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**A NOTE ON THE LANDSLIP NEAR
TODUPULAI, KOTTAYAM DIVISION, UNITED
STATE OF TRAVANCORE AND COCHIN**

By

**N. K. N. AIYENGAR
and
M. S. BALASUNDARAM,
Geologists, Geological Survey of India.**

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Introduction.

The landslip near Todupulai (58 C/9 — 9° 53' 45" N, 76° 43' E) is said to have taken place on the 27th of August 1949 soon after its occurrence reports appeared in the "Hindu" of Madras and the local press of Travancore and Cochin. A vernacular daily paper "Malayala Manorama" of Kottayam (58 C/10 — 9° 36' N, 76° 32' E) gave wide publicity giving graphic descriptions of the extent of damage to property and the loss to life due to this landslip.

Messrs N.K.N. Aiyengar and M.S. Balasundaram who were deputed to examine this landslip, visited the area on the 5th and 26th of September. We are thankful to the Tahsildars of Kottayam and Todupulai for their co-operation. Our thanks are also due to Mr. A.N. Madhava Nair, Taluk Assistant of Todupulai, who not only accompanied us throughout our investigation in the affected area but was also helpful in securing local information on this subject.

Physical features of the area.

. Topography:- The country around Todupulai is hilly. On the east, these hills stretch for a distance of about 15 miles up to Muvattupuzha river, rarely rising more than 500 feet above M.S.L. Further west, for about six miles, the general level of the country falls until it reaches the backwaters of the Arabian sea. East of Todupulai, the hills increase gradually in elevation until they reach the high ranges of the Western Ghats. Most of these hills have a capping of lateritic soil which support thick vegetation. One thing that attracts the attention of a visitor to this area is the scenic grandeur of green verdure, and the thick and luxuriant vegetation that stretches from end to end of this hilly and undulating country. Plantations of rubber, tapioca, coffee, pepper, coconut and arecanut adorn the slopes of these hills up to the summit. In fact, all available cultivable space has been utilised by the people.

. Rivers:- There are no big rivers of importance, but this area is traversed by numerous hill streams. One of them of some importance, and which drains this area, is Todupulai Ar, named after the town of Todupulai. This stream takes its origin on the high hills southeast of Todupulai and flows past Todupulai town, taking a north-westerly course, and finally joins Muvat-

tupula river. Another stream of lesser importance is the Karumannur stream which is also a tributary to Muvattupula. It is in the Chelavu malai and Mudia malai, two hill ranges, which lie between these two streams, that the largest number of landslips have taken place. These hill streams are still actively eroding their low banks during rainy season.

5. Rainfall:- The rainfall is fairly heavy in this area. The average for the last three years, 1946-48 is 179.62 inches. For the year 1949 up to 22-9-49 the total rainfall recorded at Todupulai is 114.12. inches.

General Geology.

6. The main types of rocks seen in this area are gneisses and charnockites. These rocks are in many places jointed and on weathering form lateritic cappings. Generally the upper portion of the cappings are coarse and sandy with some clayey matter. Hence the soil is porous.

7. Banded gneisses occur in the two hills, Chelavu malai and Mudia malai, where the landslips have taken place. The weathered surfaces in many places show foliation. The main mineral constituents of these light coloured gneisses are quartz, felspar, biotite with apatite as an accessory mineral. Quartz shows undulose extinction indicating pressure; the felspar is of the orthoclase variety with little albite and forms a large percentage of the rock. It has been noticed to be easily susceptible to weathering forming kaolin.

8. The general run of the rocks in this area appears to be ESE-WNW, the dips varying.

Location.

9. The area affected by the landslips are the two parallel hill ranges, Chelavu malai and Mudia malai. They are situated about six miles E 15° S and eight miles E 30° S of Todupulai, respectively. In the first mentioned hill range the damage is greater and the area affected extends for about 2½ miles and includes numerous slips on both the southern and northern flanks. In the Mudia malai there is only one slip of some magnitude, the rest being very minor ones.

Occurrence and description.

