

*Notes on the Topography of Murree, by Dr. A. GORDON, H. M.  
10th Foot.*

*Geographical Position.*—The new sanatorium of Murree is situated on a mountain ridge in the Hazarah country; its precise geographical position being  $34^{\circ}$  N. Latitude,  $73^{\circ} 2'$  East Longitude,—and its altitude above the level of the ocean variously estimated at 7,500 to 8,000 feet.

*Aspect of the Station.*—The general appearance of the station is rendered striking, not so much by the grandeur of its scenery as from the manner in which the residents' houses are dotted about irregularly on the various prominences and acclivities, some half hid in the dense forest vegetation which clothes the more sheltered places, and others exposed on bare projecting rocks.

*General position of Barracks and Hospital.*—The barracks and hospital occupy the summit of the ridge, whose general direction is as near as may be N. and S. The private houses are built at various elevations on its western face, the bazaar and natives' huts being on the eastern. From the highest point, where it is proposed to erect an observatory, a very extensive view may, in tolerably clear weather, be obtained. To the East and N. East the Cashmere hills may be seen. Those of Cabul and Afghanistan can be traced more to the westward. To the South, the Indus, although at a distance of 80 miles in a direct line, is distinctly visible, and in the East the river Jhelum. The station of Rawul Pindee also may readily be distinguished.

*Character of Mountains.*—The general appearance of the numerous precipitous mountain masses that rise in wild confusion at and around Murree, presents unequivocal traces of the action of those disturbing forces which are still in active operation in that portion of Asia comprised between Cutch, Herat, Cabul and Afghanistan.

*Terraced faces of Hills.*—That they have been elevated by successive heaves from below, occurring at intervals of various and uncertain length appears to be clearly indicated by the terraced

Fig. 1.



faces of each, as is endeavoured to be shown in the accompanying sketch, in which the individual terraces are indicated as being of various height and breadth as they occur, and it may be noted that the few patches of cultivation, being on these terraces at the lower part of each hill, give them a very distinct

and unequivocal appearance.

*Valleys.*—Intersecting these abrupt hills occur deep valleys in which streams of clear calcareous water run with more or less rapidity over rocky beds; bringing with them boulders and irregular fragments of stone of all sizes. The valleys do not appear however to run in any definite direction but wind about irregularly, giving to each rocky ridge an isolated appearance as if totally unconnected with those immediately adjoining—and in addition to the principal line of valley, each individual slope is grooved as it were by the waste of the softer rocks by the elements; the dells thus produced being of very variable depth and precipitancy, but almost all clothed with dense brushwood and tall magnificent forest trees interspersed.

*Soil.*—The soil is not deep, but rich and prolific in the extreme: it consists of red alluvial loam intermixed with micaceous sand and containing in some places calcareous nodules as of marl both green and grey, and of kunkur.

*Geological Age of Rocks.*—The rocks constituting these hills belong to a modern period; the oldest being apparently of a date not earlier than the Eocene, but the greater portion evidently diluvial and alluvial deposits. These may, for the sake of convenience of description, be divided into two classes,—namely, the sandstone, and the calcareous.

1. *Sandstone rocks.*—The sandstone rocks constitute the ridge upon which Murree station is built, and includes a variety of substances of greater or less consistence throughout all stages from soft argillaceous mud to hard grey micaceous sandstone fit for building purposes.

*Section made by a new road.*—A new road, which, for the convenience of horse and foot passengers, is being cut along the face of the hill, reveals each individual stratum; and the following diagram, taken during a walk along it, will show the succession of these in a distance of half a mile.

Fig. 2.



*Section 1.* Blue sandstone.

2 and 3. Red clayey sandstone with green marl, the strata having different dips.

4. Red clayey sandstone without green marl.

5. Boulders of grey sandstone with stalactites in their interspaces.

6. Red argillaceous mould.

7. Grey sandstone with nodules of oxide of iron.

8. Ditto ditto without iron.

9. Boulders of grey sandstone.

10. Ditto of red sandstone with organic remains (shells).

11. Reddish sandstone containing streaks of carbonate of lime.

12. Argillaceous soil on red nodulated ferruginous rock of various consistence, with a few nodules of green marl and kunkur.

