

lævigatus lucens cærulescenti-viridis. *Spatha* in nostrò vivo exemplari uniflora (an semper?) vix uncialis erecta striatula valde marcescens subferruginea. *Pedunculus* 2-uncialis erectus parum angulatus. *Germen* (ratione magnitudinis plantæ) magnum grossè ovale obtusissimè trigonum. *Tubus* vix uncialis teres lævis sordidè prasino-viridulus. *Corollæ laciniæ* loratæ 8-lineares acutæ lineam latæ basi distinctæ tubi colore stellato-semireflexæ. *Corona* primulina sexpartita (quasi hexapetala) singulis partibus incrassatis erecto-incurvulis sive concavo-cochleariformibus rotundo-obovatis laciniis corollæ concoloribus at septies brevioribus. *Filamenta* omnia omninò tubo connata, tria tubo 2 lineas breviora, tria longitudine tubi. *Antheræ* (defloratæ in nostro) erectæ grossè ovales sive ellipticæ sulcatæ luteæ, tres tubo altè inclusæ harum media aliquantillum altior, tres e tubo paululum progredientes præcipuè harum ultimarum media. *Germen* (florendi tempore) habet semina varia incipientia, alba at majuscula. *Stylus* gracilis teres viridis antherarum altitudine, *stigmatibus* in lente tribus horum duobus (in nostro) incompletis. *Folium* solitarium in singulo bulbo non vidi; at secundum auctores, scapo omninò conforme, at solùm post florescentiam viget. *Floret* (in nostro exemplari) in Decembre. *Habitat* in Barbariæ maritimis.

integer. CHL. (The entire-cupped) spathâ 2-3-florâ, coronâ integrâ. *Narcissus Juncifolius autumnalis* flore viridi. Park. Parad. 94. 11. t. 93. f. 6.

Hanc plantam non vidi, et fidelis Parkinsoni fide solùm admisi. A priore differt coronâ integrâ nec hexapetalo-partitâ. *Habitat* in Barbariâ. *Parkinson* in loco. *Floret* Octob. *ibid.*

P.S. It is apprehended that as both the above described plants have green flowers, no apology is necessary for relinquishing the specific name of *viridiflorus* for the former, as names which have any tendency to mislead or delude, are ever objectionable, and the green flowers are common to both.

XXI. Papers relating to the Earthquake which occurred in India in 1819.*

To William Erskine, Esq. &c. Bombay.

My dear Sir,

AS it was at your suggestion that I attempted to draw up the following account of the earthquake which occurred in India in June 1819, I beg that, should you consider it as at all interesting, you will do me the favour to present it to the Society. It consists of a plain description, and no circumstance has been admitted that has not been well certified; at the same time it must be observed, that the whole is written from memory, or very scanty memoranda.

I remain, my dear sir, yours very faithfully,

Camp at Bhooj, Jan. 27, 1820. (Signed) J. MACMURDO.

P.S. At noon this day we had a very strong shock, attended by a loud noise like distant thunder. Several shocks have likewise occurred since the accompanying details were written.

On the 16th of June 1819, between fifteen and ten minutes before seven o'clock P.M., a shock of an earthquake was felt in Cutch; and as it appears to have been remarkable in India for the great extent of its range, and also for the very confined limits of its severe effects, I shall attempt to describe the course and results of the phænomena as they appeared in this province, without offering any scientific speculations, for which I am totally unqualified, or even stating opinions on the subject which I have heard advanced by others.

The shock was foretold by no uncommon appearance in the heavens; at least nothing was remarked previously, either in the heavenly bodies or in the atmosphere, to indicate the approach of any convulsion of nature. The hot months had passed on with the clear and serene sky, the burning sun, and the westerly wind, which commonly prevails at that season of the year. It was observed that the month of May was extremely hot, perhaps more so than usual, but the thermometer seldom higher than 108° or 110° of Fahrenheit in the shade of a tent, and generally not above 105°. On the evening of the 3d June we experienced a severe storm of rain and wind, with thunder and lightning from the north-east quarter, an occurrence by no means uncommon at the same season; the storm lasted about two hours, with rain through the night,

* From the Transactions of the Literary Society of Bombay, vol. iii., for 1822.

was pretty general through the province, and was felt in some places to the eastward of Bhoj in a degree approaching to a hurricane.

In the description of the shock it will be necessary to speak in the first person, because I can only pretend to describe with correctness my own feelings, thoughts, and observations. In the subsequent observations, however, I shall avail myself of those felt and made by others under different circumstances and in different situations.

At the moment already mentioned, after a hot day, I was sitting with a party of friends on an earthen terrace, in front of a house in which we were about to dine. The evening was remarkably serene, not a cloud to be seen, and a light and cool breeze from the west. The situation was on a ridge of slate rock in the town of Anjar, and close under a large round tower with four heavy guns mounted on it. Our notice was first attracted by a slight motion of our chairs, as if they had been lifted up, and a noise from the doors and windows, as if they had been moved by the breeze: before the question of "What is that?" could be uttered a second lifting of the chairs took place, and the motion became too evident to be mistaken even by me, who had never before experienced a shock. Every person made what haste he could to leave the tower, which, after rolling and heaving in a most awful degree, gave way at the bottom, on the western face, and crumbling down, buried guns and carriages in the rubbish: a moment after, the towers and curtains of the fort wall, and upwards of fifteen hundred houses, were reduced to ruins; but as I was within thirty yards of the round tower, my attention was particularly drawn to it.