10. These landslips are reported to have taken place on the Chelavu malai and Mudia malai area on the 27th August 1949, between 11 A.M. and 11.30 A.M. (11th Chingam, 1125 of the Malayalam Era). The slips are said to have preceded by a booming sound, which according to some persons, was heard at

Todupulai. After the landslips there was considerable release of water which carried on its way the slipped soil, rock boulders, trees, etc. that lay on its path. The liberated water and debris covered the hill slopes below, and filled the Todupulai and Karumannur Ar, which overflowed their banks causing destruction to life and property.

11. In describing this phenomenon the local people and the press used such terms as "Hill burst", "Rock Burst", "Cloud burst" and "Eruptions." Several explanations were given by the local people for these "Hill bursts." One of them is worth mentioning here. It appears that just prior to the occurrence the entire area where the landslips took place was shrouded in mist and cloud. This cloud, according to them, was locally frozen and "burst" on the hill bringing about the landslides. The subsequent flooding of water was due to the "hill bursts" which released considerable quantity of water causing damage.

12. The following day after the occurrence the Division Peishkar of Kottayam, the District Superintendent of Police and other local officials visited the area and arranged for relief measures. Even the Chief Minister of Travancore and Cochin Union, Mr. T.K. Narayana Pillai also personally took interest in the occurrence and paid a visit to the affected localities. Soon after, a Relief Committee with the co-operation of the public men of the locality, was set up to assess the extent of the damage and the relief measures to be adopted.

Slips on the northern flank of the Chalavu malai.
(Vellantanam side)

13 (a). Half a mile west of hill 1629:- Locally this dome shaped hill is called the Chelavu hill or Mandanam hill. Here the slip has taken place westwards along the slope. Just south of the slip there is a water course. The slip face extends to about 150 feet in a S 30° E - N 30° W direction which is also the direction of banding of the gneisses. The vertical fall of the slip is about 50 feet. The slip face shows an inclination of 50° towards W 20° S. It exposes either hard rock or a thin covering of lateritic clay, attaining a maximum thickness of 6 inches which in some places has been washed out. Slikensides are also noticed on the clay surface in a few places. The slip section shows on top and on either slopes a reddish soil cover of 10-12 feet thick. On the northern side of the slip weathered and jointed banded gneisses is seen standing in a precarious position. This hill has been deforested for Tapioca cultivation which is still to be seen further eastwards of the slipped portion of the hill.

14 (b) Chelavu hill — 'Marudum paraikkal' slip near the house of Phillipose Chacko. This slip is a minor one less than 30 feet in lateral extent. The slip took place towards NW along the slope having an inclination of 50°. At the place from where the slip commenced there is a small spring with a very limited discharge of water. Here the hard rocks exposed appear to dip (SSE) into the hills. Among the material washed out could be seen huge boulders.

15 (c) Near the hill .2151, locally known as 'Marakombu' hill several slips have taken place in the neighbourhood of the house of C. Augustine. Here the soil cover is 3 feet thick and is dark in colour. At this place a large area has been cleared to plant Tapioca.

16 (d) For a distance of two miles between the hills .1629 (58° C/13 — 90° 52' 45" : 76° 47' 40") and .2151 (58° C/13 — 90° 52' : 76° 49') there are numerous slips observed on either flank. The group of slides which took place on the northern flank locally known as Vellantanam (58° C/13 — 90° 53' 30" : 76° 48' 30") slips caused the greatest damage to property, loss of lives, and destruction of houses. It is reported that the Karumannur stream was choked up with the material that was washed into it and as a result it swelled considerably flooding the low lying lands west of Karumannur (58° C/13 — 90° 54' 30" : 76° 47' 30") and also washed out twenty five shop sites and several small huts located close to the stream near the village. Most of the slips examined are either at or in close proximity of drainage courses. In all the cases the underlying fresh rock has remained unaffected.

Slips on the southern flank of the Chelavu malai.
(Vellimattam side)

17. On this side also numerous slips have taken place. The hills are very steep and approaches to the landslip areas are inaccessible. Compared to the southern slope, habitation is scarce on this side. Only three houses were washed out and two children lost their lives due to the flooding of the Muriatodu stream. Apart from this, the considerable soil matter brought down by the floods after the slips took place, completely filled the road section a little past Kondalapalle (58° C/13 — 90° 52' : 76° 47') and Muriatodu (58° C/13 — 90° 51' 45" : 76° 48'), and caused dislocation of traffic. Some road bridges were breached, and paddy lands were filled up. During our visit we could still see signs of the previous flooding.