13. Brecciated clayey ferruginous stone with organic remains.

14. Red argillaceous loam.

15. Grey ditto ditto on soft grey sandstone.

*Remarks on Section.*—The above diagram is intended to represent the succession of vertical strata exposed during the formation of the narrow road to which allusion has just been made; the lower extremity (at 1,) representing the northern end of the road and the upper end (at 15,) the southern—the whole space therein comprised including one of those

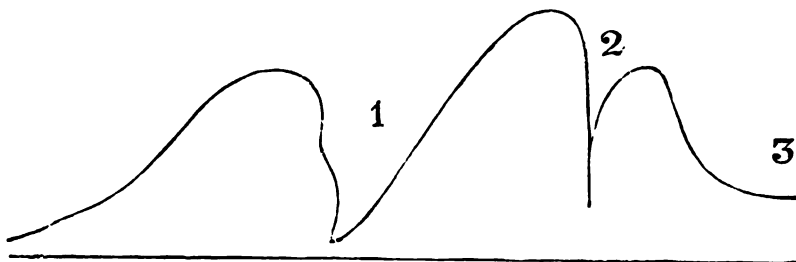
minor gorges on the mountain side that have already been described, around the upper portion of which the road winds.

In those cases where the dip of strata has been various, it has been represented in the sketch, and with reference to the figures, it will be immediately discovered how very great a variety of modern sandstone and argillaceous deposits is displayed in this short section.

*Smaller ravines how formed.*—As might be expected, the smaller ravines are formed in the softer substances, such as Nos. 6, 12, 14, and 15; the harder materials noted by the other figures forming promontories on the hill face around which the road at such parts is made to bend.

*Serrated appearance of Hills.*—It would appear as if different portions of the above line of strata had been subjected to various degrees of elevating force, so that the summit of the hill which they form has an irregular serrated appearance as shown underneath.

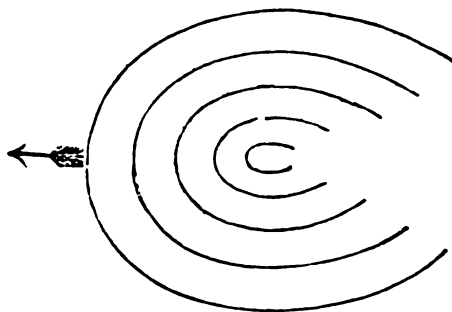
Fig. 3.



*Causes which give rise to this.*—This may, however, be accounted for by another series of causes, for although the harder strata do in reality appear to have been originally more violently upheaved than the softer materials, it must be borne in mind that the compressibility of the latter would have a considerable influence in modifying the extent to which parts formed of these would become raised. It is also evident that the elements would more readily triturate away valleys in the softer substances than in hard rock such as the grey and ferruginous sandstone, so that the gorges marked in Fig. 3, respectively 1, 2 and 3, correspond with the portions of the section marked 6, 12, 14 and 15, in Fig. 2.

*Specimen of sandstone how deposited.*—At the point marked 9 in Fig. 2, a very interesting specimen of sandstone occurs, its exposed

Fig. 4.

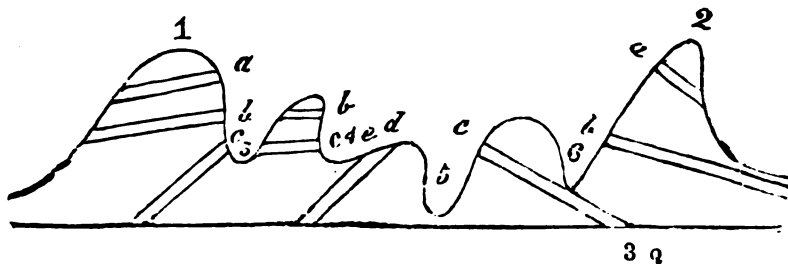


face presenting numerous concentric lines as represented in the margin, showing that the rock was originally deposited in an eddy, but it does not appear that any foreign substance of either animal or vegetable origin

exists in the centre so as to have formed a nucleus.

*Continuity of Hills destroyed and how.*—On examining the various hills around Murree and carefully noting the outcrop of individual strata on the face of adjoining ones, it becomes evident that their continuity must have been destroyed at a period considerably posterior to their solidification,—and that two distinct forces combined to produce this effect is equally clear. In the first place there are deep fissures running irregularly in the rocks, with individual portions more or less elevated than the general line of rock, showing that the layers were shattered and displaced by forces of a subterranean nature. Then again, we find terraces with intervening cliffs of a few feet or yards in height with boulders of all sizes, showing marks of greater or less attrition in the bottoms and on the sides of the various intervening valleys—thus evincing the effect of water in a state of motion.

Fig. 5.



*Outcrops of Strata.*—The above section is intended to represent the appearance of outcrops of strata on the various mountain faces in the vicinity of Murree, and they will be readily recognised as occupying that position which a fracture would exhibit if produced by force from below, tearing asunder the strata as shown at the points marked a and b, and thus producing “a valley of elevation” such as is included between the mountain peaks 1, and 2.

It is almost needless to observe in this place that the strata above represented do not include the whole number that actually exist on the hill faces,—the object aimed at in the sketch being nothing more than to illustrate the theory of their formation now being discussed.

