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On the Physical Geography of the Himálaya. By B. H. HODGSON, Esq.

A clear outline, illustrated by a sketch map, of the principal natural divisions of the Himálaya, is, and long has been, a great desideratum ; for, physical Geography, which derives so many aids from the other physical sciences, is expected in return to render back to them without unnecessary delay a distinct demarcation of its own provinces, since by that alone researchers in so many departments are enabled to refer the respective phænomena they are versant with to their appropriate local habitations, in a manner that shall be readily intelligible, causally significant, and wholly independant of the shifting and unmeaning arrondissementments of politics.

It is true that our knowledge of the large portion of these mountains lying beyond the limits of British dominion, is far from complete. But is our knowledge any thing like complete of our own hill possessions? and, if we are to wait until Népal, Sikim and Bhútán become thoroughly carossable to science, must we not indefinitely postpone a work, the most material part of which may (I think) be performed with such information as we now possess?

The details of Geography, ordinarily so called, are wearisomely insignificant ; but the grand features of physical geography have a pregnant value, as being alike suggestive of new knowledge, and facilitative of the orderly distribution and ready retention of old. I purpose to adhere to those grand features, and to exhibit them in that causal connexion which gives them their high interest with men of mind.

I had been for several years a traveller in the Himálaya before I could get rid of that tyranny of the senses which so strongly impresses almost all beholders of this stupendous scenery with the conviction that the mighty maze is quite without a plan. My first step towards freedom from this overpowering obtrusiveness of impressions of sense was obtained by steady attention to the fact that the vast volume of the Himálayan waters, flows more or less at right angles to the general direction of the Himálaya, but so that the numberless streams of the mountains are directed into a few grand rivers of the plains, either at or near the confines of the two regions. My next step was due to the singular significance of the topographic nomenclature of the Nepalese, whose "Sapt Gandaki" and "Sapt Cousika,"* rivetted my attention upon the peculiar aqueous system of the Himálayas, urging me thence forward to discover, if possible, what cause operated this marked convergence of innumerable transverse parallel streams, so as to bring them into a limited series of distinct main rivers. My third and last step was achieved when I discovered that the transcendant elevation and forward position, at right angles to the line of gháts, of the great snowy peaks, presented that causal agency I was in search of, the remotest radiating points of the feeders of each great river being coincident with the successive loftiest masses† belonging to the entire extent of the Himálaya. It was in Népál that this solution of these problems occurred to me, and so uniformly did the numerous routes I possessed represent the points of extreme divergence of the great rivers by their feeders as syntopical with the highest peaks, that I should probably long ago have satisfied myself upon the subject, if my then correspondent, Capt. Herbert, had not so decidedly insisted on the very opposite doctrine—to wit, that the great peaks intersect instead of bounding the principal alpine river basins.

Capt. Herbert's extensive personal conversancy with the western Himálaya, added to his high professional attainments, made me for a long time diffident of my own views. But, the progress of events and increasing knowledge of other parts of the chain, seeming to confirm

* See Journal, No. 193 for Dec. 1848, p. 646, &c.

† This expression is used advisedly, for every pre-eminent elevation of the Himálaya is not so much a peak as a cluster of peaks springing from a huge sustaining and connected base.



Name of the Peaks	Heights	Latitudes	Longitudes	Remarks
a Jamboutri	25669	36° 55' 0"	78° 12' 0"	J.A.S. 37° 126
A Nanda Devi	25693	30° 22' 27"	79° 57' 24"	G.T.S. (A.N. 2)
B Dhaulagiri	27600	28° 30' 0"	83° 0' 0"	A. R. Vol. 12. J.A.S. supra
C Gonsarshan	24700	28° 50' 0"	86° 0' 0"	A. R. Vol. 12
D Kangshang	28176	27° 41' 35"	88° 11' 50"	G.T.S.
E Chumalari	25929	27° 52' 0"	89° 18' 0"	J.A.S. Nov. 46
e Gomers	21600, 21476	27° 50' 0"	92° 50' 0"	Yamamoto's Report and Map

REMARK a forms the West and A the East limit of the Alpine basin of the Ganges
 A D^e East limit of the alpine Ganges basin, & the West one of the Alps Karakoram Basin
 B D^e D^e Karakoram D^e D^e basin of the Gandaki
 C D^e D^e Gandakian D^e D^e D^e Geron basin
 D D^e D^e Geron D^e D^e D^e Tschistan basin
 E D^e D^e Tschistan D^e D^e D^e basin of the Merus
 e D^e D^e of last named basin, or that of the Merus? & the West one of the basin of the Subhanore

NATURAL DIVISIONS OF THE HIMALAYAN MOUNTAINS.



the accuracy of those views, it occurred to me more carefully to investigate whether the facts and the reason of the case were not, upon the whole, demonstrative of the inaccuracy of that able and lamented officer's dogma. Doubtless the western Himálaya presents appearances calculated to sustain Capt. Herbert's opinion, whilst such persons only as are unaccustomed to deal with the classifications of science will expect them to correspond point by point with those natural phænomena, which it is at least one chief merit of such arrangements, merely to enable us readily to grasp and retain. But, that the entire body of facts now within our ken is upon the whole opposed to Capt. H.'s doctrine,* and that that doctrine suits ill with the recognised axioms of geology and geography, is, I think, certain, and I shall with diffidence now proceed to attempt the proof of it.

A tyro in geology, I shall not further dwell on the theoretical side of the question than may be requisite to facilitate and complete the apprehension of my readers: but the facts, quoad Nepal at least, I trust that my sketch map, rude as it is, and the following observations, may render sufficiently indisputable; it being always remembered that I deal with generals, not particulars, aiming to establish the general accuracy of my main proposition, viz., that the great peaks, bound instead of intersecting the alpine river basins, and that, in truth, the peaks by so bounding *create* the basins, whereas their *intersection would destroy them*.

And now, without further preface, I turn to the accompanying sketch map, and submit such remarks as it seems to require. It will be seen at a glance that it embraces the whole Himálaya from 78° to 94° of longitude, comprising the following peaks and basins;—peak of Jamnoutri (a), peak of Nanda-dévi (A), peak of Dhoula-giri (B), peak of Gosainthán (C), peak of Kangchang (D), peak of Chumalari (E), peak of the Gemini† (e): which peaks include and constitute the following alpine river basins, viz., that of the Ganges, that of the Karnáli, that of the Gandak, that of the Cósí, that of the Tishta, that of the Mónas, and that of the Subhansri (pars). The subjoined table exhibits the elevation and the position of these dominant peaks with the authority for both.

* Journal, No. 126, Extra, pp. 20 and 22.

† I have so named the two proximate peaks of nearly equal height, which are inserted without name in Pemberton's large map, in long. $92^{\circ} 50'$, lat. $27^{\circ} 50'$.

a	Jamnoutri	25669	30°55'	78°12'	J. A. S. No. 126, As. Res. Vol. XII.
A	Nanda-dévi	25598	30°22'	79°50'	J. A. S. No. 126.
B	Dhoula-giri	27600	29°10'	83°	As. Res. Vol. XII. J. A. S. No. 126.
C	Gosain-than	24700	28°20'	86°	As. Res. Vol. XII.
D	Kangchang	28176	27°42'	88°10'	J. A. S. No. 197, with map annexed.
E	Chumalari	23929	27°52'	89°18'	The same.
e	Gemini	{ 21600 21476 }	27°50'	92°50'	Pemberton's Report and map.

The longitudinal dark lines of the map indicate, the upper one, the Himálaya proper, the lower one, the last low range verging on the plains. The transverse or vertical dark lines denote the great peaks with the ridges sent southwards by them. The Himálaya proper is traced along the line of the gháts or water shed between Tibet and India; and the principal passes of Népal and Sikim into Tibet, or Taklakhár, Mústáng, Kérúng, Kúti, Hatia, Wallúng, Láchén, are set down along the Himálaya, as well for their novelty as to illustrate the ghát line of the snows.