Mudia Malai .1230 (58° C/13 — 90° 50' 25" : 76° 47' 45").

18. The most important slip which took place in this hill lies half a mile SE of .1280 on the southern flank. The slip has occurred very near the top in a water course. The slip face extends laterally to less than 100' and it reveals a 3' dark soil capping on hard rock. Considerable material of soil and debris was brought down the slope along with the trees that stood on the way. No loss of life is reported from this locality.

19. Conclusion:- None of the numerous slips that occurred in the localities described above exceeded 200' in lateral extent. Majority of them were less than 100' wide. The vertical drop could not be said with certainty since most of the slips are located very near the top of the hills and invariably the several thousand cubic yards of the soil mantle that was removed have all been washed out by the subsequent release of ground water.

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Damage.

20. The local information regarding loss of life, and damage to property varies a great deal and in most cases only exaggerated accounts are available. According to the 'Malayala Manorama' the total number of persons dead was 20. About 32 houses were destroyed rendering 150 persons without shelter. The total estimated damage to property is over 500,000 rupees. This statement is an exaggerated one. Unfortunately the detailed report prepared by the relief committee was not ready for our scrutiny. We were however, given to understand that the loss to property arrived at by them after detailed investigation was about three lakhs of rupees. The details gathered by us from a fairly reliable source is given below.

Details

Total lives lost (mostly women & children)	—	13
Number of persons wounded	—	70 to 80
Number of houses (mostly huts) destroyed or damaged. (Most of the houses are less than Rs.100 in value very few exceeding Rs.800)	—	about 100
<u>Cultivable land silted up and damaged</u>		
Northern flank of Chelavu malai (Vellantanam side)	—	170 acres
Southern flank of Chelavu malai (Velliamattam side)	—	25 "
Mudia malai	—	5 "
	<u>Total</u>	<u>200</u> "

(It is estimated that out of this 200 acres, about 20 acres cannot be reclaimed).

Total damage to property etc., is more than one lakh and less than two lakhs of rupees.

Nature of landslip.

21. It should be mentioned here that in all the slips examined, only the soil cover has been affected exposing fresh rock at the slip faces. Excepting for removal of weathered and disintegrated rock material and boulders that lay in the path of the floods that followed the landslips, there was not a single instance wherein rockmass was deformed or weakened below the plane of slide. These landslips can be described as 'soil cap movements,' 'slope failures,' or 'soil creep.' Almost all these slips are confined to the higher reaches of the hill ranges and they invariably occupy the head of the water courses. The slips have taken at the junction of the soil cover and the underlying rock (banded gneiss). In certain places there is a thin layer of lithomarge or lateritic clay present at these contacts.

Causes of landslip.

22. As remarked in the above paragraph the landslips are the normal or gravity slides chiefly due to saturation of rain water of the porous soil cover resting on top of the fairly impervious metamorphic rock which was not affected. The several causes that may initiate movement are as follows:-

from the observations made round about this locality, it may be pointed out that the factors that gave rise to the present slips are still present and future falls are not unlikely in this area. 'Can the landslips be prevented?'

Preventive measures.

27. The very fact that these slips take place in wet weather is proof positive that they are mainly due to ground water conditions. Hence in any preventive measure (1) correction of ground water conditions comes first. This can be achieved by properly draining the slopes by means of cutting vertical drains or a herring-bone system of channels or providing a special drainage tunnels to take off the water, so that rain water does not accumulate at the contact of the soil cover and the rock. (2) By saturation the soil becomes soft and attains an inherent weakness. So soil consolidation is of utmost importance. This can be done by planting certain types of trees like 'Robinia trees' (a pseudo acacia) and Hottentot fig plant. It would be advisable to take immediate steps not only to plant such trees as mentioned above but also to prevent haphazard felling of tree for tapioca and lemon grass cultivation. (3) Lastly comes the treatment of the unstable slopes either by contour bunding or terracing. In many cases this may be neither practicable nor economical. It is strongly recommended that such places of instability beyond repair be avoided for at least human habitation.