The opinions with regard to the length of time which this shock lasted are various, but appear to be limited to from two to four minutes: my own conviction is that the first is nearest the truth, and perhaps even a little beyond the mark. On subsequently observing the time by a watch, it seems to me that if the motion had continued for more than two minutes, no building could have been left entire. Allowances must be made for agitation at the moment, and the general voice seems to fix the duration of the severe shocks at two minutes and a half. A philosopher, who had been in the habit of observing and speculating on the great convulsions of nature, might have coolly taken out his watch and been delighted with the opportunity of adding to the knowledge which the experience of the shock might have afforded. For my own part, however, my feelings at the moment were such as for an instant to deprive me of all presence of mind and power of reflection; and

and when self-possession did return, my mind was too deeply occupied with the awful and appalling spectacle of the face of nature in a state of excessive agitation to admit of other thoughts or impressions. It certainly was terrific to behold hills, towers, and houses, the stability of which we had been in the habit of considering as proof against every power, and against the lapse of centuries, rocking to and fro, or rising and sinking, while the former sent forth clouds of dust, or perhaps smoke, and the latter crumbled into rubbish.

With regard to the nature of the motion there is likewise a variety of opinions. Some persons with whom I have conversed feel convinced of the action of the shock being directly upwards, as if the earth was on the point of opening under their feet; a few assert that it was vibratory, whilst others attribute to it an undulating motion. I confess I am one of those who favour the last-mentioned opinion, although the slight motion at the commencement did certainly feel as a direct elevation of the chair attended by a blow as if under its feet. When the shock was at its height, the motion of the earth was so strongly undulatory that to keep our feet was no easy matter. The waving of the surface was perfectly visible, and in attempting to walk, the motion has been most aptly compared by a gentleman to that felt when walking quickly on a long plank supported at both ends;—when one foot was elevated, the earth either rose and met it, or sunk away from it in its descent.

The shock was attended with a violent gust of wind and a noise like that of a numerous flight of birds; but this did not precede the event; I think, on the contrary, that the noise was heard even after, or at all events towards the conclusion of the motion. Both of these occurrences have been denied, although, for my own part, I feel convinced that they did happen; more especially as the noise has been frequently heard to accompany subsequent shocks.

The night of the 16th proved extremely serene and beautiful; and as we slept in the open air, we had a favourable opportunity of remarking any thing extraordinary that might occur. We observed, as we thought, a more than usual number of the meteors known by the name of falling stars; but whether we might not have been biassed by what we had read of such phenomena having been supposed to attend earthquakes, I will not venture to affirm. Before 11 o'clock P.M. we experienced three shocks; and, according to the statements of the sentinels and townspeople, there were many in the course of the night. These were however trifling, and their effects were confined to shaking the tiles and bringing to the

ground loose stones from the ruined houses. The next day, the 17th, the earth was frequently in motion, attended by gusts of wind and a noise like that of wheeled carriages. For some time before 10 A.M. these symptoms intermitted only for a few minutes, until about a quarter to 10, when a severe shock was experienced; this lasted for about fifty seconds, and brought down a number of shattered buildings.

As no register has been kept, or could well have been preserved, of the number of shocks felt, it is impossible to furnish particulars on this head. Until the beginning of August, no day passed without one or more shocks; and subsequently they became less frequent, only occurring every third or fourth day. During the whole of this time the shocks were generally very slight; many persons did not feel what was sensibly felt by others. Subsequently to this period shocks became still less frequent, occurring at uncertain periods of many days interval, until the 23d of November, which seems to be the last distinct one we have had.

It would be hazardous to state a decided opinion of the number of shocks felt, both in consequence of the cause before assigned, and because motions of the earth appear to have been felt in one spot and not in others; but as it is necessary to give some vague idea to enable a judgement to be formed by the reader, it may be observed that probably until the 1st of July there were not fewer than two or even three shocks every day; one daily throughout that month; one every three days in August and September; and perhaps six in the course of October; and three in November. This calculation, which is made avowedly on no solid grounds, gives short of 100 shocks in all; and it is probable that the number is at least a third within the truth.

I know not how to class the shocks, unless in the fanciful manner of 1st, 2d, 3d and 4th, implying the degree of their severity. Of the 1st, we had only the first and most violent; of the 2d, which were such as could be felt by a person while standing, but without affecting buildings in any material degree, we had, I think, about four; these occurred as follows: 17th June, 10 A.M.; 29th June, 2 P.M.; 4th July, 3 A.M.; and another at midnight in the same month, but the day forgotten: the longest of these did not last more than 50 seconds. The third class, which is the most numerous, are those shocks evident to persons sitting or reclining; few of these lasted longer than perhaps 30 seconds, and did no damage. The fourth class is that in which are included slight motions of the earth, felt by some and disputed by others.

The motions of the different classes were by many considered

sidered as undulatory and vibratory; although in some instances direct perpendicular shocks were certainly felt. The second class was remarked to be attended by a noise like that of a flight of birds and gusts of wind, and in some cases similar noises to those already mentioned followed or preceded the third class. Noises were frequently heard as if proceeding from the earth, and the expectation which they occasioned of the usual shock was never disappointed.

The direction in which the motion travelled was, as almost every other part of this phenomenon, disputed; many (of which I was at first one) believed that the direction was nearly from N.E. to S.W. The most general opinion, and which appears since to be corroborated by circumstances, was, that it was from S.W. to N.E.

The severe effects of the shock of the 16th were principally confined to the province of Cutch, the damage done to other countries even bordering on it being comparatively trifling; and it is remarkable that the shock appears to have been more severely felt in many distant countries than it was in those intermediate, and even in some closely bordering on Cutch. The great shock was felt at Calcutta about twenty minutes past eight o'clock; which, when corrected to the longitude of Bhooj, will give six minutes past seven o'clock P.M., or eighteen minutes later than the shock was felt in Cutch.

