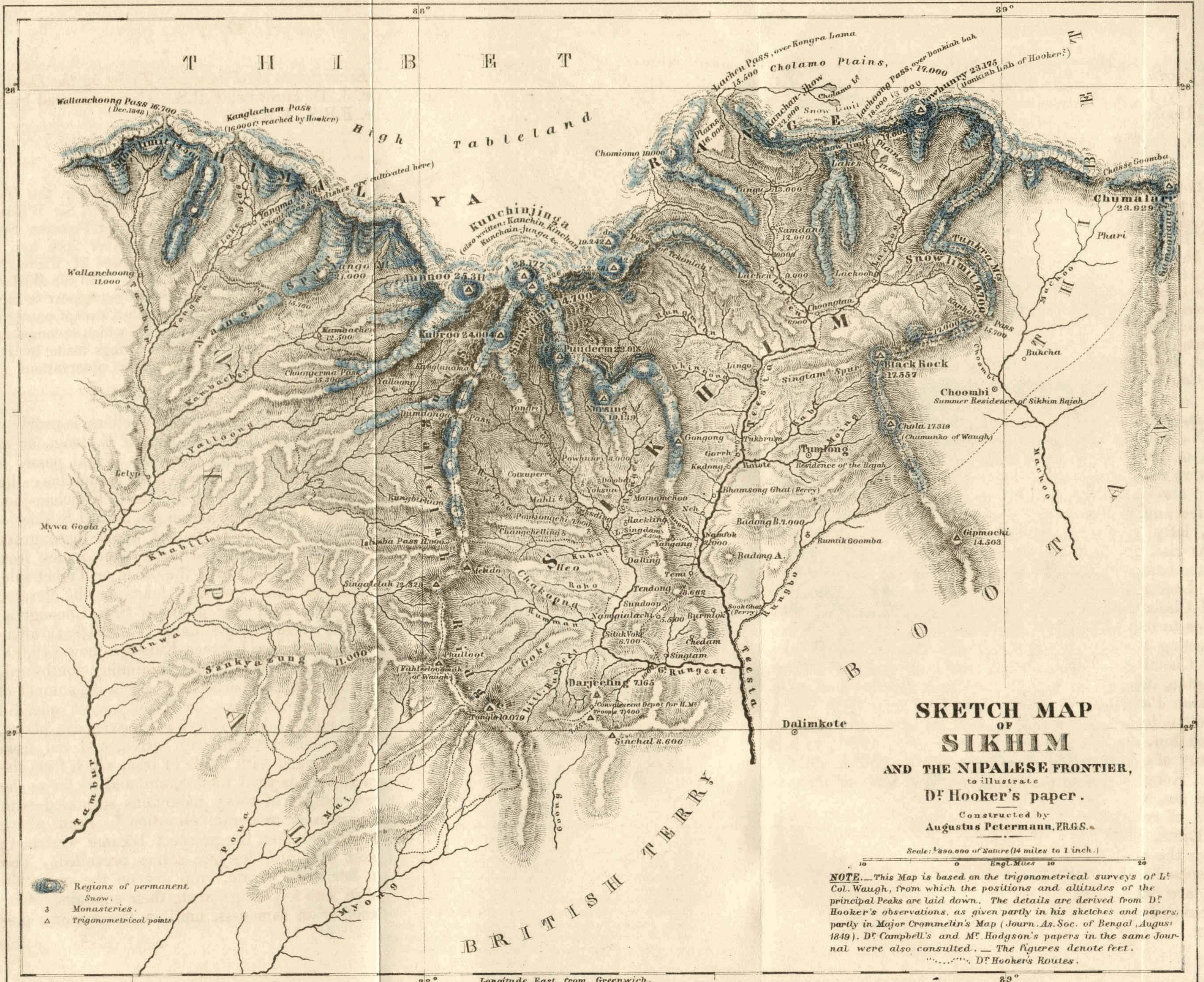
III.—*A fourth Excursion to the Passes into Thibet by the Donkiah Lah.* By Dr. J. D. Hooker, F.R.S. Communicated by Sir W. J. Hooker, F.R.S., F.R.G.S.

[Read December 10th, 1849.]

[The following account was extracted by Mr. J. Hogg, the *Hon. Secretary*, from a letter by Dr. Hooker to his father, Sir William J. Hooker, bearing date "Lachoong River, Thibet Frontier, September 13, 1849," and only received on November 26th last, in which he described another excursion to the Passes of Thibet, by the *Donkiah Lah*, in the East Himalayan Chain. But Sir William Hooker informed Mr. Hogg that his son "does not appear to have been *actually upon* the Great Plateau of Thibet, except on *one* of these occasions." The map, by M. Petermann, which accompanies this paper, is executed partly from rough drawings made by Dr. Hooker, partly from trigonometrical and other observations by Lieut.-Col. Waugh and Dr. Campbell.]