*Materials represented in sketch.*—The bands noted a and b may be also looked upon as representing the micaceous and clayey ferruginous sandstone which seem to constitute the great mass of the Murree hills, but as has already been stated boulders and more or less perfectly consolidated strata of clayey conglomerate containing nodules of brown iron exist towards the lower portion of these, and such strata may in a theoretic section be represented by that marked c, while the bottoms of the gorges 3, 4, 5 and 6, would be framed more or less thickly with débris of such materials,—and accordingly this is in reality found to be the case, the fragments of stone found there consisting of the same materials confusedly blended together—that constitute the substance of the neighbouring hills.

2. *Calcareous rocks, position and presumed age.*—Calcareous rocks appear to prevail to a considerable extent in the hills around Murree, although only to a small extent in that on which the station has been established. In Fig. 5, the low round hill marked d is almost entirely comprised of this formation, the underlying rock consisting of impure limestone, apparently of the Eocene period,—covered with superimposed layers of fibrous gypsum which occur in definite lines as represented by that marked e, and lying more or less conformably upon the deeper material.

In some parts, the gypsum is tinged of a rose colour, but generally speaking it is transparent and colourless. The dip of its strata is 30° or 35° from West or nearly so, to East, the line of strike being as nearly as possible North and South.

In addition to this more perfectly formed gypsum there are at the

same time found considerable quantities in a less perfectly crystallized condition, and of an impure nature, but evincing marks of deposition from igneous solution in the alternating layers of the ashy-like calcareous matter, with intervening streaks of dark clayey substance, which the fractured surface of a specimen presents.

My opportunities for observation having been very limited, it was not in my power to extend my investigations beyond the immediate vicinity of the station; but two points of considerable importance have come to my knowledge with regard to the geology of this range of hills,—namely, that a thermal spring exists within some twelve or fifteen miles of Murree from which it is worthy of inquiry whether any calcareous deposits now take place,—the other point is that a fossil bone of a large animal, supposed to be of one of the gigantic Pachydermata of the later Tertiary period has been discovered at about a corresponding distance in an opposite direction.

*Meteorology.*—No extended observations have as yet been made regarding the meteorology of Murree, as the sanatorium has so lately been established there. It is hoped however that the register taken from the daily observations made at the hospital there for the five months from May to September 1852 inclusive, will, if compared with similar observations made during the same period at Wuzzeerabad, show the contrast between the temperature at that place, and in the plains of upper India, while a similar register being inserted of the range of the thermometer in the united kingdom will, it is hoped, render the comparison still more extended and complete. The latter however must refer to Dublin in 1844, as no observations for any other place or time are at present available.

