



# THE UNIVERSITY OF THE WEST INDIES SEISMIC RESEARCH CENTRE

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## Report on visit to Morne Prosper, Dominica

19-20 May 2014

Prepared by

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## Introduction

In response to some landslips in the Morne Prosper area of Dominica, and the response of citizens in the area to the perceived threats resulting from geothermal exploration in the area, a request was made by the Acting Director of the Office of Disaster Management (ODM) for a team from The University of the West Indies Seismic Research Centre (UWI- SRC) to visit Dominica and further investigate the situation. The focus of the team was on determining, as far as possible, what the nature of the reported and observed incidents was, and to try to determine if there were any implications for the volcanic systems in the area. The SRC team comprised of Dr. Erouscilla Joseph and Dr. Frederic Dondin. They were accompanied in the field by Mr. Mandela Christian of the ODM, Dr. David Farrell and Shawn Boyce of the Caribbean Institute for Meteorology and Hydrology (CIMH), two members of the Dominica Geothermal Awareness Group, and two local villagers, one of whom (Mr. Joseph Fontaine) acted as a guide for the Morne Prosper area. The visit to Dominica took place during the 19 – 20 May 2014, with field visits to Morne Prosper, Watten Waven, and Laudat taking place on the 19 May, and a stakeholders meeting with various government officials and the staff of the Geothermal Unit held on the 20 May. The SRC team also met informally with members of the Geothermal Awareness Group on 20 May.



Fig. 1: Local villagers of Morne Prosper (left two) and members of the Geothermal Awareness Group (right two), who accompanied the SRC team on the site visit to Morne Prosper.

## Morne Prosper Site Visit

Reports on 7 – 8 May in online media sources of Dominica, indicated that several landslips had occurred in the Morne Prosper area, with reports of dead fish, land subsidence, and the presence of “blue sulphur” being evident. On visiting the area, a series of small to moderate landslides were observed within ~100 meters of a small river on the Robinson Estate. This area is situated in a very steep-sided valley at the base of Morne Watt and Morne Nichols. The materials comprising the landslides consisted

of very highly weathered volcanic material (possibly ash and breccias). The steep slopes of the valley, along with the volcanic origin of the soil, in addition to the undercutting of the base of the slopes by the river have created stratigraphic and lithologic conditions favouring the landslides. All indications are that this is a mass wastage problem, which is not unusual in Dominica or in any of the other islands of the Eastern Caribbean. We were informed by Mr. Fontaine that signs of these landslides may have been evident in the last 3 to 4 years, with cracks appearing on the slopes along sections of the river valley. Further inspection of the area revealed the presence of other similar near-vertical cracks along the river valley (Fig. 2), which are likely to be very unstable, particularly during periods of moderate to heavy rainfall.



Fig. 2: Near vertical cracks in the steep sided slopes of the Morne Prosper river valley.

Additionally, a network of well developed cracks (Fig. 3) punctuated by deep holes (cavities) were observed extending for several meters from the river valley towards the interior of the Estate. These are the areas described by villagers in the online reports as areas of land subsidence. It may be possible that with an increase in pore-water pressure along these cracks, within the weathered soil that decreased shear strength coupled with the added weight of water within the saturated mass, may lead to failure along these lines eventually.



Fig. 3: One of the cracks observed running throughout the Morne Prosper area.

The material being described as “blue sulphur” by the local villagers of the area was found to be highly weathered volcanic clays (Fig. 4), commonly found in volcanic areas in the Lesser Antilles.



Fig. 4: Clump of highly weathered volcanic rock, with a bluish coloured clay matrix that has been deposited in the river valley.

