

The Lusi mud volcano of Java, Indonesia, 2006

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Professor Davies delivered an articulate review of the Lusi eruption of mud in Java for the NEGS members. Using the example, he developed our awareness of the risks associated with the recovery of fossil energy. The ongoing Lusi eruption now covers 7 sq.kms and has been responsible for death, displacement of thousands of local inhabitants and the loss of their homes. The eruption initially was rich in mud with some gas; today the gas element is more significant.

When the eruption occurred it was proposed that a 6.3 seismic event 3 days earlier and 150 miles away could have been responsible. Analysis of similar events suggests this is most unlikely. More probable was the drilling process that had been employed.

The erupted mud is controlled by massive bunds, now brick reinforced, together with some removal of mud to offshore sites. The area of the eruption is now subsiding creating a caldera like depression with new, smaller mud / water type eruptions associated with the subsidence. 200 such events are logged. The techniques used to control the eruption have not been effective. Only one of the companies involved in the drilling (Lopindo) remains involved, this is an Indonesian company. Some compensation has been provided to local inhabitants but no liability has been accepted.

The cause of the eruption might be due to the drilling process. The area sits on Pliocene deposits of mud and volcanoclastic material; this lies above a limestone aquifer. Sedimentation of the surface materials was rapid limiting normal lithification / diagenetic processes that allowed water to remain in the sediments. Whilst the initial well was well cased, as it went deeper a decision not to encase the drill hole was made, this reduced the ability to control a possible eruption. In the early hours of the day a significant 'kick' occurred, this was not acted on quickly. One explanation of what may have happened is that the pressure at depth exceeded the rock strength so hydraulic fracturing occurred allowing the hydrous fluid to migrate towards the surface over a 24-hour period. The well blow out preventer worked but control was lost as the pressure fractured the rock. It seems likely that the limestone aquifer had been breached providing massive quantities of water that exploited the fracturing.

Analysis of the situation has suggested there may be sufficient pressure to maintain the eruption of mud for 26 years. The increase of gas and the pulsing nature of the gas flow however may indicate a quicker end to the eruption.

The area has buried mud volcanoes that could have warned the present drilling operation to be aware of the risk.

In summary the situation demonstrates the characteristics of disasters, a number of actions and decisions taken, (rock strength, use of a dense drilling mud, gas pressure, missed early warning sign, ownership of the operation) in sequence, together with underestimation of the controlling conditions to produce a so-called Black Swan scenario of disaster. The understanding of the causes of the eruption reflects the work of several centres around the world.

Images and additional information are available at the following web sites:

1. [Lusi Mud Volcano, Indonesia : Image of the Day](http://earthobservatory.nasa.gov/IOTD/view.php?id=42526)
earthobservatory.nasa.gov/IOTD/view.php?id=42526
1. [Mud Volcano In Java May Continue To Erupt For Months And ...](http://www.sciencedaily.com/releases/2007/01/070123181953.htm)
www.sciencedaily.com/releases/2007/01/070123181953.htm