Along the last low range of hills are marked the position of the Máris or Dhúns, within the range, and the position of the Bháver and Tarai, without it.

Sallyán mári, Gongtali mári, Chitwan mári, Makwáni mári and Bijay-púr mári, are so many Nepalese samples of those singular quasi valleys, termed Dhúns to the westward.* In the plateau of Tibet I have indicated the limits of the three great trans-Himálayan provinces, or Gnári, extending (from the Bélúr) easterly to the Gangri boundary range of lake Mépang; Útsáng, thence stretching to the Gakbo river beyond Lassa; and Khám, which reaches from the Gakbo river to the Yúnling or Péling or limitary range of China and Tibet. Thus, reverting to the regions south of the line of gháts leading into Tibet, we have, clearly defined, the several natural provinces or divisions of the Himálaya, with their causal distribution, as follows, commencing from the westward, 1st, the alpine basin of the Ganges, extended from the peak of Jamnoutri to the peak of Nanda-dévi (Juwár or Juwáhir,) or, in other words, from east long. 78° 12' to 79° 50'; 2nd, the alpine basin of the Karnáli, reaching from the peak of Nanda-dévi to that of Dhoula-giri, or from 79° 50' to 83°: 3rd, the alpine basin of the Gandak, stretching from the peak of Dhoula-giri to that of Gosain-than, or

* See J. A. S. No. 126, p. xxxiii. et seq. and p. cxxxiv.

from 83° to 86° : 4th, the alpine basin of the Cósí extending from the peak of Gosain-thán to that of Kangchang, or from 86° to $88^{\circ} 10'$: 5th, the alpine basin of the Tishta, reaching from the peak of Kangchang to that of Chumalári, or from $88^{\circ} 10'$ to $89^{\circ} 18'$: 6th, the alpine basin of the Mónás, stretching from the peak of Chumalári to that of the Gemini, or from $89^{\circ} 18'$ to $92^{\circ} 50'$: and, lastly, the alpine basin of the Subhansri, of which the western limit is the Gemini, but the eastern peak, unascertained. It should be sought somewhat about $94^{\circ} 50'$ between which point and the extreme eastern limits of the Himálaya, must be the basin of the Dihóng. That the above distribution of the Himálaya into natural districts is, upon the whole, as consistent with the facts as it is eminently commodious and highly suggestive, I have no hesitation of asserting. Lest however I should extend my present^t Essay to undue limits to trench upon the province of Col. Waugh and the other able professional men who are now engaged upon the western hills, I shall say nothing further of the alpine valley of the Ganges and those west of it, nor upon those lying east of Sikim. If my main assumption be valid, it will be easily worked out by abler hands and better furnished ones than mine : wherefore the following more detailed expositions will be chiefly confined to the three great central basins of the Karnáli, the Gandak, and the Cósí. In the first of these basins we have (successively from west to east) the Sarjú, the Góri, the Káli, the Swéti-ganga, the Karnáli proper, the Bhéri and the Jhingrak or Rapti. And it is certain that, whereas these streams drain the whole alpine valley of the Karnáli, so their most westerly source and course is confined on the west by the Nanda-devi peak, as their most easterly is limited on the east by that of Dhoula-giri. These rivers do not wholly unite within the hills, though their tendency to union is so decided that they are known by one name, even in the plains, where their collective appellation is Sarjú, vel Káli, vel Ghógra. In the hills the whole of them are universally denominated by the collective name of Karnáli (corrupted by Rennell and his followers into Kenár). Karnáli is the proper name of this noble river, the Karnáli branch being by far the largest the central and most remote of origin. It rises in Tibet, not far from one of the sources of the Satlege, and has a considerable trans-Himálayan course to the westward of the Taklakhár pass, where it quits Tibet. No natural district can be more distinct than the alpine basin of

the Karnáli, as above defined. It includes the political divisions of Káli Kúmáun, belonging to Britain, and of the Báisi, or 22 Rájes of Nepál, with Yúmila vel Júmla, Dóti and Sallyán. In the second basin, or that of the Gandak, we have, successively from the west, as before, the Barigár, the Náráyani, the Swéti-gandaki, the Marsyángdi, the Daram-di, the Gandi, and the Trisúl. These are the "Sapt Gandaki" or seven Gandaks of the Nepalese, and they unite on the plainward verge of the mountains at Tirbéni above Sáran. They drain the whole hills between Dhoula-giri and Gosain-thán; the Barigár and one head of the Náráyani, rising from the former barrier, and the Trisúl, with every drop of water supplied by its affluents, from the latter. Nor does a single streamlet of the Trisúl arise east of the peak of Gosain-thán, nor one driblet of the Barigár deduce itself from the westward of Dhoula-giri. We have thus in the alpine basin of the Gandak another admirably defined natural division comprised within two great proximate Himálayan peaks. This division is named, vernacularly, the Sapt Gandaki. It includes the old Choubísi, or 24 Rájes and belongs to the modern kingdom of Népal.

Our third sample of a Himálayan natural province conterminous with the utmost spread of the feeders of a large river, and bounded on either hand by a prime snowy peak, is the basin of the Cósi, which, like the Gandak, has seven principal feeders. These are as follows: the Milamchi, the Bhotia Cósi, the Tamba Cósi, the Likhú, the Dúd Cósi, the Arún, and the Tamór. Of these, the Milamchi, rising from Gosain-thán, is the most westerly, and the Tamór, rising from Kang-chang, is the most easterly, feeder.* And those two great peaks, with the pre-eminent ridges they send forth southwards, include every drop of water that reaches the great Cósi of the plains through its seven alpine branches. All these branches, as in the case of the Gandak, unite (at Varáha Kshétra above Náthpúr) within the hills, so that the unity of this alpine basin also is as clear as are its limitary peaks and its extent.

The alpine basin of the Cósi is denominated by the Nepalese the Sapt Cousika, or country of the seven Cósis. It comprises the old Rájes of the Kirántis,† Limbús and Kála Makwánis, and is included, like the two prior basins, in the modern kingdom of Népal.

* See J. A. S. No. 189. Route from Kathmandu to Darjeeling.

† The classical Cirrhatæ, and a once dominant and powerful race, though they

The country drained by the above three rivers (Karnáli, Gandak and Cósi) includes the whole of Népal and the proximate part of Kúmáun, or, in other words, 800 miles of the central and most characteristic portion of the Himálaya. Wherefore it is legitimately presumeable that whatever is true of its natural divisions, is true of those of the residue, quoad ruling principle and geological causation.

Now, if the above facts relative to these three rivers be justly represented (and that they are so, in the main, I confidently assert), we are led irresistibly to inquire *why* the numerous large feeders of the rivers, instead of urging their impetuous way from the snows to the plains by independant courses, are brought together upon or near the verge of the plains? *how* unity is effected among them despite the interminable maze of ridges they traverse, and despite the straight downward impulse given them at their sources?—I answer, it is because of the superior elevation of the lateral barriers of these river basins, between which there are synclinal slopes of such decided preponderance that they overrule the effect of all other inequalities of surface, how vast soever the latter may sometimes be.

It will be seen by the map that these lateral barriers of the river basins are crowned by the pre-eminent Himálayan peaks, that the peaks themselves have a forward position in respect to the ghát line or great longitudinal water shed between Tibet and India, and that from these stupendous peaks, ridges are sent forth southwards proportionably immense. Thus from the peak of Kangchang is sent forth the ridge of Singiléla, which towers as loftily over all the other sub-Himálayan ridges of eastern Népal and western Sikim as does Kangchang itself over all the other Himálayan peaks.

This Singilélan prolongation (so to speak) of Kangchang, entirely separates the waters of the Cósi and of the Tishta. A similar ridge, that of Dayabhang,* stretching south from the great peak of Gosainthán, as entirely divorces the waters of the Cósi and of the Gandak. Another like ridge rising from Dhoula-giri as effectually sunders the waters of the Gandak and of the Karnáli. Another starting from

have long since succumbed to the political supremacy of other races—first the Makwánis and then the Gorkhális.