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ANNEX I.

Rainfall in August 1949 at the Todupulai

gauge station.
 The rain was very much in excess of the normal amount.
 The following are the amounts recorded in tenths of an inch.
Tenths of an inch Hundreds.

1	17	5
2	16	9
3	5	5
4	29	1
5	21	5
6	1	0
7	0	5
8	0	5
9	0	0
10	0	0
11	0	2
12	1	5
13	1	5
14	11	5
15	5	0
16	2	0
17	11	0
18	14	1
19	4	0
20	1	0
21	14	0
22	0	0
23	6	0
24	0	0
25	2	0
26	11	0
27	63	0
28	21	0
29	7	0
30	0	0
31	0	0
<hr/>		
	264	49
<hr/>		

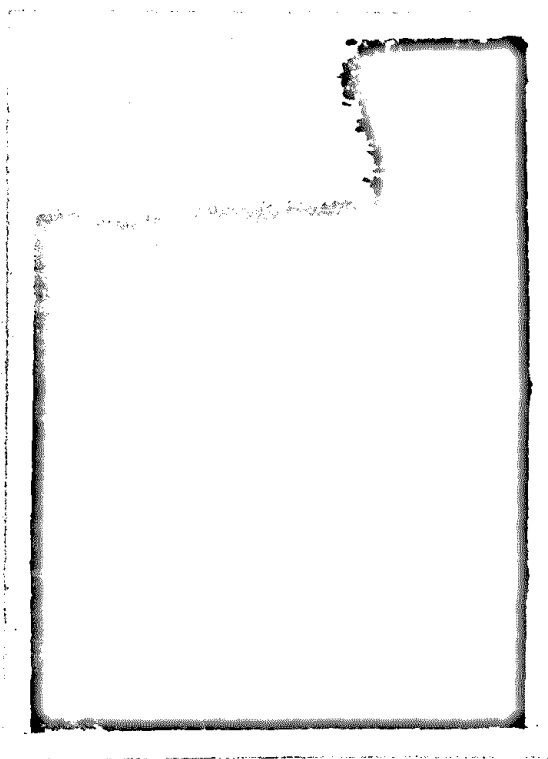
Annual rainfall in inches for the years 1946-49.

<u>Year</u>	<u>Rainfall in inches</u>
1946	182.15
1947	187.9
1948	168.82
1949	114.12 (upto 22-9-49)

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1. View of the slip face of the "Mandanam Hill"
 half a mile west of hill. 1629.
 N.K.N. Aiyengar.



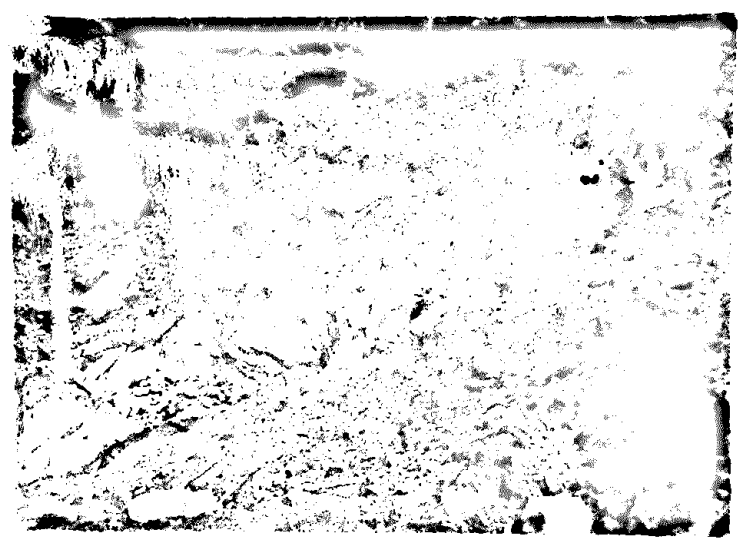
2-3. Views of the important levels...

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4-9. Illustrative views of the important land slips on the southern flank of Mudiamalai.

