Journal of the Society of Arts.

No. 2,369. VOL. XLVI.

FRIDAY, APRIL 15, 1898.

All communications for the Society should be addressed to the Secretary, John-street, Adelphi, London, W.C.

Proceedings of the Society.

INDIAN SECTION.

Thursday, March 31; Sir DENNIS FITZPATRICK, K.C.S.I., Member of the Council of India, in the chair.

The CHAIRMAN, in opening the proceedings, said to many of those present, and especially to those who had been in Assam, Mr. Luttman-Johnson needed no introduction. For a larger number of years than usual, he occupied a high and important position there, and was known, not only as an official of great ability, but also as a man of great powers of observation, and of deep sympathy with the people. He also possessed in an unusual degree the faculty of graphic description, so that he could arouse interest in whatever subject he dealt with. He felt sure, therefore, that his paper would be both interesting and instructive.

The paper read was—

THE EARTHQUAKE IN ASSAM.

BY H. LUTTMAN-JOHNSON, I.C.S.

CONTENTS.—Description of Assam—Geological description—What an earthquake is—Earthquake origin—Depth of origin and velocity—Assam an earthquake area—Former earthquakes—This earthquake the most violent—Effects of earthquake at principal stations: Shillong, Mr. McCabe, Gauhâti, Sylhet, Tura—Experience of civil surgeon of Goalpara—Conduct of native servants—Conduct of native population—Further troubles—Message from the Queen—Behaviour of animals—Damage to roads and railways—Tea gardens—Effects in Bengal—Fissures—Geysers—Upheaval of river beds—Buildings—Extension of earthquake—No seismological result—Conclusion.

DESCRIPTION OF ASSAM.

I propose to take you this afternoon to rather a remote corner of India—indeed, a remote corner of the earth. If you will turn your mind's eye to the map of our great dependency, you will see that to the north-east it overlaps Burmah, the Straits Settlements, &c. Here the red line which distinguishes British territory extends almost to the western borders of China. The overlapping corner is the British province of Assam. It is bounded on the north by the Himalayan mountains, on the east by hills bordering on China and Burmah, on the south by Burmah and the huge province of Bengal, on the west by the same province. The province consists of two valleys running east and west, with a range of hill country rising some 5,000 feet above the sea between them. It also contains within its limits a large stretch of hill country on the confines of Burmah, while the hill tribes of the Himalayan mountains on the north and north-east are more or less within its administrative group. The northern valley is that of the great Brahmaputra river, which, after draining a large part of Thibet beyond the Himalayan mountains on the north, breaks through those mountains nearly due south, and then flows west by south till it reaches the province of Bengal. The southern valley is named after its principal river the Surma. The northern valley is some 450 miles long from east to west, and from 60 to 40 miles broad; the southern is only some 150 miles long from east to west, and about the same breadth as the northern valley. But though the northern valley is so much the larger, the populations of the two valleys are about the same. Something in the climatic conditions of the northern valley militates against increase of population and cultivation, whereas the southern valley is almost fully populated. The northern valley is inhabited by a mixed population largely Mongolian in origin; the southern tract is inhabited by Bengalis. The hill tract lying between the two valleys is very sparsely inhabited by very interesting and very primitive peoples.

Formerly these outlying parts were under the Government of Bengal, but in 1874, partly in order to relieve that Government, which was thought to be too large, partly because it was thought that these backward, undeveloped tracts suffered from their union with the strictly regulation province of Bengal, they were constituted into a separate province. The upper part of the northern or Brahmaputra valley had long been called Assam, a name perhaps derived from the Ahoms, a people of Shan origin, who ruled there in former times. To the natives of Hindustan this old Assam is an uncanny, ill-omened land—a land of mysteries and terrors, not probably on account of its earthquakes or its plagues, but rather because it is either non-Hindu or only superficially Hinduised. The name is well known in this country because the province produces tea in

large quantities. The cultivation of this product has brought a large number of European settlers to the province. It is rather a British colony than an Indian province, so prevalent is the tea industry. No other part of India owes so much to this class.