Day of Month.	May.				June.				July.				August.				September.								
	Wuzzee- rabad. 1852.	Dublin. 1844.	Mutree. 1852.	Wuzzee- rabad. 1852.	Dublin. 1844.	Mutree. 1852.	Wuzzee- rabad. 1852.	Dublin. 1844.	Mutree. 1852.	Wuzzee- rabad. 1852.	Dublin. 1844.	Mutree. 1852.	Wuzzee- rabad. 1852.	Dublin. 1844.	Mutree. 1852.	Wuzzee- rabad. 1852.	Dublin. 1844.	Mutree. 1852.							
1	63.54	94	70	65	45	62.58	84	80	60	44	72.62	100	87	66	49	64.62	84	81	62	48	70.64	100	85	74	50
2	61.56	98	72	66	46	68.62	96	72	63	46	76.64	92	85	58	47	66.64	85	78	67	49	70.66	100	82	76	53
3	68.57	104	78	67	50	68.66	92	71	60	51	74.68	101	84	66	49	68.61	87	82	70	56	70.66	98	81	72	46
4	70.60	106	80	68	56	63.62	102	72	63	52	74.69	94	86	68	52	66.62	90	82	68	48	67.64	100	88	68	58
5	70.62	107	81	63	44	70.66	106	78	68	55	68.62	100	84	63	53	68.64	91	83	66	46	64.62	100	88	69	60
6	70.64	109	85	67	45	74.68	106	82	69	54	68.62	100	84	65	52	65.64	90	87	61	55	65.64	90	87	70	58
7	70.62	108	84	67	44	74.66	106	82	68	55	70.64	103	82	56	44	68.64	97	82	62	62	66.64	94	84	67	61
8	72.62	108	84	63	43	73.66	104	84	63	55	72.66	100	83	68	55	66.64	83	81	66	52	66.62	89	85	69	55
9	74.64	112	83	64	46	74.68	106	86	69	53	74.68	102	84	68	54	68.64	93	81	66	52	66.64	94	82	66	50
10	75.68	101	87	61	42	76.70	106	87	63	47	74.66	104	85	68	53	68.64	89	83	65	51	67.66	94	85	58	50
11	66.65	107	85	61	44	76.68	107	89	69	50	76.68	106	90	67	54	68.62	91	84	65	52	64.62	96	82	63	55
12	60.59	99	81	64	47	78.68	107	91	70	51	78.70	107	90	67	53	70.66	85	83	65	55	64.62	97	82	61	53
13	56.54	100	85	71	50	76.72	109	92	71	55	79.70	103	92	67	53	70.68	96	81	64	54	66.62	98	82	64	51
14	66.54	100	82	68	37	79.63	104	86	68	51	72.68	100	84	63	54	68.66	90	83	66	52	68.64	98	82	62	56
15	68.56	98	71	68	43	72.66	103	91	69	48	72.68	101	87	58	52	68.64	95	82	65	53	68.64	99	82	70	61
16	68.66	106	81	65	43	72.66	104	86	67	45	72.68	98	89	69	48	70.66	97	81	63	43	66.60	96	84	66	55
17	69.62	103	80	37	44	68.66	97	83	64	50	70.68	102	89	71	47	70.66	95	82	68	53	66.62	96	74	66	55
18	66.58	89	84	56	32	72.63	104	86	58	52	71.66	101	88	62	49	66.62	90	82	65	42	64.62	97	82	57	46
19	58.54	89	73	55	39	76.68	108	88	60	45	74.68	104	88	61	48	64.61	96	87	66	44	65.63	100	82	62	45
20	54.49	86	71	58	48	78.68	106	91	67	52	72.70	99	88	62	47	68.62	97	86	70	56	66.62	97	80	60	51
21	52.49	75	67	63	48	78.68	105	92	70	58	72.68	97	81	70	56	68.62	97	86	65	46	67.60	98	80	50	45
22	56.48	83	66	65	50	72.66	106	95	68	56	72.66	102	89	77	54	64.60	84	79	63	51	67.58	97	82	59	42
23	59.52	87	72	69	48	70.66	94	83	70	57	74.70	103	92	81	57	66.62	94	81	60	48	67.58	94	82	58	43
24	49.46	88	75	70	50	72.66	95	84	69	56	70.66	84	93	81	61	68.64	96	84	62	52	65.59	95	76	58	48
25	52.48	86	69	68	55	74.68	102	89	71	53	66.64	99	82	76	54	68.64	91	87	67	50	68.59	95	74	58	38
26	52.48	82	71	64	47	76.68	100	86	73	57	67.66	90	83	68	56	68.61	97	12	65	53	68.58	96	74	66	42
27	52.48	82	68	60	42	73.66	99	88	60	53	68.64	84	81	73	54	69.68	94	82	60	48	69.58	97	72	63	52
28	58.51	92	69	63	43	66.62	98	79	67	47	68.62	85	82	74	60	68.61	94	82	66	45	69.59	99	77	64	57
29	63.54	100	71	64	44	70.62	98	83	70	50	68.64	89	82	69	51	66.64	92	81	66	50	68.58	99	77	60	41
30	66.56	101	77	66	42	72.64	93	83	70	50	68.62	87	84	71	55	66.64	93	81	68	48	68.56	98	76	59	30
31	66.60	101	72	60	44	0	0	0	0	0	66.64	82	81	67	53	66.64	95	84	76	48	0	0	0	0	0



*Approximation of temperature to that of Dublin.*—A bare register of the state of the thermometer gives but a very imperfect idea of the meteorological condition of any locality, and it is to be regretted that observations on more extended scales are not regularly taken at Murree. From the preceding table, however, not only may the temperature of this sanatorium be contrasted with that of a considerable military station in the plains of upper India, but a comparison may readily be established between it and that of one of the most important cities of the united kingdom,—such comparison will show, that during five months of the year at least, the difference in temperature indicated by the thermometer (in the shade) is but a mere trifle between Dublin and Murree.

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*Note on the present state of the Excavations at Sárnáth.*—By  
E. THOMAS, Esq., C. S.

On Major Kittoe's departure from Benares in January, 1853, I undertook, during my brief stay at that station, to continue his Archæological operations, so far as they related to the laying open of the inhumed remains of the old Buddhist Monastery at Sárnáth.

At the moment of engaging in this mere mechanical occupation, I trusted that Major Kittoe would, himself, be able to give to the world his own conclusions as to the date and associations of his interesting discovery. I abstained therefore, from even making myself his scholar, preferring alike to form an independent opinion which might follow the developments of the progressive explorations, and still more definitively desiring to avoid any possible appropriation of his varied antiquarian lore; I was, I felt, placed in a delicate position, I came to the work as a simple amateur, he had been professionally entertained as the Government "Archæological Enquirer."

Such members of our Society, as were then present in Calcutta, will call to mind that shortly after this, on his way homeward, Major Kittoe delivered a lecture on Sárnáth, at one of the Society's monthly meetings. No résumé of this discourse has as yet been embodied in *our* transactions—and otherwise I fear that of the