

# Coal-mining hazard resembles explosive volcanic eruption, study shows

October 1 2009

---

Worldwide, thousands of workers die every year from mining accidents, and instantaneous coal outbursts in underground mines are among the major killers. But although scientists have been investigating coal outbursts for more than 150 years, the precise mechanism is still unknown.

New research by scientists at the University of Michigan and Peking University in Beijing, China, suggests that the outbursts occur through a process very similar to what happens during explosive volcanic eruptions. The research is described in a paper in the October issue of the journal *Geology*.

"Just as magma can fragment when pressure on it is reduced, triggering an explosive eruption, gas-rich coal can also erupt when suddenly decompressed, as happens when excavation exposes a new layer of coal," said Youxue Zhang, professor of geology, whose previous work on volcanic eruptions, Africa's "exploding lakes" and theorized methane-driven ocean eruptions set the stage for the current research.

Zhang did much of the work on the coal outburst project in 2006 and 2007, during a part-time professorship at Peking University. Around that time, a number of deadly coal mine accidents---in China, Russia and the United States---had made headlines, and just before leaving for China in 2006, Zhang had printed out articles about the disasters to read during his flight.

"While reading a paper describing coal outbursts as violent ejection of pulverized coal particles and gas, the similarity of coal outbursts to magma fragmentation suddenly occurred to me," Zhang said.

When he arrived at Peking University, he discussed the idea with colleague Ping Guan, and the two decided to collaborate on experiments simulating coal outbursts. Zhang recruited undergraduate student Haoyue Wang to help with the project, in which the researchers used a shock tube apparatus similar to the one Zhang had used in previous experiments on explosive volcanic eruptions. Their experiments verified that coal outbursts are driven by high gas pressure inside coal and occur through a mechanism similar to magma fragmentation.

Before an explosive [volcanic eruption](#), magma (molten rock in Earth's crust) contains a high concentration of dissolved gas, mainly water vapor. When pressure on the magma is reduced, as happened in the 1980 eruption of Mount St. Helens when overlying rock was suddenly removed, gas bubbles in the magma rapidly expand. Pressure is higher inside the bubbles than in the surrounding magma, and when pressure on the bubble walls builds to the breaking point, the bubbles burst and the magma fragments into pieces in an explosive eruption.

In deep coal beds, coal contains high concentrations of the gases carbon dioxide and [methane](#). When a coal seam is exposed, pressure on the coal is reduced, but pressure on the gas inside the coal remains high. When the resulting stress exceeds the coal's strength, the coal fragments, releasing high-pressure gas that suddenly decompresses, ejecting outward and carrying pulverized coal with it.

The first recorded coal outburst was in France in 1834. Since then, outbursts have occurred in China, Russia, Turkey, Poland, Belgium, Japan and about a dozen other nations. They happen only in deep mines where coal contains gas at high pressure, but as deeper coals are mined

to satisfy the world's energy demands, the risk of outbursts increases.

"Knowing the mechanism of coal outbursts is the first step toward predicting and preventing such disasters," said Zhang.

Next, the researchers plan more experiments to verify their results. Then, they hope to capture details of the outbursts with a high-speed camera and to study a variety of [coal](#) types from different mines.

More information: *Geology* -- [geology.gsapubs.org](http://geology.gsapubs.org)

Source: University of Michigan ([news](#) : [web](#))

Citation: Coal-mining hazard resembles explosive volcanic eruption, study shows (2009, October 1) retrieved 9 May 2024 from <https://phys.org/news/2009-10-coal-mining-hazard-resembles-explosive-volcanic.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.