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### **Mud volcano in Java may continue to erupt for months and possibly years**

The first scientific report into the causes and impact of Lusi, the Indonesian mud volcano, reveals that the 2006 eruption will continue to erupt and spew out between 7,000 and 150,000 cubic metres of mud a day for months, if not years to come, leaving at least 10 km<sup>2</sup> around the volcano vent uninhabitable for years and over 11,000 people permanently displaced.

The paper by a Durham University-led team and published in the February issue of US journal, *GSA Today*<sup>1</sup>, reveals that the eruption was almost certainly manmade and caused by the drilling of a nearby exploratory borehole<sup>2</sup> looking for gas, reinforcing the possible explanation in a UN report<sup>3</sup> from July last year.

The mud volcano, known locally as 'Lusi', has been erupting for 239<sup>4</sup> days and has continued to spew between 7,000 and 150,000 cubic metres of mud out every day, destroying infrastructure, razing four villages and 25 factories. Thirteen people have also died as a result of a rupture in a natural gas pipeline that lay underneath one of the holding dams built to retain the mud. It first erupted on 29 May 2006 in the Porong subdistrict of Sidoarjo in Eastern Java, close to Indonesia's second city of Surabaya.

The team of mud volcano and pressure experts, who analysed satellite images of the area for their study, propose that a local region around the central volcano vent will collapse to

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<sup>1</sup> Published by the Geological Society of America

<sup>2</sup> The borehole is owned by Indonesian gas company Lapindo Brantas

<sup>3</sup> As reported in *Environmental Assessment: Hot Mud Flow East Java, Indonesia. Final Technical Report: United Nations Disaster Assistance and Coordination mission in June and July 2006 and Follow up mission in July 2006*. 2006, published by Joint UNEP/OCHA Environment Unit.

<sup>4</sup> As at 23 January 2007

form a crater. In addition an area of at least the dimensions of the flow (10km<sup>2</sup>) will probably sag over the next few months and years.

Seepage of mud and water are common on earth but usually a preventable hazard when exploring for oil and gas.

Mud volcano expert, Professor Richard Davies of Durham University's Centre for Research into Earth Energy Systems (CeREES) comments: "It is standard industry procedure that this kind of drilling requires the use of steel casing to support the borehole, to protect against the pressure of fluids such as water, oil or gas. In the case of Lusi a pressured limestone rock containing water (a water aquifer) was drilled while the lower part of the borehole was exposed and not protected by casing. As a result rocks fractured and a mix of mud and water worked its way to the surface. Our research brings us to the conclusion that the incident was most probably the result of drilling."

"Lusi is similar to a 'blow-out' (eruption of water at the surface) that happened offshore of Brunei in 1979. Just as is most probably the case with Lusi, the Brunei event was caused by drilling and it took an international oil company almost 30 years and 20 relief wells and monitoring before the eruption stopped."

Prof. Davies continued: "Up to now scientists have known relatively little about mud volcanoes and Lusi has provided the first opportunity for experts to study one from birth onwards. Our work offers a clearer understanding of how they are created and what happens when they erupt. We hope that the new insights will prove useful to the oil and gas industry, which frequently encounters pressurised fluid in rock strata that could, if not controlled, force their way to the surface during exploration drilling. Ultimately we hope that what we learn about this incident can help insure it is less likely to happen again."

The team from Durham, Cardiff and Aberdeen Universities and GeoPressure Technology Ltd, an Ikon Science company, has essentially discounted the effect of an earthquake which occurred in the region two days prior to the mud volcano as the cause of the eruption. This is based on the time-lapse between the earthquake and the eruption, the fact that there were no other mud volcanoes in the region following the earthquake and through comparison with other geological examples.

## Ends

### For further information please contact

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### Notes to editors

This news release is based on the findings published in the paper: *Birth of a mud volcano: East Java (29 May 2006)*. Davies, R.J et al; GSA Today v. 17, no 2 (2007) 4-9 published by the Geological Society of America. Link to paper - <http://www.gsaajournals.org/perlserv/?request=get-toc&issn=1052-5173&volume=17&issue=2>

The team involved in the study was made up of: Richard J. Davies, CeREES (Centre for Research into Earth Energy Systems), Durham University, Richard E. Swarbrick, Geopressure Technology Ltd, an Ikon Science company, Robert J. Evans, School of Earth, Ocean and Planetary Sciences, Cardiff University and Mads Huuse, Department of Geology and Petroleum Geology, University of Aberdeen.

### About mud volcanoes

Mud volcanoes are extrusions of a water and mud mix on the earth's surface that form cone-shaped volcanoes. These can be metres to kilometers wide and metres to hundreds of metres thick. They commonly occur in convergent tectonic settings, such as Azerbaijan, in front of deltas, such as the Mississippi and due to the gravitational collapse of continental margin sediments such as the Niger Delta.

### About CeREES

CeREES aims to be a world leading research centre in petroleum and sustainable energy sources. Opened in 2006, it works closely with other research groups to create and transfer knowledge through innovative, cross-disciplinary research programmes & education.

### About Durham University

Founded in 1832, Durham University aims to provide internationally recognised research, scholarship and learning within a distinctive collegiate environment. Based on two sites in Durham city and Stockton on Tees in the North East of England it has 15,000 students, employs 3,000 staff, has created 16 spin out companies since 2000 and has an annual turnover of over £175m, making it the equivalent of a top 50 North-East business.

The University is collegiate, with colleges providing residential, social and welfare facilities for their student members, and creating a sense of community for staff and students together.