Geological Description of Assam.

Both the northern and southern valleys are more or less alluvial. The eastern end of the southern valley is deltaic. Both valleys are probably areas of subsidence. The central range is composed of more or less hard crystalline rocks, through which an earthquake shock would be transmitted with great readiness.* The geological character of this central range connects it rather with Western Bengal and the peninsula of India than with the Himalayas on the north. The Himalayan mountains are composed of indurated rocks, also well adapted in themselves for the transmission of earthquake shocks, but mountain ranges are found to form a barrier to the transverse progress of earthquakes, probably because the shocks have to cross the strike of the strata flanking them. The southern face of the central range presents some very remarkable phenomena of upheaval or subsidence. Coal is found elevated to a height 4,000 feet above the level of the sea, accompanied by a series of rocks, limestone, and sandstone, similar to that at the base of the hills a few feet above the sea level.† It is probable that this entire group of strata, both that part which is now at the top of the hill and that which is at the bottom, some 2,000 feet thick, was deposited and formed in water of no great depth. Subsequently, either the northern part of the group was elevated to its present position or the southern part subsided. It is probable that the present steep southern face of this central range is formed along a great line of fault.‡ I mention this because the majority of earthquakes are probably due to faulting, and the origin of the recent earthquake is supposed to lie somewhere in this region. The alluvial deposit too in this part below the hills exhibits signs of upheaval or subsidence.‖

* "Cachar Earthquake, 1869," "Memoirs of Geological Survey," vol. 10, p. 86.

† "Memoirs of Indian Earthquakes," "Journal Asiatic Society of Bengal," vol. 12, part 2, p. 1044.

‡ Oldham, "Geology of Khan Hills," pp. 48-49.

‖ Oldham, "Geology of India," p. 443. Medlicott, "Shillong Plateau," "Memoirs of Geological Survey," vol. 7, p. 155.

What an Earthquake is.*

The description I am about to give of the Jubilee earthquake in Assam will only be intelligible to those who know what an earthquake is. As many of you have probably not studied seismology, I will explain as shortly as possible what an earthquake is. When a blow is given to any elastic body or material, the blow—that is, the wave or impulse generated by the blow—travels through or along the body or material; in other words, the particles which form the body or material first struck have pushed forward the particles immediately in front of them, which in their turn, after communicating the motion to the particles in front of them, again return to their original position, and so on. Now imagine an explosion of some kind to take place at some point inside an elastic material. The impulse or elastic wave generated by this explosion will travel from it in the manner I have described in all directions. If the explosion occurs in the centre of a sphere of homogeneous material, its impulse or wave will touch the outside at all points at the same time. The sphere will be distended as a bladder blown out with air, and will then again contract. What we call an elastic wave is rather a backwards and forwards pulsation or vibration, and must not be confounded with waves of water which depend on the action of gravity. It is propagated in a manner similar to that in which sound vibrations are propagated. Now suppose the blow to be struck not in the centre, but at some point near the surface of the sphere. The vibration will reach the outside of the sphere at the point nearest to the blow vertically, at all other points at an angle greater or smaller according to the distance from the vertical point. Imagine a marble consisting of a number of concentric shells inside a football, each shell representing a vibration, and let the blow be struck in the exact centre of the marble. The vibration or impulse will reach the crust of the football first vertically at the point where the marble touches it, and it will come out on the outside of the football through the crust just opposite that point. It will reach other points of the surface of the football later, and at a greater or less angle, according to their distance from the vertical point. This vertical point is called by seismologists the epicentrum, the point where the blow is struck or the explosion occurs

* "Earthquakes" [Milne], vol. 56, "International Scientific Series," chapter 3.

the centrum or origin, the line joining these points the seismic vertical. The angle at which the wave comes out on the surface of the earth is called the angle of emergence. The emergence of waves of elastic compression on the surface of the earth causes the undulations so familiar in earthquakes.