* Hence the name Dhaibúng, erroneously applied by Col. Crawford to the peak. Dayabhang, the destroyer of pity, from the severity of the ascent.

Nunda-dévi in like manner wholly separates the proximate feeders of the Karnáli and of the Ganges; whilst yet another originating with Jamnoutri, wholly separates the Ganges from the Jumna.

Equally effective with the divergent power of each of these supremely peaked ridges, which run parallel to each other and at right angles to the ghát line of the snowy range, upon two river basins, as just noticed, is of course the convergent power of two ridges upon the single contained river basin. The synclinal lines from the inner faces of the two adjacent ridges draw the waters together; and, because these ridged peaks are the *loftiest masses of the entire mountains*, the effect of all their other masses, even that of the spine of Hemáchal or the ghát line of the snows, is overruled or modified, so that in the ruggedest region on earth a very limited series of distinct main rivers appears in the plains from innumerable independent alpine feeders, in the manner which all behold but few indeed think of referring to its cause.

It is inconsistent with all we know of the action of those hypogene forces which raise mountains, to suppose that the points of greatest intensity in the pristine action of such forces, as marked by the loftiest peaks, should not be surrounded by a proportionate circumjacent intumescence of the general mass; and, if there *be* such an intumescence of the general surface around each pre-eminent Himálayan peak, it will follow, as clearly in logical sequence as in plain fact it is apparent, that these grand peak crowned ridges will determine the essential character of the aqueous distribution of the very extended mountainous chain (1800 miles) along which they occur at certain palpable and tolerably regular intervals. Now, that the infinite volume of the Himálayan waters is, in fact, pretty regularly distributed into a small number of large rivers, we all see; and, whereas the fact is thoroughly explicable upon my assumption that the great peaks bound, instead of intersecting, the river basins, it is wholly inexplicable upon Capt. Herbert's assumption that the said peaks intersect the basins.

The above are normal samples of Himálayan water distribution, and it is very observable that whereas all those principal streams which exhibit the unitizing principle so decidedly, take their origin in the alpine region, at or near the snows, so the inferior streams which rise from the middle region only, show no such tendency to union, but pursue their solitary routes to the Ganges; as for example, the Mahanada, the Méchi, the

Konki the Bágmati, the Gumti, the Cosilla and the Rámghanga. Here is both positive and negative evidence in favour of the doctrine, I advocate as furnishing the key to the aqueous system and natural divisions of the Himálaya ; for, the upper rivers do, and the lower rivers do not, stand exposed to the influence of the great peaks.

The petty streams of the lower region or that next the plains, which water the Dhúns vel Maris, traverse those valleys lengthwise ; and, as the valleys themselves run usually parallel to the ghát line of the snows, such is also the direction of these petty streams. In the central, as in the western,* hills they usually disemboque into the rivers of the first class.

I have observed that the three great river basins of the Karnáli, Gandak and Cósi extend throughout Nepál ; and truly so ; for a river basin, includes the widest space drained by its feeders. But, it results necessarily from the manner in which the deltic basins of the Himálayan rivers are formed, that there should be intervals between the plainward apices of these deltic basins. Of these intervals the most conspicuous in Népal, is that which intervenes between the Cósi and Gandak. This tract, watered by the Bágmati, deserves separate mention on many accounts, and it may be conveniently styled the valley region, since it contains not only the great valley of Népal proper, but also the subordinate vales of Chitlong, Banépá and Panouti.

It has been already remarked that the classifications of physical geography, as of the other sciences, do not constitute a perfect "open sesame" to the mysteries of nature, but only a material help to their study. This observation I will illustrate by a few comments on the basin of the Tishta, lest the somewhat anomalous instance of that basin, should be captiously quoted to impugn the doctrine I contend for ; but contend for, not as exhibiting in every instance an absolute conformity with natural arrangements, but as doing all that can be reasonably expected in that way, and as furnishing, upon the whole, a generally truthful, causally significant, and practically useful, indication of those arrangements.

I have stated above that the basin of the Tishta extends from the peak of Kangchang to that of Chúmalári. But an inspection of the accompanying map will show that between these two peaks there occurs

* J. A. S. No. 126, p. xxxiii.

what miners call "a fault" in the ghát line of the snows, which line, after proceeding N. Easterly from the Láchén to Powhanry,* dips suddenly to the south for nearly 40 miles, and then returns to Chúmalári. A triangular space called Chúmbi is thus detached from the Himálaya and attached to Tibet; and the basin of the Thista is thus narrowed on the east by this salient angle of the snows, which cuts off the Chúmbi district from the Tishtan basin, instead of allowing that basin to stretch easterly to the base of Chúmalári. Chúmbi is drained by the Máchú of Campbell, which is doubtfully referred to the Torsha of the plains, but which may possibly be identical with the Háchú of Turner and Griffiths,† or the Gaddada of the plains. But besides that these points are still unsettled, it will be noted that one of the transnivean feeders of the Tishta rounds Powhanry and rises from a lake (Cholámú) approximating to Chúmalári; so, that, one way or another, the Tishta may be said, without much violence, to spread its basin from Kangchang to Chúmalári.

Chúmbi and all the adjacent parts of the plateau of Tibet, constitute a region as singular as is the access to it from Sikim by the Láchén pass. That pass surmounted, you at once find yourself, without descent, upon an open undulated swardy tract, through which the eastern transnivean feeders of the Tishta and of the Arún sluggishly and tortuously creep, as though loath to pass the Himálaya, towards which

* Vide Waugh's outline of the snowy range of Sikim, J. A. S. loc. cit.

† Embassy to Tibet and J. A. S. Nos. 87 and 88, with sketch maps annexed. Also Pemberton's large map of the eastern frontier. Rennell is not easily reconcilable with them. In the accompanying map I had identified the lakes of Cholámú, which give rise to the Tishta, with Turner's lakes. But I now learn from Hooker that the latter lie a good deal east of the former, and I am satisfied that Campbell's Máchú is distinct from Turner's Hachu. We need, and shall thus find, space in the hills correspondent to that in the plains watered by Rennell's Torsha and Saradingoh and Gaddada and Suncósi. The Máchú, (Maha tchieu apud Turner) rises from the West flank of Chúmalári. The Háchú of Turner is a feeder joining his Máchú from the West. The Chaa chù of Turner is the Suncósi of Rangpúr: his Tehin chù is the Gaddada, and his Máhá chù, the Torsha. The Arún has its rise in the broken country of Tibet lying N. and a little W. of the sources of the Tishta and South of the Kambalá, or great range forming the Southern boundary of the valley of the Yárú. This broken country Dr. Hooker estimates at from 16 to 18000 feet above the sea. It is a good deal terraced near Himachal.

indeed it is not easy to perceive how they are impelled, the plateau of Tibet sloping on their right to Digarchi, and seeming to invite the streams that way. There is however of course a water-shed, though by no means a palpable one; and we know by the signal instances of the vast rivers of South America and those of north-eastern Europe, how inconspicuous sometimes are the most important water-sheds of the globe. The sources and courses of the feeders of the Tishta will shortly be fully illustrated by Dr. Hooker, my enterprising and accomplished guest, to whom I am indebted for the above information relative to the Láchén pass and its vicinity, and whose promised map of Sikim, which state is the political equivalent for the basin of the Tishta, will leave nothing to be desired further on that head.

But the Himálaya must necessarily be contemplated in its breadth as well as its length; and we have therefore still to consider what regional divisions belong to these mountains in relation to their breadth, or the distance between the ghát line of the snows and the plains of India.