This pass, before unknown to European travellers, is nearly in lat. 28° N., and somewhat to the E. of 88° 30′ E. long., at an elevation of 18,000 feet. It differs from the Nepal passes in being a very narrow, wall-like ridge between the mountains called *Donkiah Lah* (23,175 feet), on the E., and Kanchan-jhow (22,000 feet) on the W. There extend on the N. and S. sides of the pass, lofty plains (17,000 feet), out of which these grand mountains rise. On one side the Lachoong river issues from lakes at the base of Donkiah; and from the other, or Thibet side, the river Lachen takes its rise from other lakes on the elevated plains of Cholamo. The Lachoong proceeds S. to Choongtan; the Lachen to the N.W., near Kongra-Lama (15,500 feet), afterwards turning S. enters Sikhim between Kanchan-jhow (16,000 feet) and Chomiomo (19,000 feet?), and continuing southwards to Choongtan, it unites with the Lachoong. From the summit of the Donkiah Pass, Dr. Hooker says, he "had a most splendid view for 60 miles N. into Thibet. First came extensive plains, dunes, and low, rocky eminences, utterly barren, and red from the quantity of quartz, tinged with oxide of iron, which form the hills N. of Kongra Lama; beyond them again, and as far as the eye could see, were ranges of rocky mountains sprinkled with snow, and of comparatively moderate elevation." From above Kongra Lama, at 16,000 feet, the prospect became wretched; and thence the most bare and desolate scenes prevailed. The rocks, disposed in horizontal strata, crop out on the mountain faces and are broken into low crags along their summits. One range succeeded another in sameness, until in the extreme dis-



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Lithographed by A. Petermann

tance the horizon was bounded by another chain higher than the rest, rugged, black, and deeply covered with snow.

The entire landscape sloped N.W., and the ranges lie E. and W., so that Dr. Hooker could not doubt the correctness of the statement of the people that "all the waters from the N. of his position and W. of the Paniomchoo are feeders of the Arun, which enters Nepal far to the W. of Kinchin-junga." The watershed of the Yarrow (*Tsampo*), he thinks, is the lofty range which he saw in the distance. The natives do not distinguish these ranges because of their great uniformity; and the few roads wind amongst and over them in such a tortuous manner, that all the way between the Himalaya and the Yarrow the traveller beholds neither the one nor the other of these grand geographical features, until each becomes the terminus of his day's march.

Flat-bedded valleys and rocky mountain chains of moderate heights constitute the daily marches from Darjeeling (7165 feet, in 27° N. lat. and 88° 28′ E. long.) to Digarchi.

The dimensions of the Cholamo plains and lakes are much exaggerated; the latter being actually less in size and fewer than those of Lachoong, and the plains less extensive than Dr. Hooker expected. He, however, did not descend to the plain, for it is continuous with Kongra Lama, which he measured, and he could not mistake the *average* level from the top of the pass to be other than identical with that of the like plain on the south face, namely, about 17,000 feet.

The line of perpetual snow is about 17,000 feet on the S. slope of the barrier range, and above 18,000 feet on the N. or Thibetan side. The writer considers it to be not more than 14,700 feet on the S. face of Kinchin-junga, that lies much to the S. of this place; and at Tunkra (which is at about the middle parallel of the snows) it is likewise about 14,700 feet.*

The height of the Thibetan plateau is 16,000 feet at Kongra Lama, and 17,000 at Cholamo; but the latter being close to the mountains, 16,000 feet may therefore, perhaps, be the average; whence the slope is not continuous to the Yarrow, but broken up by so many chains and valleys, that no safe results can be deduced without an examination of the whole distance. This at present cannot be effected; even these *cis-Thibetan* expeditions are difficult. Where Dr. Hooker was then located (about 2000 feet higher than the summit of Mont Blanc) he had many miles to send for supplies of *Rhododendron* branches for firing; and headache and sickness constantly harassed him.

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* In a later letter, dated *Darjeeling*, January 3, 1850, Dr. Hooker writes—"Humboldt's 'Aspects of Nature' has just arrived here. What he quotes from my communication to him, respecting the *Snowline* here, is perfectly correct, viz. 15,000 feet for the southernmost ridge of the belt in Sikhim, and 20,000 feet for the Thibetan elevation of the belt."—H. S.

The flora is remarkable, but less rich than that of Kongra Lama and the plains of Thibet. The mountain scenery is grand beyond all description—so magnificent an amphitheatre of rocks and snow occurs at the base of Kanchan-jhow that no one can properly describe it.