Of course the earth is in no sense a homogeneous medium like the air in a football or the material of a marble. The elasticity of the parts of which it is composed varies enormously, and the parts themselves are permeated by fissures and faults. It has been calculated that nearly seven-eighths of the full velocity of the earthquake wave due to the material if solid and continuous is lost by reason of the heterogeneity and discontinuity of the rocky masses as they are found piled together in nature. This want of homogeneity of course affects the so-called waves in many different ways, which I have not time to explain. Then the original blow or explosion may be of various kinds. For instance, a long break or fissure would produce waves differing from those produced by a short one. Lastly, we may have waves not only of elastic compression, which I have described produced by alteration of volume, but also waves of elastic distortion produced by alteration of shape. From all which you will readily understand that earthquake motion is an extremely complicated phenomenon—indeed, an earthquake is rather a thing of freaks and eccentricities than of law.

Earthquake Origins.

When an earthquake occurs we are told that the first thing we have to do is to find out where it originated, so that we may be able to avoid that part of the country, or at least make arrangements for future earthquakes emanating from the same origin.

In order to find out where an earthquake originates, we must observe its direction. If in one place to the west, the direction is from east to west, in another place further east, from west to east, we infer that the origin is situated somewhere between the two places. Personal observations of direction are extremely unreliable. But in the absence of recording instruments we can generally get a good idea of direction from the way in which walls, columns, and other objects have been overthrown, or fractured, or projected.*

Depth of Origin and Velocity.

Seismologists take great interest in ascertaining the depth below the surface of the earth of the origin and the velocity with which the wave is propagated. If we know the angle at which the wave emerges on the surface of the earth at different places, we can easily calculate the depth from which it is propagated. This angle is calculated from the inclination of fissures produced in buildings. It is assumed that these figures are at right angles to the direction of the shock.* Again, if we have accurate records of the time at which an earthquake reaches different places we can calculate its transit velocity, that is the speed at which the wave or impulse above described travels along or, rather, emerges upon the surface of the earth.† It is obvious that these calculations must always give very uncertain results. In the present case we have no cracks. When the Director of the Geological Survey telegraphed to be sure to observe and record all cracks in walls, the answer was, "There are no walls left."

The final results of the investigations made by the members of the Geological Survey of India into the Assam earthquake have not yet been published. From preliminary investigations it is supposed that the centrum of the Assam earthquake was somewhere west of the line joining Shillong and Sylhet, in the region of the great upheaval or subsidence which I have noticed.

Professor Omori, a Japanese seismologist, who was deputed to Assam to make enquiries into the earthquake, thinks it originated 20 miles below the surface. The famous Japanese earthquake of 1891 was found to have an origin 5 miles below the surface. While the intensity of that earthquake was four times that of the present one, the area of greatest disturbance in the present case is four times greater than it was in the Japan earthquake. From this the Professor argues that the origin of the recent earthquake is four times deeper than it was in the case of the Japan earthquake. Other big earthquakes have been found to originate from 5 to 30 miles below the surface of the earth. One has actually been traced to a depth of 50 miles.

The velocity is said to have been 10,000 feet per second, or 112 miles per minute. Other

* "Earthquakes" (Milne) vol. 56, "International Scientific Series," p. 69.

* "Earthquakes" (Milne) vol. 56, "International Scientific Series," p. 213.

† "Earthquakes" (Milne), vol. 56, "International Scientific Series," p. 87.

famous earthquakes have had much smaller velocities, from 2,000 to 3,000 feet per second. But more recent earthquakes in Japan, where systematic observations have been carried on under the Earthquake Department, have produced velocities up to 9,000 feet. Telegraph signallers prove useful recorders of velocity. In two instances in Bengal where the quake was travelling east to west, telegraph stations west were working stations east. There was stoppage due to earthquake at the east station, and almost immediately afterwards the quake reached the west station.