The Himálayan mountains extend from the great bend of the Indus, to the great bend of the Brahmapútra, or from Gilgit to Brahma Kúnd, between which their length is 1800 miles. Their mean breadth is about 90 miles; the maximum, about 110, and the minimum, 70 miles. The mean breadth of 90 miles may be most conveniently divided into three equal portions, each of which will therefore have 30 miles of extent. These transverse climatic divisions must be, of course, more or less arbitrary, and a microscopic vision would be disposed to increase them considerably beyond three, with reference to geological, to botanical, or to zoological, phænomena. But, upon comparing Capt. Herbert's distribution of geological phænomena with my own of zoological, and Dr. Hooker's of botanical, I am satisfied that three are enough. These regions I have already* denominated the lower, the middle and the upper. They extend from the external margin of the Tarai to the ghát line of the snows. The lower region may be conveniently divided into—I. the sand-stone range with its contained Dhúns or Máris;—II. the Bháver or Saul forest;—III. the Tarai. The other two regions require no subdivisions. The following appear to be those demarcations by height which most fitly indicate the three regions.

* J. A. S. for December 1847, and June 1848.

<i>Name.</i>	<i>Elevational limits.</i>
Lower region	Level of the plains to 4000 feet above the sea.
Central region.	4000 to 10,000 feet above the sea.
Upper region	10,000 to 16,000* feet above the sea : Highest peak measured is 28,176.

It is needless to remind those who are conversant with physical geography, that in passing in a tropical country, by a long and gradual ascent, from near the sea level to several (4-6) miles above it, one must necessarily meet with regions equivalent, quoad organic phænomena to the three great zones of the earth, or the tropical, the temperate and the arctic; and, in fact, our three regions above indicated correspond in the main with those zones, and might be named after them, but that it is desirable to avoid terms involving theory, when those designating mere facts will suffice. Nor is it merely by organic phænomena that the three regions are contradistinguished.

In geology the upper region is the locale of granites and gneisses; the middle region, that of gneisses and schists; the lower region that of the sandstone formation and of diluvial debris. It may be added that granite is much more extensively developed, in the upper region than had been supposed, and that igneous rocks are by no means so entirely unknown. Indeed igneous *action* is displayed to a stupendous degree, in the hypogene rocks both stratified and unstratified of the upper and even central region. In botany the first is the region of Junipers, Cedars, Larches, dwarf Rhododendrons, Hollies, Willows, Walnuts, Birches, and in general of the superior sorts of Coniferæ; the second, that of Oaks, Chesnuts, Magnolias, Laurels, Alders, tree Rhododendrons (many kinds). Cherry and Pear trees (large and wild), Oleas (large forest tree), Maples, Wax trees, Camelias, tree ferns, some few and peculiar Palms (Chamerops, &c.), and the inferior sorts of Pines; the last, that of Sauls (*Shorea*), *Sissus* (*Dalbergia*), Acacias, Tunds (*Cedrela*), cotton trees (*Bombax*), tree figs, (*Catechu*, *Indicus et Religiosus*.) *Buteas*, *Dillenias*, *Baudangas*, *Erythrinas*, *Premnas*, some common Palms (*Phœnix*, &c.) but rare and poor, and, lastly, tree ferns, but much rarer than above. *Pinus longifolia* likewise recurs in this region, but not one other of the many

* This is about the average height of the ghâts and of the perpetual snow. It is also nearly the limit of possible investigation, and of the existence of organic phænomena. But the upward limit need not be rigorously assigned.

Conifers above.* In Zoology, again, to begin with man, the upper region is the exclusive habit of the Bhótias, who extend along the whole line of the gháts, and who, with the name, have retained the lingual and physical characteristics of their tramontane brethren. To the central region are confined, but each in their own province from east to west, the Mishmis, the Bors and Abors, the Ákás, the Daphlas, the Lhópás, the Lepchas, the Limbús, the Kirántis, the Múrmis, the Néwárs, the Súnwárs, the Chépángs, the Gúrúngs, the Magars, the Khas or Khasias, the Kóhlis, the Garhwális, the Kakkas, the Bambas, the Gakars, the Khatirs, the Awáns, and the Janjúhs. To the lower region are as exclusively limited the Kócch, the Bódó, the Dhimál, the Kíchak, the Thárú, the Dénwár, the Pallah, and the Bóksar. Of these races, those of the central region are all of transnivean origin like the first named; but they are much altered in speech and aspect, by 12 to 15 centuries of residence in a csnivean climate, and by mixture in some few cases (as Khas or Khasia) with southern blood; whilst the races of the lower region are of the aboriginal Indian or Tamulian stock, and nearly unmixed, though some of them have adopted the speech and customs of the Hindus.† The hill Bráhmans, Rájpúts and Moslems so common to the westward, so rare to the eastward, are mere modern immigrants from the plains. It is very deserving of special notice that the people of the upper region cannot endure the climate of the central one, nor those of the central region, the climate of the lower one; so that the distribution even of the human race in the Himálaya affords a remarkable verification of our triple transverse division from a quarter the least likely to afford any such argument. But to proceed to our zoological enumerations. To the upper region exclusively belong, among the Ruminants, the Bisons (Poephagus) and Musks, the wild goats (Ibex, Hemitragus) and wild sheep (Pseudois,

* Last winter Dr. Hooker pointed out to me in the lower region a Hawthorn and a Horse Chesnut. But these are exceptional traits.

† For these tribes see J. A. S. for December 1847, and April and June 1848, and May 1849; also the prior paper in the same by Mr. Brown. Essay on the Kocch, Bodo, and Dhimal Languages and Literature of Nepal. Cunningham's History of the Sikhs, and Hamilton's Nepal. The Kholis of Kumaon are one of the tribes of Helot craftsmen of India, who are most of them Tamulian in origin, I think; but the subject is yet to be treated.

Ovis) among the Rodents, the Marmots and Pikas (*Lagomys*); among Plantigrades, the Bears proper (*Ursus*). In the middle region, true Bovines (*Bos*) take the place of the Bisons of the upper region; Caprine Antelopes (*Nemorhædus*, *Kemas*) replace its Musks and wild goats and sheep; common Rats, and Mice, and Hares, and Porcupines, and Hedgehogs, its Marmots and Pikas; and sun Bears (*Helæretos*) its true Bears; whilst the Deer family, unknown to the upper region, is here represented only* by the anomalous stilt-horns (*Stylocerus*). In the lower region the ox family is represented by *Bibos* and *Bubalus*; (splendid wild types); the deer family, here abundant, by *Rusas*, Stags, *Axis*, and stilt-horns to boot; the Antelopes by *Tetracerus*, or the four-horned kind; the Rodents by the *Bambú* rats (*Rizomys*) and spiny hares (*Caprolagus*); and the bear family by the honey bears (*Melursus*); add to all which that to this region are exclusively confined all the large *Pachydermes*, such as the Elephant and *Rhinoceros*; and the Monkeys also (*Semnopithecus* et *Macacus*) though not so exclusively in their case. The carnivora, again, are represented in the upper region by ounces, by foxes of a large sort (*Montanus*), by the weasels proper, and by the *Ailuri* or Cat lories; in the middle region by the wild Dogs (*Cyon*), the Marten weasels, leopards, thick-tailed leopards (*Macroceloides*), wild cats (*Murmensis*, *Pardochrous*, *Ogilbii*), Lybian lynxes (*Lybicus*). *Zibets*, *Screw-tails* (*Paradoxurus*), and *Prionodons*; and in the lower region by tigers, leopards, hyenas, wolves, jackals,† insectivorous foxes (*Kokri*), Bear badgers (*Ursitaxus*), *Urvas*, *Mangooses*, *Helictes* or Oriental gluttons, small civets (*Viverrula*), *Hirsute screw-tails*, and shap-faced cats (*celidogaster*). *Zibets* recur in this region but rarely, and one small species of *Mongoose* is found in special spots of the central region. The otters in the upper region are represented by the small golden and brown species (*Aurobrunnea*); in the central, by *monticola* and *indigitata*; in the lower, by the large

* I am fully aware that *Rusas* (*Sámber*) are found in the western hills, but a careful consideration of the facts in that part of the Himálaya with due advertence to the known habits of the group, satisfies me that these deer have been driven into the western hills by the clearance of the *Tarai* and *Bláver*.