"On two sides" (Dr. Hooker writes) "scarped cliffs of gneiss with sunken veins rise abruptly, capped with snow, which streams in glaciers down every gully. In front the wall of Kanchan-jhow rises as a glacier 4000 feet nearly perpendicular, to all appearance a great blue curtain, reaching from earth to heaven, except where a small black rock appears, and then icicles 50 feet long run in lines like organ-pipes; the lower part of the valley on the fourth side of the area is shut off by a sharp ridge of debris swept down from the glaciers above, 500 feet high; and all within is a maze of cones of snow, laden with masses of rock rising 50 or 60 feet from the snow."

He continues, "This valley is about 2 miles broad each way, and I can compare it to nothing but the crater of a stupendous volcano, whose little enclosed cones of fire have been suddenly turned into ice. To-day I went up the flanks of Donkiah to 18,000 feet, amongst the knot of snowy peaks W. of Chumaliri (23,929 feet), and such gulfs, craters, plains, and mountains of snow are surely nowhere else to be found, except in the polar circles. Of course, I have seen nothing to compare for mass and continuity of ice with *Victoria Land;* but the mountains, especially Kanchan-jhow, are, beyond all description, beautiful; from whichever side you view this latter mountain, it presents a fortress of pure blue glacier-ice, 4000 feet high, and 6 or 8 miles long."

Dr. Hooker, at the altitude of 17,000 feet, "was trying to make a panorama of the frontier mountains, especially of Kanchan-jhow and Donkiah, which rose in all their grandeur on either side, with the broad plains and blue lakes of Lachoong at his feet, and the rugged crested rocks and intermediate peaked mountains of the pass in front—all backed by the blue sky of Thibet;" but suddenly a snow storm coming on, prevented his completing his drawing.

Dr. Hooker met with many interesting lichens at the summit of the Donkiah Pass, and in particular *Lecanora miniata;** this species, which he calls his "most antarctic plant," having found it on the rocks of Cockburn Island in 64° S. lat., he observed on stony hills at 19,000 feet, and of the same bright *orange-red* colour, rendering it visible afar off, as in the former locality.

Here, at 16,000 feet, the adventurous traveller visited a considerable *hot spring*, having a temperature of 112° Fahr., and

* This plant is beautifully drawn and coloured at No. 2, plate 198, of Dr. Hooker's 'Botany of the Antarctic Voyage.' In geographical range it extends to both extremities of the globe, for it also occurs in the Alpine regions of Sweden.—H. S.

containing sulphurous hydrogen gas; it is remarkable as "issuing from the broad mossy floor of a valley, close to a bed of *perpetual snow.*"

Additional Note.—In a subsequent letter from Dr. Hooker, dated *Darjeeling*, January 3, 1850, he observes:—"These mountains (the Himalaya) can in the meridian of Sikhim be only defined by the bed of the Yarrow (*Tsampo*) (say 14,000 feet) on the N., and the plains of India (3000 feet) on the S. All between is Himalayan mountains. We naturally call the heavily snowed mass the *ridge*, or *axis* of the chain—for that is the visible prominent feature from the S. But it does not follow that the snowy portion indicates the *true axis*, although a few isolated peaks may rise therefrom and top the world; for the snow, being deposited by a southerly wind, only falls on the southernmost elevations, and is prevented from reaching the true axis behind. Were the snow deposited equally on all the Himalaya, we should have the whole land between the parallel of Kinchin-junga and the Yarrow covered with perpetual snow, and then the axis of the chain would clearly show itself far behind Kinchin-junga, and the latter mountain would appear rising from a spur of the same. The snow-line being 5000 feet higher on the Thibetan portion of the range than on the Sikhim, cannot but deceive any one as to the *true* position of the centre of the chain, *i. e.* its *axis*.

I have always said that the Sikhim Himalaya (I mean *the snowed* mountains) do not form a continuous snowed chain running E. and W., but that they are meridional ridges, running N. and S., separated by waters that flow southerly between them. I have also insisted that the mean elevation of the ranges between the courses of the Arun and Yarrow is much greater than that between the Arun and the plains of India, though so little snowed.

And Sir William J. Hooker has recently (April 27th) communicated, that Dr. Hooker in his last letter, just then received, says:—"I no longer consider the Himalaya as a *continuous snowy chain* of mountains, but as the *snowed spurs* of far *higher unsnowed land behind;* which higher land is protected from the snow by the peaks on the spurs that run S. from it. Dr. Thomson" (brother of the distinguished chemical professor of Glasgow) "has, independently of me, come to the same conclusion."