Assam an Earthquake Country.

As a rule, earthquakes are most frequent in volcanic districts. The Malay Archipelago is one of the volcanic districts of the world.* In Java, in Sumatra, there are many active volcanoes. North of Sumatra, we still find volcanoes, first Barren Island, which is a true volcano; then, on the coast of Burmah, the mud volcanoes of Ramree Island, with Cheduba close to it in latitude about 19°. Near Chittagong there are many hot and cold springs giving forth inflammable gas. Further north, however, towards Assam, and in Assam, though there are hot springs and one mud volcano, there are no true volcanoes, either active or which have been recently active. Still, though not a volcanic tract, earthquakes are no new things in Assam, or indeed on the east side of India. The late Mr. Oldham, of the Geological Survey of India, compiled a list of Indian earthquakes observed without the aid of instruments.† In this list I find 110 earthquakes recorded as having occurred in Eastern Bengal, Assam, and Burmah, up to 1869. In Assam alone in the twenty years ending 1869 there were some fifteen. This is, no doubt, a very incomplete list. We have only been 150 years in Bengal and 75 years in Assam, and before our time there was no systematic record of such events. In an old diary I find eleven earthquakes occurred at Dilvooghar, at the upper eastern end of the Brahmaputra Valley, between January, 1839, and September, 1843. All of these came from the south-west, indicating an origin in the central hill trail.

Even in quite recent times, the record has been very incomplete. It is only recently that columnar seismometers have been in use. This seismometer consists of a series of round columns or cylinders of wood, or other material, placed on a level plane and surrounded by soft material to prevent their rolling when they fall. The number and diameters of the columns overthrown measure the intensity, while the direction of their fall gives the direction of the shock. Such seismometers are not sensitive to slight shocks, and even where the shock suffices to overturn one or more columns, the information given is not wholly reliable.* A long-continued gentle shaking may overturn a column which would stand a very considerable sudden shock. Then earthquakes often give columns, gravestones, &c., a rotatory motion, which results in the columns falling in different directions. Besides the direction of motion of an earthquake seldom continues the same throughout the disturbance. So far as earthquakes of sufficient intensity to be recorded without the aid of instruments are concerned, we should have a complete record for the last 24 years, for the first Chief Commissioner opened a register of them in 1874. I think this was the first official notice taken of such phenomena. The results of the record thus established have not, I am sorry to say, been published. In Japan, where earthquakes have been carefully recorded for 2,000 years, there are from 20 to 40 more or less destructive ones in a century, and many of these are local; that is, are felt in particular localities only. Besides these there are something like two a day of sufficient intensity to be recorded without the aid of instruments. During the 18 years I was in Assam, I can recall some half-dozen more or less destructive earthquakes which is not far behind Japan. But in minor earthquakes, Japan is clearly *facile princeps*.

Former Earthquakes.

Among large earthquakes in Assam and neighbourhood, I may mention the following. I omit that of 1737, which, in Mr. Oldham's list, is alleged to have caused the steeple of the principal church in Calcutta to sink into the ground, because it is now thought that the steeple was blown down by a cyclone and buried in mud by a storm-wave—a curious and interesting instance of the growth of myth.

A very bad earthquake which occurred in 1762 has become classic, that is, is referred to in all the text-books.† It was specially violent at Dacca and Chittagong in Eastern Bengal, south of the present Province of

* Lyell's "Principles of Geology."

† "Memoirs of Geological Survey of India," vol. 19, p. 263.

* "Earthquakes" (Milne), p. 16.

† "Journal of Asiatic Society of Bengal, 1843," vol. 12, part 2, p. 1044.