† Jackals have made their way (like crows) to the most populous spots of the central region, but they are not proper to the region, nor Indian foxes, though some of the latter turned out by me in 1827 in the great valley of Nepal, have multiplied and settled their race there. *Ex his disce alia*.

Chinese species (*Sinensis*). Among the squirrels, the great thick-tailed and purple species (*Macruroïdes* et *Purpureus*) belong solely to the lower region; the small Lokries (*Locria* et *Locroïdes*) to the central; and the Siberian, to the upper; whilst flying squirrels, a numerous group, are confined to the central region, so far as appears. In the Bat group, the frugivorous species, or Pteropines, all are limited to the lower region, whilst the horse shoes (*Rhinolophinæ*) specially affect the central region; and the bats proper (*Vespertilioninæ*) seem to be the sole representatives of the family in the northern region. From the class of birds we may select as characteristic of the three regions the following:—

The true pheasants (*Phasianus*), the Tetrugalli, the sanguine pheasants (*Ithaginis*), the horned and the crested pheasants (*Cerionis*, *Lophophorus*) of the upper region, are replaced by fowl pheasants (*Gallophasis*)* in the mid-region, and by fowls proper (*Gallus*) in the lower. In like manner, among the partridges (*Perdiciinæ*), the grouse partridges (*Tetrauperdix*) belong exclusively to the upper region; the chakórs (*Caccabis*) and the tree partridges (*Arboricola*) to the central; and the Francolines (*Francolinus*) to the lower, though the black species of this last form are also found in the mid-region. In the pigeon group the blanched pigeons (*Leuconta*) belong solely to the upper region; the vinous pigeons (*Hodgsoni*) to the central, and the green, the golden, and the banded (*Treron*, *Chalcophaps*, *Macropygia*) as entirely to the lower; the *Trerons* alone partially entering the central tract from the lower.

The splendid Edolian shrikes (*Chibia*, *Chaptia*, *Edolius*) belong exclusively to the lower region. They are replaced in the central tract by plain *Dicrurines*, and in the upper, by plainer *Lanians*. The cotton birds (*Campephaga*) of the south are replaced by gaudy *Ampelines* (*Cochoa*) and *Leiothricinians* (*Leiothrix*, *Pteruthius*, *Cutia*) in the middle region: but both groups seem excluded from the north. Among

* The influence of longitude on geographic distribution might be singularly illustrated, did space permit, from numerous Himálayan groups, Galline and other: thus, for example, a black-breasted *Cerionis* is never seen east of the Káli, nor a red-breasted one west of it. So of the black and white crested *Gallophases*; whilst a black-backed one is never seen west of the Arún, nor a white back, east of it.

the Fly-catchers the gaudy or remarkable species and forms, belong wholly or chiefly to the lower region, as Tchitrea, Rhipidura, Cryptolopha, Myiagra, Hemichelidon, Chelidorynx; whilst those which approach the warblers (Niltava, Siphia, Digenea) belong to the mid-region; and the plainer and more European types are alone found in the northern.

Among the Fissirostres, Goat-suckers and Swallows are pretty generally distributed; but Rollers, Bee-eaters, Eurylaimi, Trogons and all such gaudy types belong to the south, with only occasional alpine representatives, as Bucia is of Merops. The tenuirostral birds belong distinctively to the lower region. Yet they have representatives or summer visitants in all three, even among the Sun-birds. Upon the whole however it may be safely said that the Sun-birds (Nectarinia) belong to the south; the Honey-suckers (Meliphagidæ) to the centre and south; and the Creepers, Nut-hatches and Wrens* to the north and centre. The Sylvians or warblers are too ubiquitous, or too migratory for our present purpose, even Boreal types being common in the lower region in the cold weather. Horn-bills, Barbets, Parroquets (Palæornis, Psittacula) belong to the lower region, though they have a few representatives in the central; none in the upper. Wood-peckers abound in the lower and central regions, but are rare in the upper. True Cuckoos (Cuculus) are as common and numerous in the central region as walking Cuckoos (Phænicophaus, Centropus), &c. are in the southern, where also the golden (Chrysococcyx) and dicurine Cuckoos (Pseudornis) have their sole abode, whilst what few of the group belong to the upper region, are all allied to the European type. The Ravens, Pies, Choughs, Nut-crackers and Conostomes of the upper region are replaced in the central region by Tree Pies (Cissa, Dendrocitta), Jays, Rocket birds (Psilorhinus), Pie thrushes (Garrulax), Timalias, and Hoopoe thrushes (Pomatorhinus); and in the lower region by the common Indian crows (Culminatus et Splendens), Grackles, † staves, vagabond pies

* I have in this paper followed without entirely approving Mr. Gray junior's classification of my collections in the printed catalogue. The geographic distribution is now attempted for the first time. But I will recur to the subject in a separate paper devoted to it.

† When Darjiling was established there was not a crow or pastor to be seen. Now there are a few crows but no pastors. Enormously abundant as both are in

and dirt birds (*Malococercus*). Thrushes proper with rock thrushes, Ousels, Myophones, Zotheres, Tesias and Hypispetes are as abundant in the central and upper region as Bulbuls, Orioles, Pittas, are in the central and lower.

In the Finch family the Haw-finches, Bull-finches, Gold-finches and Cross-bills (*Loxia*) are as strictly confined to the upper region, as are the corvine *Conostomes*, Nut-crackers, Choughs and Ravens. The former are replaced in the central region by the Buntings, Wood-finches (*Montifringilla*), and Siskins; and in the lower region, by the Weavers and *Múnias*. The Raptorial birds are, in general, too cosmopolitan to subserve the purposes of Geographic distribution. Still it may be remarked that the true eagles belong, quoad breeding at least, to the upper region; the crested eagles (*Circæetus*), the Neopuses and Hawk eagles (*Spizaetus*) to the central; and the Pernes (*Haliæetus et Pandion*) and *Haliasturs* to the lower. Among the vultures the distinction is more marked: for, the eagle vultures (*Gypaetus*) belong exclusively to the upper region; the large European vultures (*Fulvus et Cinereus*) to the central; and the Neophrons, and the small Indian vultures (*Bengalensis et Tenuirostris*) to the lower. The Himálaya abounds in Falconidæ, all the occidental types and species being found there and many more, peculiar and oriental ones; and it deserves special remark that whereas the former (*Imperialis, Chrysætos, Lanarius, Peregrinus, Palumbarius, Nisus, &c.*) affect the upper and central regions, the oriental types (*Hypotriorchis, Haliastar, Jerax, Hyptiopus, Elanus, Poliornis*) are quite confined to the lower region.

Those perfect cosmopolitans the waders and swimmers, migrate regularly in April and October, between the plains of India and Tibet, and, in general, may be said to be wanting in the mountains though most abundant in the Tarai. The great Herons (*Nobilis et Cinereus*) the great Storks (*Nigra et Purpurea*) and great Cranes (the *Cyrus* and *Damoiselle*) of the Tarai are never seen in the mountains where the Egrets alone represent the first group. But the soft-billed smaller waders (*scolopacidæ*) are sufficiently common in the mountains, in which the woodcock abounds, breeding in the upper region and frequenting the central, and rarely the lower, region, from the lower region, this sufficiently proves they are not native to the central tract though common in the great valley of Nepal.