At Chunar the severe shock was felt at seven minutes past eight o'clock P.M. on the 16th, equal to 7^h 15^m 16^s Cutch time.

At Pondicherry it was experienced at eight P.M., equal to twenty minutes past seven o'clock Bhooj time.

At Ahmedabad the shock occurred about seven o'clock; but at Broach, which is little more than 3° E. of Bhooj, it occurred at nineteen minutes past seven o'clock, corrected by observation*. This extraordinary variation in the moment of the occurrence of the great shock can hardly be accounted for by neglect or error in fixing the moment, or from errors in the watches.

	E. Long.	E. Long.	E. Long.
Calcutta,	88° 28'	Chunar, 82° 54'	Pondicherry, 79° 58'
Bhooj,	69 58	Bhooj, 69 58	Bhooj, 69 58
	18 30, or diff.	12 56, or diff.	10 0, or diff.
	Time.	Time.	Time.
	1 ^h 14 ^m	0 ^h 51 ^m 44 ^s	0 ^h 40 ^m
	8 20	8 7 0	8 0
	7 6	7 15 16	7 20

* Bombay newspaper.

The

The utmost limits within which this earthquake was felt, as far as we have yet learned, may be fixed at Catmandoo in the north, Pondicherry to the south, Calcutta to the east, and the Mountains of Billoochistan to the west. In Nepal it was felt sensibly on the evening of the 16th June, the exact time not specified. At Calcutta the shock was felt very sensibly, but apparently not so severely as at Chunar, and more so than in Malwa and Khandesh, in many parts of which it was not felt at all. At Pondicherry it was severely experienced, and described as much more awful than in many intermediate provinces. In Sindh it was felt very partially and slightly; and similarly at Shikarpoor on the southern frontier of the Peshawar country.

The range of the great shock is therefore known to have embraced a space of 18° of lat. and 20° of long. In many particular spots in this extent of country, of course, the motion was either not noticed or did not occur; but it was severely or sensibly felt at these limits on the evening of the 16th June.

The ocean extending S. and S.W. from Cutch will prohibit our ever knowing the limits of the shock in those directions; but it may be remarked that early in June a severe earthquake occurred at Mockha on the Red Sea; but I have never heard that it was experienced (or that of ours of the 16th) at Muscat, which is nearly due west of Cutch*.

What forms, in my opinion, one of the most striking circumstances connected with this phenomenon is, that it should have been felt over such an extensive surface, and that its severity should have been confined to the limited space of 200 miles or less. The damage sustained by Bulliarea, Amercote, and Jesilmer, which all lie in the Desert and north of Cutch, points out that the severity of the motion extended beyond Cutch in that particular direction; yet Sindh, Marwar, and Guzerat, including the peninsula of Kattewar, all of which border on this province, suffered nothing †. The destructive motion, therefore, seems to have been confined to a narrow space, running in a direction of N.N.E. from Bhooj, as far as Jesilmer. How far it extended in an opposite point it is impossible to say; but taking Cutch as a centre, the radius

* It may not be superfluous to remark, that about the beginning of June 1819, Mount Etna was threatening to bury in its lava the cities in its vicinity; Vesuvius was in a similar state of violent agitation; and earthquakes were felt in different parts of Italy, and I believe in Sicily, although not in the vicinity of these mountains.

† Poorbundor, Moorbee, and Amrun, are exceptions; but those people who have seen its effects in these places and in Cutch declare the former to be comparatively insignificant.

should

should have extended into Persia and Arabia, and nearly to the equator. As we know, however, that the shock of the 16th was not felt in these countries, it follows that Cutch was not the centre of motion, because, if the cause of this phenomenon had its origin in Cutch*, the power which agitated the earth must have acted nearly entirely to the eastward of a line extending north and south through the centre of the province.

That the cause of the shock, wherever it had its seat, must have been at a vast depth below the surface of the earth, may perhaps be admitted, when we reflect on the immense surface moved; but, as I have already observed, my want of knowledge on the philosophical branch of the subject warns me to stop.

We come now to speak of the effects of this awful occurrence. And first of all it may be proper to advert to our own feelings, and the state of our minds, on witnessing, for the first time, such a visitation. If I were to say that the impression, after the shock had subsided, was an agonizing fear, it might perhaps offend, although the strong oppression at the heart, a kind of gasping anxiety, weakness in the limbs, and, in some cases among Europeans, and generally throughout the natives, a slight sickness of stomach †, certainly cannot be interpreted in more appropriate language.

For a long time, and indeed I believe up to the present day, among natives, similar symptoms in a less degree are felt on the occurrence of the slight shocks; but for a short time after the 16th there was a restlessness and disinclination to be alone, or to attend to usual occupations, visible in both European and native societies. In the latter, despair and helplessness were strongly depicted in their countenances, and their language and actions both corroborated the fact of these feelings being the sole tenants of their minds. They insisted to a man that there was almost a constant undulatory motion in the earth, and frequent vibrations between the shocks, for ten days after the 16th; and this last feeling among Europeans was, I believe, confined to myself and one or two other persons.

The brute creation in general did not appear to show much sensibility to the motion; but it was remarked that horses in

* From the circumstance of the shocks still continuing in this province alone up to this day, now nearly eight months, I confess that, ignorant as I am of the theory of earthquakes, I am inclined to think that the causes are to be found in the structure of the country.

† The information from Pondicherry states a similar feeling to have been excited there on the 16th.

action

action partially lost their equilibrium, and that pigeons and other birds roosting were delicately sensible of the least motion. The elephants in Bhoj broke from their pickets, and seemingly in great alarm attempted to rush through the street, till obstructed by the falling of houses.