Assam. At the latter place the ground opened, throwing up water of a very sulphurous smell. The water gushed out prodigiously. In the chaise road, that is, the driving road, there were great chasms 2 feet wide and upwards. The bungalows (that is, houses of wooden frame and lath-and-plaster walls) proved very convenient on so melancholy an occasion. Brick houses must inevitably have been shattered and levelled to the ground. There was not a brick wall or house but was either greatly damaged or fallen. Anticipating the theory that an earthquake is an abortive attempt of pent-up forces to free themselves, the observer, hearing that two volcanoes had opened out, expresses a hope that they will prove a sufficient vent to discharge all the remaining sulphurous water in the bowels of the country.

There was another very severe earthquake in the eastern part of India in 1842.* This does not appear to have been very violent in Assam, though the focus of the seismic force lay at some distance north-east of Calcutta, that is towards Assam. We read this earthquake was accompanied by a noise which at first resembled some mighty rushing wind and then the loud rattling of carriages over a stony street. Again, in 1869, there was a very serious disturbance, of which we have an admirable account by the late Mr. T. Oldham, of the Geological Survey of India.† The centrum or origin of this earthquake was traced to the northern edge of the hill tract which I have described as forming the centre of what is now the Province of Assam, north-east of the head-quarters station, Shillong. Its velocity was found to be some 7,000 feet per second. Several places in Assam, especially Carbuc, at the eastern end of the southern valley, suffered very severely. At Shillong, a good deal of damage was done. A prominent feature of this earthquake were fissures and openings throwing up sand and water.

Again, there were destructive shocks in 1876 and 1885. The centrum of this last was some 200 miles north-east of Calcutta, some 60 miles south of the western end of the central range of Assam.‡ This earthquake did great damage in the parts of the Province of Bengal adjoining Assam. And there were many other shocks during the eighteen years I served in Assam, so that one came to regard them almost with contempt.

* "Journal of Asiatic Society of Bengal, 1843," vol. 12, part 1, p. 286.

† "Memoirs of Geological Survey of India," vol. 19.

‡ "Records of Geological Survey of India," vol. 18, p. 210.

This Earthquake the Most Violent.

But no earthquake, so far as we can judge, has ever been so violent, or has wrought such havoc as the one I am about to describe this afternoon. As regards more recent earthquakes, this is abundantly proved by the descriptions we have of them, and by the fact that many buildings which have succumbed on this occasion have resisted former attacks. And in regard to more ancient times, we have strong negative evidence. There is a very curious set of stone monuments at Demapur, on the northern edge of the central tract, probably set up by some primitive people ages ago. These have been twisted, broken, and overthrown by earthquakes in former times, but such an earthquake as the recent one would have wrought much greater destruction. Again, monoliths or menhirs set up by these primitive people in honour of deceased ancestors, who are supposed to have benefited them, are a prominent feature of the hill tract, which I have said forms the centre of the province. Probably in no country are menhirs more numerous.* Many of these are very ancient. They are now broken and snapped; in some cases they have been torn out of the earth. Those of you who have seen the Druidical stones at Stonehenge and at other places in these islands can form a good idea of what this means. A massive stone bridge, of great antiquity, in the Brahmaputra Valley has been destroyed. Very careful geological surveys, especially of the central hill tract, have not disclosed traces of such a catastrophe within historic time. Lastly, had such a catastrophe occurred, the people would have a tradition of it.

Effects of Earthquake at Principal Stations.—Shillong.

I will first describe the earthquake and its effects at four of the principal stations in the province.

And first of Shillong, the head-quarters station. When the Province of Assam was first constituted in 1874—though Calcutta is the natural business capital of these outlying parts, especially so far as the tea interest is concerned—it was thought necessary to find a local head-quarters within the limits of the new province. The chief town in the northern valley which had been the head-quarters of the Commissionership of Assam was Gauháti, very picturesquely situated on the

* Fergusson's "Rude Stone Monuments."

not. The kites soared about. An observer noticed the large bats, which we call flying foxes, flying and squeaking piteously round the bamboo clumps, from branches of which they had been hanging. Elephants generally just sat down, but in some cases they were caught and rolled over. The crows, who are always with us in India and give us notice of approaching storms, were much disturbed immediately before the shock, flying about and cawing wildly.