October till April. Geese, ducks and teals swarm in the Tarai, where every occidental type (so to speak, for they are ubiquitous) may be seen from October till April; and many oriental non-migratory types; whereas in the mountains the Mergansers, (*orientalis*) and the Corvorrants (*Sinensis* et *Pygmæus*) only are found, and that very scantily; with a few Rails and Gallinules and Sandpipers, from the vast host of the Waders.*

But I must hasten from these zoological details to make some remarks on the subdivisions of the lower region, a subject which, though in many ways interesting and important, is so little understood that the celebrated Mrs. Somerville in her very recent treatise of physical geography has represented the Tarai as being *within* not only the Bháver, but the sandstone range.†

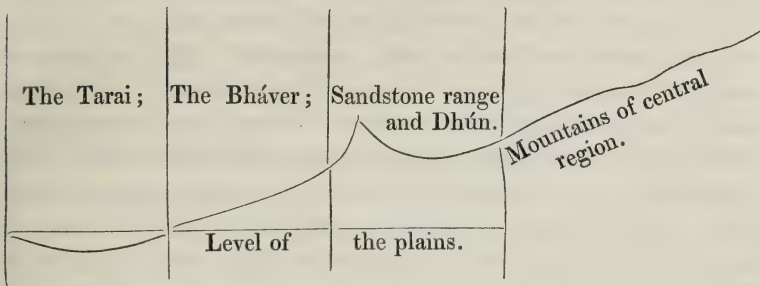
All observant persons who have proceeded from any part of the plains of India into the *Himálaya* are sensible of having passed through an intermediate region distinguished by many peculiarities; and, if their route have lain to the N. W., they can hardly have failed to notice successively the verdant Tarai, so unlike the arid plains of upper India; the vast primæval Saul forest, so every way unique; and the Dhúns or valleys, separated from the last tract by a low range of hills. The natives of the plains have in all ages recognised these several distinct parts of the lower *Himálayan* region which they have ever been, and are still, wont to frequent periodically, as strangers and foreigners, in order to graze innumerable herds of cows and buffaloes in the Tarai, or to procure the indispensable timber and elephants peculiar to the Bháver, or to obtain the much-prized drugs and dyes, horns and hides, (Deer and Rhinoceros), râls and dhúnas (resin of Saul and of Cheer) and timber of the Dhúns. Nor is there a single tribe of Highlanders between the Cósi and the Sutledge which does not discriminate between the Tarai or Tari, the Jhári or Bháver, and the Dhúns or Máris. Capt. Herbert has admirably described‡ the geological peculiarities and external aspect of each of these well known tracts. His details are,

* For an ample enumeration of the mammals and birds of the *Himálaya*, (150 sp. of the former, and 650 of the latter,) see separate catalogue printed by order of the Trustees of the British Museum in 1845. The distribution is not there given.

† Physical Geography, Vol. I. p. 66.

‡ J. A. S. No. 126, extra pp. 33 and 133, et seq.

indeed, confined to the space between the Káli and the Sutledge; but the general characteristics of these tracts he affirms to be equally applicable to all the country between the Méchi and the Sutledge; and Capt. Parish, whilst confirming Herbert's statements, makes them so likewise as far westward as the Beas.* What Capt. Herbert states as holding good from his own personal researches in regard to the western Himálaya (Sutledge to Káli), I can confirm from mine in regard to the Nepalese portion (Káli to Mechi), but with this reservation, that no more in the western than in the Nepalese Himálaya does the sandstone range, with its contained Dhúns, prevail throughout or continuously, but only interruptedly or with intervals; and thus the Sallyán-mári, the Gongtali-mári, the Chitwan-mári, the Makwánpúr-mári and the Bijaypúr-mári of Népál (which are mostly separate) represent with perfect general accuracy the Deyra, Kyarda, Pinjor, Pátali and other Dhúns to the westward. The accompanying sectional outline will give a distincter idea than any words could do of the rela-



Disposition of parts in lower region of Himálaya.

tions of the several parts of the lower Himálayan region to the plains on the one hand, and to the mountains on the other, according to Capt. Herbert's views. The continuous basal line represents the level of the plains: the dip on the left, the Tarai; the ascending slope in the centre the Saul forest; the dip on the right, the Dhúns or Máris. It is thus seen that the Tarai sinks below the level of the plains; that the forest forms a gradual even ascent above that level; that the Dhúns

* J. A. S. Nos. 190 and 202, for April 1848, and 1849.

continue the ascent to the base of the true mountains, but troughwise, or with a concave dip; and, lastly, that the Dhúns are contained between the low sandstone range and the base of the true mountains. *The Tarai* is an open waste, incumbered rather than clothed with grasses. It is notorious for a direful malaria, generated (it is said) by its excessive moisture and swamps—attributes derived, 1st, from its low site, 2nd, from its clayey bottom, 3rd, from innumerable rills percolating through the gravel and sand of the Bháver, and finding issue on the upper verge of the Tarai (where the gravelly or sandy debris from the mountains thins out), without power to form onward channels for their waters into the plains. *The forest* is equally malarious with the Tarai, though it be as dry as the Tarai is wet. The dryness of the forest is caused by the very porous nature of that vast mass of diluvial detritus on which it rests, and which is overlaid only by a thin but rich stratum of vegetable mould, every where sustaining a splendid crop of the invaluable timber tree (*Shorea robusta*), whence this tract derives its name. *The sandstone range* is of very inconsiderable height, though rich in fossils. It does not rise more than 3 to 600 feet above its immediate base, and is in some places half buried (so to speak) in the vast mass of debris through which it penetrates.* *The Dhúns* are as malarious and as dry as the Bháver. They are from 5 to 10 (often less, in one instance more) miles wide, and 20 to 40 long, sloping from either side towards their centre, and traversed lengthwise by a small stream which discharges itself commonly into one of the great alpine rivers; thus the Rápúti of Chitwan-mári falls into the Gandak, and that of Bijaypúr-mári into the Cósi. The direction of the Máris or Dhúns is parallel to the ghát line of the snows, and their substratum is a very deep bed of debris similar to that of the Bháver, but deeper, and similarly covered by a rich but superficial coating of vegetable

* The low range which separates the Dhúns and Tarai, on the high road to Kathmándú, consists almost wholly of diluvium, rounded pebbles loosely set in ochreous clay, such as forms the great substratum of Dhún and Bháver. The sandstone formation only shows itself where the rain torrents have worn deep gullies, and it there appears as white weeping sand imperfectly indurated into rock. Anthracite, shale, loam, are found in this quarter, but no organic fossils, such as abound to the westward. Herbert assigns the Siwáliks to the new red formation of geologists. But if I understand Lyell rightly, that formation is inimical to fossils. Is there any mistake as to the technical class of rocks?

mould which, if not cultivated, naturally produces a forest of Saul equal to that outside the sandstone range, and then in like manner harbouring elephants, rhinoceroses, wild bulls (*Bibos*), wild buffaloes, rusas, and other large deer, with creeping things (*Pythons*) as gigantic as the quadrupeds. The height of the sandstone range Capt. Herbert estimates at 3000 feet above the sea, or 2000 above the plains adjacent; and that of the Dhúns (at least the great one), at 2500 above the sea, and 1500 above the plains. These measurements indicate sufficiently the heights of the lower region, and it is observable that no elevation short of 3 to 4000 feet above the sea suffices to rid the atmosphere of the lower Himálaya from malaria. Thus, the Tarai, the Bháver and the Dhúns are alike and universally cursed by that plague. And this (by the way) is one among several reasons why I have assigned 4000 feet of elevation as the southern limit of the healthful and temperate mid-region; that above it being the arctic or boreal, and that below it, the tropical, region; though it must never be forgotten that more or less of the tropical characters, especially in the suite of the seasons, pervades the whole breadth (and length likewise) of the Himálaya, whatever be the decrement of heat, and also that from the uncommon depth of the glens in which the great rivers especially run, and which in the Central and even Upper region often reduces the height of those glens above the sea below the limit just assigned for salubrity, such glens are in both these regions not unfrequently as malarious as is the whole lower region.

But, the above characteristics of the subdivisions of the lower Himálayan region, how noticeable soever to the west of the Méchi, are by no means so to the east of that river, where a skilled eye alone can painfully detect the traces* of the sandstone formation (without which there can be, of course, no Dhúns,) and where the Tarai, considered as a trough running parallel to the mountains, forms no marked feature of the country, if indeed in that sense it can be said to exist at all.