The shock of the 16th was the only one by which the face of nature or the works of man were materially injured or changed. In the province of Cutch it may be fairly asserted that no town escaped feeling its effects, either in the fall of houses or in that of its fortifications. It would be difficult to particularize the damage done to each. I shall therefore confine myself to general remarks.

The capital naturally attracts our first attention; and, as fortune would have it, Bhoj suffered in many respects more severely than any other town; nearly seven thousand houses, great and small, were overturned, and eleven hundred and forty or fifty people buried in the ruins. The houses were built of stone and chunam, or in many cases mud instead of this cement. Such houses as were built of mud alone, were little or no ways affected by the shock. Of the original number of houses which escaped ruin, about one-third are much shattered. Bhoj stands in a plain of sand-stone covered with a thin soil of sand and clay, but in many parts the rock is exposed. To the north-eastward about half a mile rises an abrupt hill, apparently composed of solid rock, on which are extensive fortifications. The north-eastern face of the town wall, which is a strong modern building, on an average four and a half and five feet broad, and upwards of twenty feet high, was laid level nearly to the foundation; whilst the hill works suffered in a very trifling degree. The south and western sides of the town are situated upon a low ridge of sand rock, and the water from the town finds its way out to the northward, where is an extensive swamp of low and springy ground. This face has also been overturned in many places, and not a hundred yards of entire wall left. The town has been utterly destroyed in the N.N.E. quarters, while the S. and S.W. quarters stand comparatively little injured. I have entered thus particularly into minutiae, to explain what I conceive to have been the case every where, that buildings situated upon rock were not by any means so much affected by the earthquake as those whose foundations did not reach the bottom of the soil, which I conceive to have been the case with those houses on the swampy and low sides of Bhoj*.

At

* There are some strong exceptions to this observation: Roha, which is a fort on a rocky hill, was laid in ruins, while the lower town, on the plain, escaped

At Anjar, half of the town, which is situated on low rocky ridges, suffered comparatively nothing; whilst the other half, upon a slope to a plain of springs and swamps, into which the town is drained, was entirely overturned. About 1500 houses were destroyed from the foundations, and about a similar number rendered uninhabitable. The loss in lives amounted to 165, besides a number who afterwards died of their bruises. The fort wall consisted of 3000 yards of masonry in circumference, not more than three feet and a half thick, and in some places forty feet high; and in this extent are included 31 towers, round and square. Of this 1000 yards are level with the ground, 1333 yards destroyed to within ten feet of the bottom, and only 667 yards standing to the rampart, and the greatest part of this split in half*. All the houses excepting four are cut as it were in two; in some the inner and in others the outer half has crumbled into ruins. The east and swampy face is down to the very surface of the earth.

There are, or rather were, a great number of fortified towns throughout Cutch: in general their works are destroyed. Thera, which was esteemed the best in the province, has not a stone unturned; the town fortunately did not suffer in the same unparallded degree, although few or no houses were left securely habitable †.

Kotheree, another town of the same kind five or six miles from Thera, was reduced to a heap of rubbish, only about fifty or sixty gable ends of ruins left standing. The fortifications down, but not so utterly destroyed as those of Thera.

Mothora, a similar place to those described, suffered equally in houses and ramparts, and more in lives than any place of its size. Nulliah, Kotharee, Venjan, and many other towns of the same size and description, suffered nearly in the same manner; but it would be a much easier task to enumerate those that escaped. Among the latter, Mandvee, Moondra, Sandhan, Poonree, Buchao, and Adooee, may be recorded as the most fortunate. The total of lives lost, according to the

escaped undamaged. Moondra, Mandree, and Sandhan, close to the sea shore, situated very low, and in sandy plains, escaped with little damage. It is probable, however, that their foundations are on the strata of sandstone, which at different depths appear to be the support of the soil of the whole province.

* The walls of Anjar were remarkably bad, and in most places off the perpendicular: they are not more than one hundred and ten years old.

† The towns mentioned do not contain more than 5 or 6000 inhabitants.

best information I have been able to procure, does not exceed two thousand: of these,

	Bodies.
In Bhooj,	1140*
In Anjar,	165
In Mothora,	73
In Thera,	65
In Kotheree,	34
In Nulliah,	8
In Mandree,	45
In Luckput,	13

Total, 1543

The rest are chiefly sufferers in villages and small towns, of which no very authentic account can be procured. Many very distressing accidents might be related; but I know of none so much so as that of a whole family of women and children male and female, to the number of eleven people, the wives and offspring of a Jhareja family of rank in Mothora, being smothered in one room (where they had hastily assembled) by a lofty bastion being precipitated directly upon their apartment. An aged grandfather and one son, I believe, are alone left of the stock. It is remarkable that under the heaviest misfortunes of mankind there is generally some cause for congratulation; and in the case of this calamity, had the accident occurred in the night time, perhaps a third of the population of the province would have been buried in the ruins of their own dwelling-houses.

As far as comes under our notice, the face of nature has not been much altered by the shocks. The hills, which are most likely to show its effects, although from their abruptness and conical or sharp ridgy summits, and from the multitude of half-detached rocks with which they are generally covered, they might have been expected to have displayed strong marks of the convulsion by which they were agitated, have in no instance, to my personal knowledge, suffered more than having had large masses of rock and soil detached from their precipices. I have seen none with the cones flattened, or in any remarkable degree altered.

