

# Geological survey report of the Bisteutar and Jhyadi villages, Sindhupalchowk

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## Abstract

The geological survey was carried out in Bisteutar and Jhyadi villages in the Bhimtar area. These villages lie at latitudes 27.709 N and 27.707 N and longitudes 85.670 E and 85.676 E. Bisteutar village can clearly be separated into two morphologies, the side facing Indrawati river has alluvial deposits whereas the one facing Jhyadi khola has slaty phyllites. Jhyadi village has slaty phyllites lying over low grade sandstone. Cracks 5-10 centimeters in width and 2-3 meters in depth were observed in both the villages thus implying high probability of possible landslides in the monsoon season.

## 1 Introduction

The two villages: Bisteutar and Jhyadi were selected as the survey site as they suffered huge damages due to the earthquakes on the 25<sup>th</sup> of April and 12<sup>th</sup> of May. The plan is to adopt these two villages, so a geological survey was done to map the landslide hazard in the region. After interacting with the locals it was known that the landslides in Bisteutar only started occurring after the earthquakes. This implies that the shaking of the ground led to the creation of various ruptures along the sides of the mountain and thus the landslides.

Jhyadi village has not experienced a landslide yet but with various ruptures running along the length of the mountain, a big landslide this coming monsoon is quite probable.

## 2 Bisteutar village

Bisteutar village lies at an elevation of 600 to 740 meters. Two points were selected within this span to study the different morphologies. The side facing the Indrawati river has alluvium deposited by the river and it has slowly been uplifted. The underlying rock has a dip of 38° and a strike of 300°. As the dip implies the slope of the underlying rocks, the loose alluvium rests on a big gradient and is easily prone to landslides. This seems to be the most plausible reason for the occurrence of dry landslide after the recent earthquakes. This face also has big cracks measuring upto 7cm in length and at least 2-3 meters in depth. The soil is resting on a loosely compacted alluvium and is very prone to erosion.

The morphology changes at the ridge of the hill and the other side facing the Jhyadi river has very little alluvium and the underlying slaty phyllite can be observed at the surface. No cracks were visible on this side of the mountain and there are no landslides. The rocks on this face at the top as

well as the bottom have the same dip and strike, so it can be assumed that there are no big faults in between.

For habitation the side facing the Jhyadi river seems to be the safest option at least for this monsoon. As the full length of the hill was not traversed and only the cracks known to the locals were observed, the improbability of landslides occurring in this face can only be assumed with partial confidence.

### 3 Jhyadi village

Jhyadi village also lies at the same altitude but is much closer to the mountain face. The lower part of the mountain is composed of sandstones and the upper part has slaty phyllites that are quite similar to the ones in Bisteutar village. The stones are dipping only at  $18^\circ$  so this face of the mountain was relatively safe from landslides until now. However the earthquake has created two cracks along the length of the mountain and the currently habited area falls within these cracks.

The cracks are bigger than the one in Bisteutar and were upto 10 cm in width and at least 2-3 meters in depth (we didn't have a longer probing stick). The rocks in this mountain are low to medium grade metamorphic, so they are much better than the alluvium in Bisteutar but the cracks could lead to a massive landslide in the monsoon.

The inhabitants might be much safer if they are moved south from the section which contains cracks on both sides.

### 4 Discussion and Conclusion

After consulting the Department of mines and geology, the geo-morphology was known and it was found that the Bhimtar area mostly contains Benighat slate i.e. thinly graded dark grey to black slate, grey phyllites with bands of Jhiku carbonates. There are also traces of low grade metamorphosed clay rich mudstone. The soil is red and is high in ferric oxides.

The road section in Bisteutar is constructed on the face containing loose alluvial deposits without reinforcements has led to the exposure of the weak underlying sediments. As the loose sediments have a very low load bearing capacity, the land above is slowly subsiding and this has been further helped by the recent earthquake which created several fractures. This face of the hill will most probably experience big landslides coming monsoon and it is recommended to either move the settlements to the side facing Jhyadi khola or some other safe place.

In Jhyadi village the situation is not as bad as the one in Bisteutar but there is also a probability of a big landslide due to the deep cracks that run along the length of the hill. As the rocks are low to medium grade metamorphic, they have considerably higher load bearing capacity in comparison to the alluvial deposits. Initial survey suggests that the people should be moved south but a thorough investigation and creation of proper drainage and gabion walls in places could greatly minimize the landslide risk. Cost benefit analysis has to be done to compare the costs of relocation to geo-technical engineering.

## Appendix

The location, geological formation, landslides and the existing cracks in these two places can be observed in these pictures.

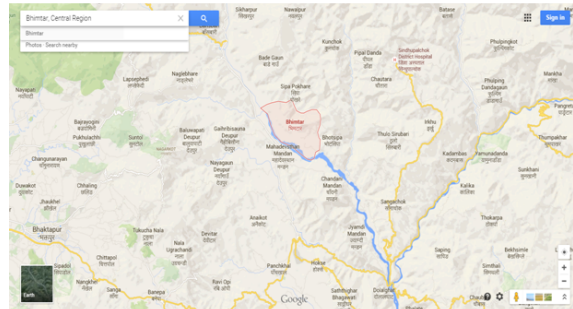


Figure 1: Bhimtar on google maps.

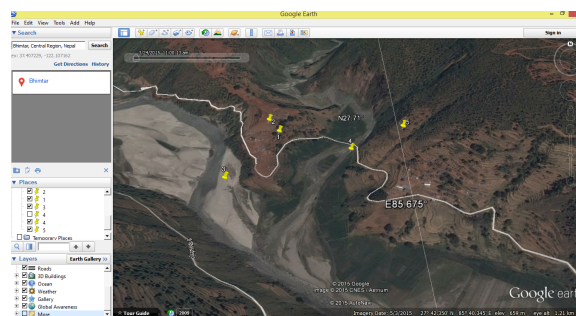


Figure 2: Places from where rock samples were taken (except point 3) during the survey.



Figure 3: Geo-morphological map of Bhimtar area, acquired from Department of Mines and Geology, Nepal.



Figure 4: Landslide with a span of 73 meters and height of 95 meters in the western (Indrawati facing) side of Bisteutar village.



Figure 5: One of the cracks on the western face of Bisteutar village hill.



Figure 6: The stable slaty phyllite face of the Bisteutar hill, which faces the Jhyadi river.



Figure 7: One section of the crack that runs along the length of the Jhyadi village hill.



Figure 8: Underlying sandstone at the base of the Jhyadi village.