* In my recent expedition in the Tarai east of the Méchi with Dr. Hooker, that accomplished traveller first detected traces of the sandstone formation, with imperfect coal, shale, &c., in a gully below the Pankabári Bungalow, as well as at Lohagarh. The sandstone rock barely peeped out at the bottom of the gully lying in close proximity with the mountains, so that nothing could be more inconspicuous than it was as a feature in the physiognomy of the country.

And as, even to the westward, the sandstone range, with its contained Dhúns, is by no means constant, it may be desirable to attempt to characterise the lower region considered as a whole without reference to local peculiarities or too rigidly defined subdivisions. Now I conceive that the lower region owes its distinctive character as a whole to the vast mass of diluvial detritus which was shot from the mountains upon the plains, like gravel from a cart, at some great geological epoch, and which has been, since its deposit, variously and often abraded both in degree and direction, by oceanic, and, in a far less degree, by ordinary, floods. Where there was, at the epoch in question, no sandstone range to intercept the downward spread of the debris, this debris would necessarily be carried further south, and be of less thickness; where there *was* such a barrier, it would be carried less far southward and be accumulated in greater thickness, especially within the barrier; and, in like manner, where no sandstone range existed, but only spurs, sent forth, like bent arms, upon the plains from the mountains, the embayed detritus would still be deeply piled and lofty within such spurs,* and thinly and unequally spread without them, by reason of the action of the spurs on the currents. Again, where, as from Gowhatty to Sardia, there was not room upon the plains for the free spread and deposit of the descending Himálayan detritus owing to large rapid rivers and to other chains, both parallel and proximate to the Himálaya, the phenomena created elsewhere by the more or less unrestricted spread of the Himálayan detritus over the plains, would necessarily be faintly, if at all, traceable. Lastly, if at the time of the descent of the debris, there existed a great dip in the Gangetic plains from N. W. to S. E., the lithologic character, as well as the distribution, of the debris, would be materially affected thereby; for, the subsiding oceanic current would have a set from the former to the latter quarter, and would continue to lash

* There is a signal example of this on the road to Darjiling viâ Pankabári where the debris, embayed by a spur, is accumulated to several hundred feet, and where moreover there is outside the spur a conspicuous succession of terraces, all due to oceanic forces, and clearly showing that the subsidence of the sea was by intervals, and not at once. Constant observation has caused the people of the Tarai to distinguish three principal tiers of terraces, from the prevalent growth of trees upon each. The highest, is the Saul level; the middle, the Khair level and the lowest, the Sissú level; Shorea, Acacia and Dalberga being abundantly developed on the three levels as above enumerated.

the gravel into sand, and here to deposit both in a series of terraces, there perhaps utterly to displace both, in the latter quarter long after the former had emerged from the waves. Now, that the Himálaya really was, at one time, in great part submerged; that the vast mass of detritus from the Himálaya at present spread over the plains in its vicinity, was so spread by the ocean when the founts of the deep were broken up; that this huge bed of detritus, every where forthcoming, is now found in unequal proportion and distribution and state of comminution; as, for example, deeper piled within, than without the sandstone range, and the embaying spurs, and also, more gravelly and abundant to the N. W., more sandy and scant to the S. E. ;* and, lastly, that the Gangetic plain really now has a great oblique dip† from the Sutledge at Rúper to the Brahmápútra at Gwálpára, whereby all the Himálayan feeders of the Ganges are in the plains so much bent over to the eastward—these are presumptions relative to the past as legitimate as the extant facts suggesting them are incontrovertible; and, we have but to observe how, at the grand epoch adverted to, the action of general causes was necessarily modified by the peculiar features of the scene, as above indicated, in order to come at a just conception of the aspect and character of the lower Himálayan region, all along the line of the mountains. Thus the longitudinal trough parallel to the mountains, and exclusively denominated the Tarai by Capt. Herbert, may to the N. W. have been caused by the set of the subsiding oceanic current from N. W. to S. E. ; but, however caused, it exists as a palpable definite feature only beneath Kumáon; is

* Capt. Herbert has given statements of its depth to the westward, where there is a sandstone range. To the eastward, where is none, I found it, on the right bank of the Tishta, under the mountains, 120 feet, at 15 miles lower down, 60 to 70 feet, at 15 miles still further off the mountains, 40 to 50 feet. There was here no interruption to the free spread of the detritus, and I followed one continuous slope and level—the main high one. The country exhibited, near the rivers especially, two or three other and subordinate levels or terraces, some marking the effect at unusual floods of extant fluvial action, but others unmistakably that of pristine and oceanic forces. I measured heights from the river. I could not test the subsurface depth of the bed. There was every where much more sand than gravel, and boulders were rare.

† Saharunpúr is 1000 feet above the sea; Múradábád 600; Gorakpúr 400; Rangpúr 200; Gwálpára 112. My authorities are *As. Res.* Vol. XII. *J. A. S. No.* 126. *Royles Him. Bot.*, *Griffith's Journals*, and *J. Prinsep in epist.*

faintly traceable beneath Nepal, and is wholly lost beneath Sikim and Bhútán. But, the great bed of debris is *every where* present, and with no other distinctions than those pointed out, whether it be divided into Bháver and Dhún, by the sandstone range, as is usually the case west of the Méchi, or be not so divided owing to the absence of that range, as is always the fact east of the Méchi. Again, *every where* there is, at that point where this vast bed of gravel and sand thins out, a constantly moist tract, caused by the percolation of hill waters through the said bed, and their issue beyond it; and that constantly moist tract is the Tarai, whether it run regularly parallel to the line of mountains and be distinctly troughed, as to the westward is the case, or, whether there be no such regularity of parallelism or of troughing, as to the eastward is the case.

Why that vast mass of porous debris which every where constitutes the appropriated domain of the Saul forest, and that imporous trough outside of it which every where constitutes its drain, should, as far eastward as the Méchi, be both of them developed parallelly to each other and to the line of the mountains, whilst beyond the Méchi eastward to Assam (exclusive) they should exhibit little or no such parallelism, but should rather show themselves plainwards, like an irregular series of salient and resalient angles resting on the mountains, or like small insulated plateaux,* or high undulated plains,† surrounded in both the latter cases by low swampy land analogous to the Tarai, it would require a volume to illustrate in detail. I have given a few conspicuous instances in the foot notes. For the rest it must suffice to observe that such are the general appearances of the Bháver and Tarai

* Parbat Jowár, on the confines of Assam and Rangpúr, is one of the most remarkable of these small plateaux. It is considerably elevated, quite insulated, remote from the mountains, and covered with Saul, which the low level around exhibits no trace of. Parbat Jowár is a fragmentary relic of the high level or Bháver, to which the Saul tree adheres with undeviating uniformity.

† Conspicuous instances occur round Dinájpúr and N. W. and N. E. of Siligori in Rangpúr, where are found highly undulated downs, here and there varied by flat-topped detached hillocks, keeping the level of the loftiest part of the undulated surface. Looking into the clear bed of the Tishta it struck Dr. Hooker and myself at the same moment, how perfectly the bed of the river represented in miniature the conformation of these tracts, demonstrating to the eye their mode of origination under the sea.

to the westward and to the eastward; and that the general causes of the differences have been pretty plainly indicated above, where the necessary effects of the sandstone range and of the eastern dip of the plains upon those oceanic forces to which all the phænomena of the region owe their origin, have been suggested.

Throughout Assam, from Gwalpára to Saddia, Major Jenkins assures me there is neither Bháver nor Tarai; and if we look to the narrowness of that valley between the Himálaya and the mighty and impetuous Brahmaputra, and consider moreover the turmoil and violence of the oceanic current from the N. W., when its progress was staid by the locked-up valley of Assam, we shall be at no loss to conceive how all distinctive marks of Bháver and Tarai should here cease to be traceable.