At the moment of the shock vast clouds of dust were seen to ascend from the summits of almost every hill and range of hills. Many gentlemen perceived smoke to ascend, and in some instances fire was plainly seen bursting forth for a mo-

* Registered and discovered; but upwards of 300 bodies never found in the ruins.

ment.

ment. A respectable native chieftain* assured me, that from a hill close to one on which his fortress is situated, fire was seen to issue in considerable quantities. A ball of a large size was vomited as it were into the air, and fell to the ground, still blazing, on the plain below; where it divided into four or five pieces, and the fire suddenly disappeared. On examining the hill next day (the chieftain stated) it was found rent and shattered, as if something within had sunk, and the spot where the fire-ball was supposed to have fallen bore marks of fire in the scorched vegetation. In the neighbourhood of Murr, where alum is made, and where an entire hill is formed of a bituminous earth†, fire is stated by the inhabitants to have issued to an alarming extent. The Government Agent on the spot reported the circumstance, and that the hill had been shattered, and rent into ravines: the height was likewise asserted to have been obviously reduced‡.

The rivers in Cutch are generally dry (excepting in the monsoon), or have very little water in them. Native accounts seem to confirm the fact of almost the whole of their beds having been filled to their banks for a period of a few minutes, and, according to some, for half an hour. They are said to have subsided gradually. I was not in the way of observing this part of the phenomenon, but have no reason to doubt it. Two chieftains were sent by me to settle a dispute among the Sandhan Bhyaut; and as they travelled in a rath, they knew nothing of the shock. After it was dusk they reached the Sandhan river, in which, to their utter astonishment, they found a strong stream from bank to bank; nor did they learn the cause till they reached the town. It is remarked that rivers in the valleys, and those with sandy beds, were alone affected. Wells every where overflowed, many gave way and fell in, and in numerous places spots of ground in circles of from twelve to twenty feet diameter threw out water to a considerable height, and subsided into a slough. I saw none of these actually forming, but frequently met with them in their sloughy state. The colour of the waters sent forth gave great alarm to the natives, many of whom affirmed that the rivers had run in blood, doubtless from the colour of the soil through which they had been forced.

* Jharejah Vjerajee of Roha: which place is twenty-six miles W. of Bhooj.

† I have the pleasure to send a specimen of this earth to the Society. It is burnt as an incense by the rajpoots, and those who worship the goddess Asshapoorra.

‡ A letter from my friend Captain Elwood states, that an appearance of fire was perceived by him near Poorbunder; and the earth on examination proved to be scorched, and to bear marks of fire.

This convulsion of nature has affected the eastern and almost deserted channel of the river Indus, which bounds Cutch to the westward, and the Runn or desert, and swamp called the Bhunnee, which insulates this province on the north, in a more remarkable manner than it has any other part of the country. I myself have seen this branch of the Indus forded at Luckput, with water for a few hundred yards about a foot deep. This was when the tide was at ebb; and when at flood the depth of the channel was never more than six feet, and about eighty or one hundred yards in breadth: the rest of the channel at flood-tide was not covered in any place with more than one or two feet of water. This branch of the river Indus, or, as it may now with more propriety be termed, inlet of the sea *, has since the earthquake deepened at the ford of Luckput to more than eighteen feet at low water; and on sounding the channel, it has been found to contain from four to twenty feet from the Cutch to the Sindh shore, a distance of three or four miles. The Allibund has been damaged; a circumstance that has re-admitted of a navigation which had been closed for centuries. The goods of Sindh are embarked in craft near Ruhema Bazar and Kanjee Kacote; and which, sailing across the Bhunnee and Runn, land their cargoes at a town called Nurra on the north of Cutch. The Runn, which extends from Luckput round the north of this province to its eastern boundary, is fordable but at one spot, at this period of the year, at which it has heretofore been dry; and should the water continue throughout the year, we may perhaps see an inland navigation along the northern shore of Cutch: which, from stone anchors &c. still to be seen, and the tradition of the country, I believe to have existed at some former period.

Sindree, a small mud fort and village belonging to the Cutch Government, situated where the Runn joins the branch of the Indus, was overflowed at the time of the shock. The people escaped with difficulty, and the tops of the town-wall are now alone to be seen above the water.—The fate of Sindree was owing to its situation, for there cannot be a doubt of all the Runn land having during the shock sent forth vast quantities of water and mud. The natives described a number of small cones of sand six or eight feet in height, the summits of which continued to bubble for many days after the 16th.

The sea must have been affected by the motion of the earth;

* It is many years since the eastern branch of the Indus has been almost deserted by the waters of the river.

but

but nothing material or positive has been discovered on this part of the subject.

Although the appearance of the country in Cutch bespeaks that it has suffered at some period from convulsions of nature; and although there are strong signs of volcanic matter thickly scattered over its surface, still there does not exist even a tradition of an earthquake* of any violence having occurred. The natives, therefore, were perfect strangers to such a phenomenon, and were terrified in proportion to their ignorance. The instantaneous and firm belief adopted by all sects and descriptions was, that the world was at its end; and their minds were impressed accordingly †. After the first alarm had subsided, advantage began to be taken of the circumstance. The Brahmins enjoined charity to the Hindoos; and placards were issued from unknown quarters, foretelling misfortunes to those who did not feed their priests, or who persevered in sin. One of these papers was stated to have come from Kasse (Benares); and as it had a remarkable effect upon all classes of Hindoos, I am induced to submit a verbal translation of it.

“ A letter has been received in the name of Shri Ramjee. It has come from Kassi Benares. In the middle of this Iron Age, the Golden Age will make its appearance: Shri Bhudajee will appear. Of the iron age have elapsed 4912 years ‡; and after Sumvut 1876 (A.D. 1819) the golden age will last 13,033 years. On the 5th Asonsood (or 24th September 1819), after twenty-two ghurries of the night have elapsed, at that moment will Bhuddajee appear, and the golden age commence. The earth will shake for seven ghurries and thirty pulls. The earth will open: then will false and uncharitable people be swallowed up. They who are charitable and religious, depend upon Bhugwan, give alms, do virtuous actions, and fear bad actions,—these will be saved. The golden age will last 13,033 years: the age of man will be 250 years. There will be universal friendship and peace. Every month will consist of forty-five days; every day consist of ninety ghurries. There will be thirty-six mansions of the moon:

* The slight shocks felt of late years in Guzerat were also experienced in this province.