Damage to Roads and Railways.

I have described how the roads leading to Shillong were affected, and how that station was cut off from the rest of the world for days. Similar damage was done to roads in other parts of the province near the seismic centre. The railways also suffered considerably. Quite near the seismic centre, at the foot of the central range south from Shillong and north-west from Sylhet, was a small narrow-guage line. At places on this line the rails have been pushed up to a height of 2½ feet. At other places the line has been shifted to the east side of the embankment. Curiously, two large iron bridges have escaped. Another short line in the northern valley, leading from Gauháti to nowhere, which has hitherto been worked at a loss, has been so injured that it cannot be reopened till the end of this cold season. A line has lately been constructed along the south of the southern valley. Though some distance from the seismic centre, this line suffered a good deal. Where it crosses a swamp, the embankment has spread itself out over the swamp, and the rails remain suspended in mid-air. Generally, the damage was greatest in soft ground. One train was overturned, another was derailed and stuck. The Northern Bengal Railway, which connects Calcutta with Darjeeling, was much damaged by fissures and the sinking of embankments. In many cases, the rails were twisted out of place, and assumed a serpentine course.

Tea Gardens.

The most important industry in Assam after ordinary agriculture is that of tea; and when the news of the earthquake first reached England, grave fears were entertained for the tea gardens. Fortunately they lie, for the most part, outside the area of greatest disturbance. Except in the immediate neighbourhood of Gauháti and Sylhet, the damage was not such as to stop manufacture. The buildings consist generally of iron frames supporting corrugated iron roofs, the walls being also of corrugated iron or lath and plaster. Masonry buildings, where they existed, suffered considerably.

Effects in Bengal.

The earthquake was felt in varying degrees of intensity throughout the neighbouring province of Bengal, but only the districts adjoining Assam, on the west suffered very severely. These districts are alluvial and suffered in the same manner as the alluvial parts of Assam. The towns of Runjpur and Mymensingh, lying west and south from the western end of the central Assam range, were destroyed. At Cooch Behar, north of Runjpur, the Maharajah had a narrow escape. Noticeable features were the opening of long cracks and fissures in the ground and the formation in places of more or less circular holes, through which water and sand were ejected. A considerable area has been strewn with sand. Sand was forced up in a large proportion of the wells, and rendered them dry and otherwise unfit for use. Tanks have had their bottoms raised by the upheaval of the soil. The largest fissures are stated to have attained a length of one mile, and in some cases a depth of 30 feet. In many cases houses have been half buried. Many small river channels have been entirely blocked by the upheaval of their beds and their becoming choked with sand. In this way the surface drainage has been changed in places. Several places which were not fordable before the earthquake and could be crossed only by ferry have become fordable. The bed of one river has risen about 10 to 15 feet for a distance of some 20 miles, and as a consequence, the drainage has passed over the country, flooding a number of villages. While masonry buildings have all been destroyed, native houses of mud, wood, matting, and thatch, have escaped with comparative immunity.

Fissures.

I have referred more than once to fissures caused by the earthquake. These fissures play a very important part, especially in the alluvial portion of the province. You are, probably, all more or less familiar with the formation of alluvial tracts. As a river approaches the sea level, its fall becomes much less. Hitherto, it has been destructive; it now begins to construct. It is split up into branches which wind to and fro through the flat alluvial land, often coalescing, and thus enclosing insular

which the more southern pools have been formed, alike show that any two points lying respectively north and south of the disturbed areas are now closer together than they were before the earthquake.