## Laudat Site Visit

The area of Laudat is near the site of geothermal exploration well, and we were led by the members of the Geothermal Awareness Group to a nearby river, to observe the geothermal activity in a shallow pond 30m x 15m in diameter and ~2m deep. This man-made pond was situated along the natural path of the river, with stream water freely flowing through it. It was created as a water reserve for use by the developers of the geothermal exploration site in Laudat, to be used for site operations. Members of the Geothermal Awareness group expressed concern about the geothermal activity observed in the pool, and how it may have been generated as a result of the geothermal drilling in the area.

Very low levels of geothermal activity was observed in the pool, which was expressed as very sporadic emissions of gas bubbles (likely to be mainly carbon dioxide), emanating from the river bed at the bottom of the pool (Fig. 5). The water in the pool was generally clear with only a slightly cloudy appearance. Temperatures taken along the edges of the pool indicated near ambient values of ~27.1°C.

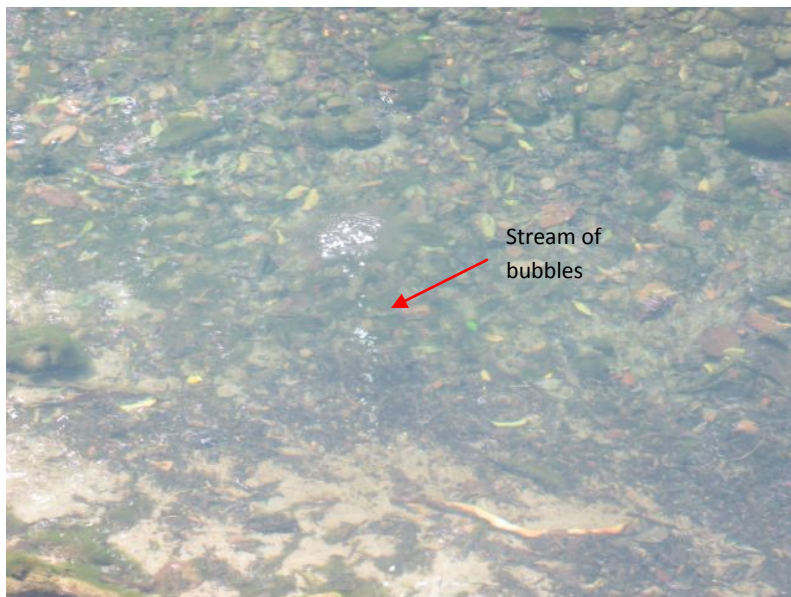


Figure 5: Stream of gas bubbles emanating from the river bed in Laudat.

Given the high level of geothermal activity in the Laudat area in general, it is likely that this type of low level degassing may exist throughout the area, and may now only be clearly noticeable at this site as a result of the additional depth of water created by the ponding, as compared to the normal shallow river depth. There is no clear evidence to link the geothermal activity in the pond to the activities resulting from the geothermal exploration in the nearby area. It is recommended that the pond be continually monitored for any changes in temperature and geothermal activity, as a precautionary measure.

## Watten Waven Site Visit

The highly vigorous Watten Waven geothermal area was visited to make general observations of the activity in the area. We were again led by members of the Geothermal Awareness Group to several sites in the area, which is also visited as part of SRC's regular geothermal monitoring programme in Dominica.

Observations of hot springs, pools, fumaroles and recreational geothermal pools in the area showed no visual signs of unusual activity (Fig. 6). Temperature and pH measurements taken of several of the regularly monitored features in area, revealed no unusual temperatures or changes in acidity as compared to what has been observed in the SRC's regular geothermal monitoring programme.

Concerns were raised by the Geothermal Awareness Group about the physical state (broken perimeter fencing and gate) of the unused geothermal borehole site at Watten Waven, and the strong hydrogen sulphide emissions possibly emanating from the site on occasion. They were also concerned about the possible effects of the nearby geothermal exploration activity in Laudat, on the state of activity at Watten Waven.



Figure 6: Measurements and observations of geothermal activity at Watten Waven.