† A few minutes after the shock, I walked through the streets of Anjar, which were crowded with people sitting on the ruins of their houses and shops which had fallen into the road. They appeared to me to be in a state little short of mental derangement; and to a question put, the only answer to be got was “*Ram Krushn*,” which they repeated constantly and loudly, apparently unconscious of what they were saying.

‡ This appears to be a mistake, as 4920 years have elapsed.

there

there will be twelve planets: there will be fifteen signs in the zodiac. At night, when thirteen ghurries remain, then will the golden age commence: Bhuddajee will appear. This event has been extracted from the Vedes after much study. From the Shri Bhud Maha Grunth, after intense study, has it been extracted. Whosoever reads, hears, or causes to be heard, copies, or spreads abroad this letter, will be fortunate. Believe in it, for he who denies its truth kills a Brahmin or a cow. He who has not faith will be damned: he who believes will be saved, he will be happy, he will attain to the presence of Bhugwan. Shri Krushan Damotherjee is truth."

This paper was written in the Bridge Bhakha dialect, and Balbood character. At the hour appointed in it for the destruction of sinners, almost every Hindoo of respectability purified himself, and sat with the toolsi leaf in his mouth, patiently expecting a fate which he had endeavoured to evade by liberal donations to Brahmins*.

The Moosulmans were equally alarmed, and abundance of threats of punishment to the wicked were fulminated from the musjeeds; and a paper asserted to have come from Mecca, with the usual seals attached, foretold the approach of the day of judgement. The Moolahs and mendicant Sijeds stated the cause of the earthquake to be, that the horse *Dooldool* was pawing for his food, and strict injunctions were issued to all good Mahomedans to send a certain quantity of grain and grass to the Moolahs &c. to satisfy *Dooldool*, which supplies were appropriated to the pious Moolah's own private emolument.

The Hindoos attributed the earth's motion to a quarrel among the Dyets and Dewas, and fabricated the most ludicrous stories on the subject. Prophets sprung up from all classes, casts and sects: some asserted that they had foretold the calamity which had occurred; others boldly pointed out the hour and moment at which still more calamitous events were to happen; and in short there was a superabundant display of every thing absurd or extravagant that could be advanced by ignorance and presumption, deceit and superstition.

It may be remarked that the monsoon commenced about the 11th of July in some places of the province, and later in others. The memory of any person living can furnish no example of so severe a season. The rain in the western parts

* Even the Banians are said to have sold their goods at just rates and with fair weights for some time previously to the dreaded day. A circumstance so extraordinary, as honesty in a Banian retailer, is certain proof of the impression which the prophecy had made on his mind.

of

of Cutch fell in such torrents for hours successively, that, combined with occasional shocks of the earthquake, it excited the most alarming fears in the minds of the inhabitants. To the eastward we had it less severe, though equally constant; and were I to say that for two months we never had a day without some rain, I believe I should not be exaggerating. In consequence, the crops have either failed, or could never be sown; and grain is now selling at the rate at which it sold in Cutch in the famine of 1812-13. We have always much thunder and lightning in Cutch during the monsoon, this season I think more than common; and the heavy clouds, which for a period of three months never ceased to travel close to the earth from the S.W., obscured the sun for many days successively. We had also a storm of wind from the westward, which amounted to a hurricane in the western parts of Cutch. These occasionally have happened before, and are called by the natives *hoorwah*.

Such are the details of the circumstances attending the earthquake of 1819. I have much reason to solicit the pardon of the Society for having descended to such trifling particulars; and the only apology I have to offer, is the circumstance of such a phenomenon having so seldom occurred in India with similar violence.

(Signed) J. MACMURDO,

Camp at Bhooj, Jan. 27, 1820.

Captain 7th regt. N. I.

[To be continued.]

XXII. *On White Copper*. By C. KEFERSTEIN. Read at a Meeting of the German Explorers of Nature at Halle, September 18, 1823*.

FOR a considerable period white copper has been made and manufactured at Suhl, in the Henneberg country, and the neighbouring places, particularly for the mounting of guns or firelocks, but likewise for other purposes, as for spurs and the like†. This metal strongly resembles silver, even to deception, keeps excellently without tarnishing, has the colour of silver on the touch-stone, is not brittle, but on the contrary extremely malleable, contains no arsenic like the metallic compound usually called white copper; and is therefore very useful in the manufactories at Suhl.

* From Schweigger's *Neues Journal*, band ix. p. 17.

† The French and Spanish gun-manufacturers are said to ornament their finest guns with the same metal, as it is peculiarly adapted to that purpose. They say they obtain this metal from the East Indies. More particular data on this subject have not come to my knowledge.

Of

XXX. *Papers relating to the Earthquake which occurred in India in 1819.*

[Concluded from p. 119.]

Extracts from Letters of Captain BALLANTYNE, Agent in Kattiwar, for his H. S. the Guicwar, concerning the Earthquake.

Letter addressed to Lieut.-col. BARCLAY.

Jooria, June 17, 1819.

WE have had a complete earthquake since yesterday evening at half past seven o'clock. The shocks have been numerous and severe, and the tremulous sensation does not yet cease.