"There is one, and so far as I can see, only one supposition which would explain all the facts, and that is the existence, or the creation, of a nearly horizontal fracture *or thrustplane*, along which the upper part of the earth's crust was pushed over the lower. This plane would nowhere come to the surface, and the movement of the upper layer against the undisturbed crust beyond the limits of the fracture would give rise to just that compression which would account for the conspicuous displacements of surface tracts seen in the eastern part of the Garo hills district, and less conspicuously to the east and the west of that district.

"In this conclusion we find an easy explanation of the area over which the shock had a maximum of destructive energy, without postulating an improbable depth for the focus. There is no necessity or reason to suppose that the thrustplane lies at any great depth from the surface, and it is possible that five miles may represent a maximum rather than a minimum value, but what the focus loses in depth it gains in area.

"It is certainly not at present, if it ever will be, possible to define the limits of the fracture. In an easterly direction there is good reason to suppose that it extended to, but probably not beyond, the meridian of Shillong. To the west it probably extends under the alluvium of Northern Bengal, perhaps as far as E. Long. 89°, or a distance of about 180 miles. The breadth from north to south is 35 miles within the Garo hills, in the eastern part of the district, and to the north it extends under the alluvium of the Assam Valley, possibly for as far again. These dimensions—180 miles by 70 miles—must be taken as extreme limits. There is at present no reason to suppose that they were exceeded, but there is no certainty that they were reached. It seems certain that the thrustplane had its greatest width, and consequent greatest movement, in about E. Long. 91°, or a little to the west, and it is impossible to realise the area below 1,000 square miles, while it may have been five times that. If we take the average depth at five miles, we find that the cause of the earthquake was the sudden and permanent displacement of not less than 5,000 cubic miles of the solid crust of the earth, and possibly of five times that volume."

Conclusion.

I have endeavoured to give you rather a glimpse of life in India—an account of an episode in an Indian official career—than a seismological discourse. Until observations have been tested by the Geological Department, it would be unsafe to draw conclusions from them. In calling this earthquake an episode, I do not mean that earthquakes such as this are common in India. But where you have not earthquakes, you have other calamities. Twenty years ago, the coast of Bengal was devastated by a sea wave, which destroyed 100,000 people; ten years ago, a tornado gutted the most fashionable part of my own town of Dacca; and, three years ago, a similar tornado cut a line ten miles long, and a quarter of a mile broad, through villages a few miles from my house, producing a butcher's bill of 135 killed and wounded. The northern valley of Assam has its local plague, which has almost depopulated large areas. Where you have not battle, murder, and sudden death, you have plague, pestilence, and famine. I hope I have been able to show that as in the fighting on the north-west frontier, as in the famine in Upper India, as in the plague in the Bombay Presidency, so in the earthquake in Assam, we may be proud of the manner in which our fellow countrymen did their duty, and not only our fellow countrymen, but also our fellow subjects, natives of India in the service of the Government, on whom perhaps the burden and heat of the day, in times of stress and calamity, more directly falls. In his report to the Government of India the Chief Commissioner selects for special praise the native gentleman in charge of one of the sub-districts in the Assam Valley.

DISCUSSION.

The Chairman said he was confident that he expressed the feelings of all present in saying that they were much indebted to Mr. Luttman-Johnson for his paper. He ought not to detain the audience, as there were other speakers to follow, but there were just two points referred to in the paper on which he wished to say a word. The first was with regard to Mr. Robert McCabe. He was in his particular line perhaps the most remarkable man he ever knew in India, and had been his companion and guide on many a long day's march through the wildest parts of Assam. He (Sir Dennis Fitzpatrick) had had the good fortune to have working under him, both on the north-east and north-west frontier of India, some of the ablest frontier officers, and he must say that there was not one of them who, in the power of impressing these wild tribes with mixed feelings of awe and affection, the faculty of rapidly evolving law and order out of chaos, could be placed above Robert McCabe. The other point was with regard to the manner in which those who had to meet this terrible calamity faced the difficulties of the situation.