### **Meeting with Government Stakeholders**

This meeting was attended by the staff of the Geothermal Unit, the Permanent Secretary for the Ministry of National Security, Mr. Nicholas Bruno, the Minister of Trade, Dr. Collin McIntyre (who is also the Parliamentary representative for the Watten Waven area), as well as Mr. Christian and Mr. Corriette of the ODM. The SRC team provided their general assessment of the situation in the Morne Prosper area and provided some recommendations to the group attending the meeting. While it was generally considered that the landslides were as a result of natural mass wastage in the area, additional signs of instability were observed and the area was still considered to be potentially hazardous, especially to members of the public who are not familiar with the area. One suggestion raised was having limited access to the area, by the villagers who use the area for farming. Continued monitoring of the area for signs of more landslides and their possible impact on the neighbouring areas, was also advised. The issue of stabilising the area was raised by Dr. McIntyre, however, the SRC team did not have the capacity to advise the group on this matter as it was outside of their expertise. It was suggested that the group from CIMH may be able to provide this type of advice.

The concerns raised by the Geothermal Awareness Group was brought to the attention of the group, and while the assessment of geothermal activity at both Laudat and Watten Waven was considered to be normal for fairly active geothermal areas, some caution was advised in the way forward to help assess any future activity. Recommendations were made to increase the environmental monitoring currently being done, including more frequent measurements of hydrogen sulphide in the air and the chemical composition of the waters in the areas around the geothermal sites, in both Laudat and Watten Waven. It was also recommended that the results of the monitoring efforts should be communicated in a timelier manner to the public, and a communication strategy be developed to relay the information being provided by the Geothermal Unit. Additionally, the value of implementing a seismic and ground deformation monitoring network in the areas being developed was raised as possibly being able to provide an ongoing assessment of the effects of the geothermal exploration activity, on the neighbouring areas. It was mentioned that SRC had provided a proposal to the Geothermal Unit to conduct this type of baseline monitoring in the areas being developed for geothermal exploration, however, no response to the proposal had been received to date. The Head of the Geothermal Unit stated that there were some clarifications on the proposal that was needed, as the Unit did not want to duplicate the efforts of the ODM in relation to the SRC, regarding seismic monitoring on Dominica. The point was raised by both Mr. Corriette and Dr. Joseph that no duplication of monitoring efforts were proposed, and the type of seismic monitoring advised in the proposal was clearly different from that currently being used for monitoring tectonic and volcanic activity on Dominica. The Geothermal Unit was advised to contact, in writing, the Director of SRC regarding any questions/concerns about the proposal for additional clarification.

### **Meeting with Geothermal Awareness Group**

This informal meeting was held to facilitate questions and concerns raised by the Geothermal Awareness Group regarding the potential impacts of the geothermal exploration activity on the natural geothermal systems in the areas being developed. Concerns were also raised on the manner in which the geothermal development activities were implemented, specifically the undertaking of pre-assessment monitoring of the areas prior to actual drilling in the areas selected. Another concern raised was the lack of availability of information regarding the environmental monitoring data being gathered by the developers, to the general public, especially to residents in the areas affected. A major issue raised by the Group was the belief that the way in which the geothermal exploration was conducted, has been in breach of the Geothermal Act of Dominica.

While the SRC could not provide any advice on the legal concerns raised, the need for better communication of the environmental monitoring data being collected by the geothermal developers, to the public was a point that we agreed to articulate in our report.

### **Conclusion**

The SRC's visit to Dominica enabled our assessment of the nature of the reported and observed incidents at Morne Prosper, as being primarily an issue of natural mass wastage. It was also determined that there were no immediate implications for the geothermal system in the area of Watten Waven.

There were no signs of volcanic activity related to the landslides, nor any signs of increased geothermal or volcanic activity in Watten Waven or Laudat as a result of the landslides in Morne Prosper. Continued physical and geochemical monitoring by the Geothermal Unit, in the areas being developed for electricity production, is recommended in order to assess any potential changes to these areas that may have resulted from such development.