The whole town is literally a ruin: the works are shaken from the foundation, and in many places thrown down. The old tower, which I had given up to Dr. Roy, is a complete ruin: the roof falling in, crushed all his things, and it is almost miraculous that we happened to be out. My sitting bungalow and sleeping apartments are one shattered ruin.

The Dewanjee has quitted the town, and lives outside, it being really not safe remaining in buildings so much injured as those here are.

Letter addressed to Mr. WILLIAMS.

Jooria, June 18, 1819.

YESTERDAY morning we went out to the westward of the town to see some rents which had been caused by the earthquake in the fields there. The earth separating, had in some places emitted water and fire. On examining the different rents, we found them to be of various extent, from an inch to a foot in breadth; the depth however in all of them was considerable, being to 10, 15, and 20 feet. In some places a black sandy and gravelly soil had been thrown out; in others, a black wet earth.

The shocks during the night of the 16th were frequent, but not very severe, and the tremulous motion of the earth scarcely ceased.

On the morning of the 17th the weather was close, and the tremulous motion continued in a very sensible and disagreeable degree: about 10 A.M. a distinct and severe shock was felt, but it did not last long.

We have had no rain, thunder, or lightning, for these six or eight days. The thermometer has ranged from 86 to 90 and 92 degrees. We had remarked on the 18th that the thermometer had risen two degrees.

The dreadful noise accompanying the earthquake was of a
rumbling

rumbling kind, and resembled sometimes that produced by the quick motion of wheeled carriages, and sometimes of a distant cannonade.

It is now between five and six o'clock (morning of the 18th): I have felt the motion frequently during the night, and am anxious as to what may yet happen. The morning is close, and appearances unfavourable. My table and chair are at this moment shaking under me.

We have already had accounts of this earthquake's having been severely felt and committing great havoc at Nowanuggur, Zoona-bunder, Moorvee, Tunkaria, Dhewrole, Amrun, &c.; at the last place much of the fort has been thrown down, and eight or ten persons have been killed, besides many horses and cattle.

P.S. June 19th, another considerable shock has been felt; the weather is unusually hot, and appearances unfavourable.

To GEORGE OGILVY, Esq. Secretary to the Medical Board,
Bombay.

SIR.—I have the honour to report, for the information of the Medical Board, all the circumstances which have come to my knowledge regarding the earthquake which took place in Cutch on the 16th instant; and which, if we take into consideration the severity of the shock, and the damage sustained within the range of its operation, has seldom been equalled in modern times. This subject, I am aware, is but little connected with medical science; but as forming by far the most interesting and awful part of the natural history of the globe, I have no doubt every thing relating to it will be acceptable to the Board.

Different from what has generally been observed in the greater number of severe earthquakes, nothing in this previously occurred, in the state of the atmosphere or otherwise, to indicate the probability of any unusual phenomenon taking place. The months of March and April were extremely hot and oppressive; but during May the weather became milder, and remained much the same as it generally is in that month. About the second or third of June, at night, there was a severe squall of thunder and rain, which lasted for about an hour and a half. After this the temperature of the air became mild and agreeable; and till the very moment that the earthquake took place, nothing could be observed to indicate even the smallest change in the weather, far less the approach of such a dreadful convulsion.

The first and great shock took place a few minutes before seven o'clock in the evening of the 16th, and the general
Y 2
opinion

opinion is that it lasted nearly two minutes. The motion of the earth during this period was most awful and alarming, giving to most people the feeling as if it was about to open and swallow every thing up. In this short space the town of Bhooj, nearly three miles in circumference, became almost a heap of ruins; most of the houses were thrown down, and the greater part of the ramparts and towers, with the guns, were precipitated into the ditch. Nothing was seen by those at a distance but a thick cloud of dust. The same occurred in a greater or less degree in every town and fort from the eastern extremity of Wagur to Luckput on the Indus; and even the smallest villages have been levelled with the ground.

The shock appeared to increase in violence as it continued, and suddenly to stop, leaving a kind of tremour; some people said it was preceded by a noise like thunder or the rattling of a number of carriages, but this was not generally observed. Difference of opinion also exists as to the kind of motion that took place; some people considering it was undulatory, others as a kind of tremour, and others again as coming directly upwards. The last kind of motion appeared to me very evident, though being at the time surrounded by houses and walls falling in every direction, I might not be so well able to judge. I felt as if the force was acting directly where I stood, and as if the earth was making an effort to burst immediately under my feet. People appear to differ as much as to the quarter from which the shock came; nor is it to be ascertained from any general direction in which the walls of the towns or houses have fallen: they appear to have tumbled in every direction indiscriminately, and frequently one half of the same wall has fallen on one side and the other half on the other.

As far as I have been able to ascertain, in no place has the surface of the earth suffered any important alteration from the shock. There are reports of fire having issued from hills to the westward of Bhooj, but I do not think they will be found correct. On the 17th I travelled between Bhooj and Anjar, a distance of twenty-seven miles, and part of the road through hills; and though I looked carefully in every direction, I could perceive no recent changes. In the bunds of tanks and the steep banks of ravines, small rents could be perceived: in the hard rocky soil, which forms the general surface of the country, no alteration was to be seen. After the shock several dry rivers became filled with water, which afterwards gradually subsided. About Anjar the water in the wells became of a milky colour, but was not altered in taste.