It will be observed that in the foregone descriptions of our Himálayan rivers I have not adverted (save casually in one instance, in order to correct an error as to the true name of the Káli) to their partial trans-Himálayan sources. And I confess it seems to me that perspicuity is by no means served by undue insistency on that feature of our rivers. Capt. Herbert was thus led to travel beyond his proper limits with a result by no means favourable; for, it appears to me that he has confounded rather than cleared our conceptions of Asie Centrale as the Bám-i-dúnya (dome of the world) by attempting to detach therefrom that most characteristic part of it, the plateau of Tibet, *because* certain Indian rivers have (in part) Tibetan sources! My theory of watersheds does not incline me thus to violate the grander arrangements of nature, and the less so, inasmuch as the rivers I have to speak of would not afford so plausible an excuse for such violation, as if I had to treat of the Indus, Sutledge* and Brahmaputra alias Sánpú.† The Arún and the Karnáli, though they draw much water from Tibet, draw far more from the pente meridionale of the Himálaya, or the ghát line

* Recte Satlúj vel Satrúdra.

† Mr. Gutzlaff, in a paper recently read before the Geographical Society of London, has reverted to Klapproth's notion that the Sánpú is not the Brahmaputra. But Mr. Gutzlaff has overlooked J. Prinsep's important, and I think decisive argument on the other side, viz., that the Brahmaputra discharges three times more water than the Ganges, which it could not do if it arose on the N. E. confines of Assam, notwithstanding the large quantity of water contributed by the Monás.

and all south of it; and this is yet more true of the Ganges, the Monás and the Tishta, though they also have partial trans-Himálayan sources. To those sources of the several Himálayan (so I must call them) rivers above treated of I will now summarily advert.

The Monás.—It is by much the largest river of Bhútán, which state is almost wholly drained by it. It has, (it is said) two Tibetan sources, one from lake Palté vel Yarbroyum, which is a real lake, and not an island surrounded by a ring of water as commonly alleged—the other, from considerably to the west of Palté. These feeders I take to be identical with Klapproth's Mon tchú and Nai tchú vel Lúbnak tchú, strangely though he has dislocated them.

The Tishta is also a fine river, draining the whole of Sikim save the tracts verging on the plains. The Tishta has one Tibetan source, also from a lake, viz. that of Chólamú. To speak more precisely, there are several lakelets so named, and they lie close under the N. W. shoulder of Powhanry, some 30 miles W. and 40 S. of Turner's lakes.

The Arún is the largest of all the Himálayan rivers, with abundant cis-Himálayan and three trans-Himalayan feeders. One, the western, rises from the pente septentrionale of the Himálaya, in the district of Tingri; another, the northern, from a place called Dúrré; and a third, the eastern, from the undulated terraced and broken tract lying N. and a little W. of Cholamu, and S. of Kambala or the great range which bounds the valley of the Yaru on the S. from W. of Digarchi to E. of Lassa.

The Karnáli is much larger than the Alpine Ganges, and nearly equal to the Arún, perhaps quite so. It drains the whole Himálaya between the Nanda-dévi and Dhoula-giri peaks, and has one considerable Tibetan source deduced either from the north face of Himáchal near Momonángli or from the east face of that crescented sweep whereby Gangri nears Himáchal, and whence the Karnáli flows eastward to the Taklakhár pass.

The Ganges also has of late been discovered to have one Tibetan feeder, viz. the Jáhnnavi, which, after traversing a good deal of broken country in Gnári between the Sutledge and the Himálaya, passes that chain at the Nilang ghát to join the Bhágarathi.*

* Moorcroft's Travels. J. A. S. No. 126, and I. S. R. Nos. 17, 18.

I will conclude this paper with the following amended comparative table of Andean and Himálayan peaks, Baron Humboldt having apprised me that Pentland's measurements, as formerly given by me, have been proved to be quite erroneous, and Col. Waugh having recently fixed Kangchang and Chumalári with unrivalled precision and accuracy.

<i>Chief Peaks of Andes. Feet.</i>		<i>Chief Peaks of Himálaya. Feet.</i>	
Aconcagua,	23,000	Jamnoutri,	25,669
Chimbarazo,	21,424	Nanda-devi,	25,598
Sorato,	21,286	Dhoulá-giri,	27,600
Illimani,	21,149	Gosain-than,	24,700
Descabado,	21,100	Kangchang,	28,176
Desya-cassada,	19,570	Chumalári,	23,929

POSTSCRIPT.

That sensible and agreeable writer, Major Madden, in a letter just received by Dr. Hooker, notices "the disgraceful state of our maps of the Himálaya, which insert ridges where none exist, and omit them where they do exist; and, moreover, in regard to all names, show an utter ignorance of the meaning of Indian words." It is the express object of the above Essay to contribute towards the removal of the weightier of those blemishes of our maps without neglecting the lesser, by exhibiting, in their true and causal connexion, the great elevations and the river basins of the Himálaya. Major Madden supposes that the term Hyún dés, which he applies to Tibet, points to that region as the pristine abode of the Huns. But this is a mistake. Hyún dés is a term unknown to the language of Tibet. It is the equivalent in the Khas or Parbatia language for the Sanscrit Himyá dés, or land of snow. Its correlative term in the Parbatia tongue is Khas dés, or land of the Khas. The Khas race were till lately (1816) dominant from the Satlege to the Tishta: they are so still from the Káli to the Méchi. Hence the general prevalence of geographic terms derived from their language. By Hyún dés the Parbatias mean all the tracts covered ordinarily with snow on both sides of the crest or spine of Hemáchal, or the ghat line; and by Khas dés, all the unsnowed regions south of the former, as far as the sandstone range.

The bráhmans and those who use Sanscrit call the Hyún dés, Bhútánt or appendage of Bhót; and hence our maps exhibit a Bhútánt in

what Traill denominates (A. R. Vol. 16) the Bhote pergunahs of Kúmáon. But, Bhútánt is not restricted by the bráhmans to such pergunahs in Kúmáon merely, far less to any one spot within them. It includes all the districts similarly situated along the entire line of the Himálaya. We might create confusion however by recurring to this extended meaning of the word, since it has long been restricted by us to the Dób Rájah's territory, or Bhútán (recte Bhutánt). Moorcroft's Giannak in Western Tibet is the ne plus ultra of abuse of words. Far to the East, some Bhótia must have told him, lie the Giannak or Chinese, and thereupon he incontinently gives this term as a name of a place.

The Tibetans call their neighbours by the generic name Gia, to which they add distinctive affixes, as Gia nak, black Gias, alias Chinese; Gia-ver, red Gias, alias Russians; and Gia-gar, yellow Gias, alias Hindús. With reference to the Huns, if I were in search of *them* in Tibet, I should look for them among the Hór of that country, as I would for the Scythians among the Sóg vel Sók. Sogdiana or Sóg-land was, I conceive, the original *Σακεια* the first known historic seat of the Indian Sákás and Tibetan Sóg, vel Sók. Hórsók as one term, means Nomade in Tibetan, such being still the condition of those two tribes in Tibet.



On Native impressions regarding the Natural History of certain Animals, by H. TORRENS, Esq. B. A. V. P. &c.

The singular impressions current among natives even of the highest rank, as to the habits and nature of certain animals are not undeserving of record. It is rarely that the credence of the narrators in these things can be elicited, if even they go so far as to mention the existence of the belief; for they dread the ridicule as much as they anticipate the incredulity of a European: consequently these strange stories are but imperfectly known, even to the best informed among us in such legends. I mention one or two with the circumstances of my acquaintance with them.

While out tiger-shooting with a party of Musalman gentlemen, I was asked, in a confidential way, whether I had ever seen the *phnew*: I spell the word with the almost undescribable nasal aspirate with which it was invariably pronounced to me. With an air of grave and serious interest, which is the best way of inspiring confidence, I replied that