With respect to the places affected by the shock, Anjar and

and Bhooj appear to have suffered much more than any other I have yet heard of; in the former nearly 200 dead bodies have been dug out of the ruins, and in the latter 1000 are supposed to have perished, besides numbers in both towns miserably maimed. It would be impossible even to guess at the number of victims throughout the country: it will be sufficient to remark that not only in large towns the fatal effects of the shock have been felt, but even in the smallest villages some lives have been lost. In Anjar the effects of the shock appear to have been greatly modified by difference of situation; the quarter of the town towards the east, and which is the lowest, has been reduced to one mass of ruins. Neither street nor lane is to be discovered, and literally there is not one stone remaining on the top of another: the town wall on this side has suffered in an equal degree. The other part of the town, with the wall, though dreadfully shattered, does not appear to have suffered one tenth part of the injury. This must be accounted for from the lower part being situated at a considerable distance from the rock, upon a bed of white aluminous earth, while in the higher part the foundations of the houses are situated immediately upon the rock. It could not be owing to the shock being more severe in that particular place, as, extending over such a considerable tract of country, its force could not have differed in such a small space.

Since the 16th constant shocks have been felt, perhaps all together nearly thirty in number. The weather continues much the same as might be expected at this season. The wind is very variable: heavy squalls are suddenly succeeded by dead calms. The atmosphere is cloudy, with a hazy horizon. There is nothing peculiar in the appearance of the sun at rising or setting; only one meteor (a ball of fire) has been observed since the occurrence of the earthquake, and that was on the night on which the first shock took place.

I have to apologize for the unconnected manner in which the above account is detailed; but the mind cannot be quite at ease in the midst of so much desolation, and while the awful phenomenon that produced it is still in some degree impending. Should any thing additional worth reporting come to my knowledge, I shall immediately communicate it to the Board. I have the honour to be, sir,

Your most obedient humble servant,

(Signed) JAMES M'ADAM,

Anjar, 29th June 1819.

Assistant-Surgeon.

P.S. I had no opportunity of forwarding the above letter till to-day. Shocks still continue to be felt, and there was a very smart one yesterday evening. The earthquake appears to

to have been felt all over Kattiwar, and as far east as Kaira and Baroda; also at Radhunpoor, and I believe in Sind. Cutch, from all accounts, appears to have been the centre of its operations, and especially the western part of it. Moondra and Mandavi, two large towns on the sea-coast, have suffered in comparatively a trifling degree; but the inland towns and forts towards the Indus have been almost completely destroyed. There has been a heavy fall of rain at this place, and the weather continues cool and pleasant.

(True copy)

(Signed) GEORGE OGILVY,
Sec. Medical Board.

Copy of a Letter from Captain ELWOOD.

Poorbunder, June 7, 1819.

WE yesterday evening experienced in this fort and city one of the most awful scenes in nature, that of a violent and destructive shock from an earthquake.

The weather was close and sultry: the thermometer ranged at 86° at sunset, and a light air, scarcely perceptible, was sometimes felt from the southward. An officer and myself were taking an evening walk on the ramparts of the fort, and had gone nearly all round, when, at 40 minutes past six, we observed to each other how excessively close and oppressive the atmosphere was; and five minutes after, I heard a distant sound not unlike that of a cannonade at sea. A thought had scarcely passed the mind as to what could give rise to the sound, when I felt a violent shock beneath my feet, and instantly exclaimed, "An earthquake!" Looking at the same time forwards, I saw the stone parapet at two yards distance violently agitated by a quick, short, wave-like motion, bending in and out with the greatest pliability, and with the vibration of about a foot, and attended with an incessant hissing cracking noise. I thought it impossible that the works could stand, and, expecting their immediate fall, I instantly determined on descending as quickly as possible; but as the rampart was a perpendicular height of masonry of about 20 feet, I was obliged to run back towards the nearest ramp, which was a flight of stone steps at some distance. The officer I was walking with followed; and as we passed along at a quick rate, the sensation felt was similar to that dangerous and disagreeable one of running along an elevated and elastic plank, the ends alone of which are supported. I every instant expected to fall with the works, or to be precipitated from them; but, reaching the steps, ran down as fast as I could, each lower step apparently meeting the descending foot (which I really

which occurred in India in 1819.

really believe was the case, as the whole flight of steps was violently agitated).

While passing down, I expected to be overwhelmed by the works, which were touching my right shoulder, and above my head.

Although the rampart and parapet are about twelve feet thick, and twenty-five feet in height, yet this wall of masonry wavered and fell.

Fortunately the steps were broad; had they been narrow, as is frequently the case, so great was their agitation that it is doubtful if we should have got down without being thrown over the side. Arrived at the bottom of the ramp, we did not cease running until we had got to a sufficient distance from the works to prevent their falling on us. On halting, we were surprised to find that the works had not fallen after so extraordinary an undulating motion.

On reaching a place of comparative safety, for there was no place absolutely safe, the attention was attracted by a vast cloud of black dust arising at about three hundred yards distance, and from the sea face of the fort, which ran at right angles with the one we had quitted. The danger being past, my curiosity became excited; and approaching the cloud of dust, I found it to be occasioned by the fall of towers and of large portions of the curtain, leaving several breaches, some forty and some sixty yards wide. This devastation extended for five hundred yards, and over a part of the fort which I had been walking on not five minutes before.

I do not imagine that a twenty-four hours' fire from ten pieces of heavy ordnance could have produced so extensive a destruction as was thus effected in the space of a minute and a half. We conjectured that the awful shock had not lasted more than that short period. Short as it was, it was powerful enough to destroy the work of ages.

We now directed our attention towards home, and the first occurrence that was met with near it, was the horse-keepers with the horses in their hands standing in the open air; having been apprehensive, as they said, that the stables would have fallen and killed the horses.

On entering the house, my servant informed me, that while making my bed in one of the upper apartments he had been thrown down on the floor, and that before he could make his escape he was thrown down a second time.

A gentleman and lady, on hearing all the tiles of their house in motion, and crackling as if in a fire, and observing the whole of their furniture shaking, immediately got down stairs into the open air. The gentleman informed me, that although

