Signs of eruption found off Oregon shores

Braving winter seas whipped to a fury by El Niño-powered storms, a crew of oceanographers visited a submerged volcano this month and pulled up evidence of a recent eruption some 500 kilometers west of the Oregon coast.

"We were very fortunate to get anything," says Robert W. Embley of the National Oceanic and Atmospheric Administration (NOAA) in Newport, Ore. The wind and waves were rough enough to break a plug in the ship's hull, allowing water to pour in and ruin two computers.

The research vessel *Wecoma* set off on Feb. 9 for Axial volcano, a broad-shouldered mountain whose summit rises to within 1,350 meters of the ocean surface. Axial has captured the attention of marine scientists over the last few years because it appears to be active and it sits directly atop a section of the midocean ridge system. Along the length of this 65,000-km chain girdling the globe, the seafloor spreads apart to form new ocean crust.

Arriving at the volcano, the researchers discovered a dramatic increase in the amount of warm water spewing out of the summit depression, called a caldera. They also found microscopic shards of glassy rock in the fluids, suggesting that fresh molten rock had forced its way up through the crust and erupted on the seafloor within the last month. The team could not collect proof of an eruption because *Wecoma* lacks equipment to image the seafloor.

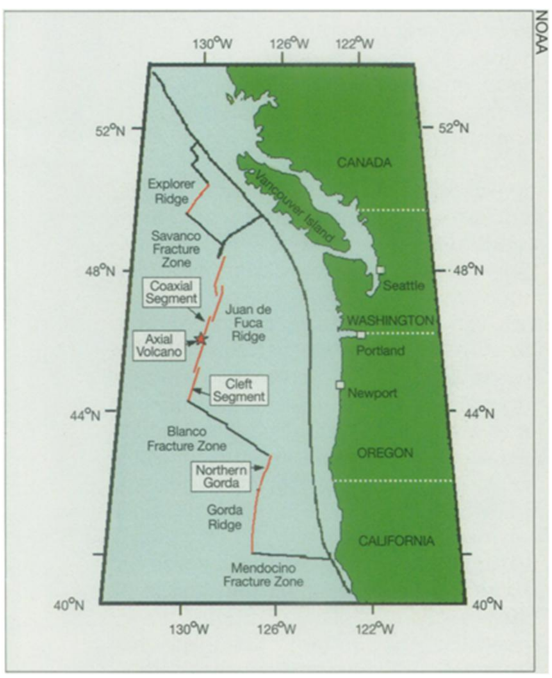
Researchers at NOAA first detected hints of the recent activity at Axial volcano on Jan. 25, when an underwater network of microphones picked up a flurry of earthquakes coming from the caldera. The earthquake swarm continued for more than a week, sometimes spawning more than 100 quakes per hour. The majority ranged in size between magnitude 2 and 3, although three quakes exceeded magnitude 4, says Christopher Fox of NOAA.

This is the third time marine scientists have detected quake swarms on the underwater sound surveillance system. The NOAA team observed swarms in 1993 north of Axial and then in 1996 southeast of the volcano. In both previous cases, researchers quickly visited the sites and documented recent eruptions.

The event at Axial volcano will yield more detailed information than the previous eruptions because scientists have been collecting baseline data at the volcano and can therefore evaluate how it has changed, says Edward T. Baker of NOAA in Seattle, a chief scientist on the *Wecoma*.

Last summer, Baker and his colleagues tethered instruments to the seafloor on top of Axial volcano. If the devices have survived the eruption, they will provide data about water currents and temperature, earthquakes, and seafloor tilting and spreading. The researchers will return to the volcano this summer with underwater cameras to image the ocean bottom and to collect the sensors. "That's going to be a crushing blow if we have all these instruments there and they turned out to be too close [to the eruption]," says Baker.

Although Axial forms part of the global midocean ridge, most other ridge segments do not form broad, high volcanoes, says Rachel M. Haymon, a marine geologist at the University of California, Santa Barbara. Nonetheless, the activity at Axial can help scientists learn lessons about the eruptions creating new crust along the ridge system. "It's so hard to document what is going on down there. To have some evidence of it is important," she says. —*R. Monastersky*



NOAA

The boxes on this map indicate sites of volcanic activity.

Working memory makes a spatial move

Spirited debate surrounds the theory that the human prefrontal cortex, a slice of brain tissue just behind the forehead, takes charge of working memory, which temporarily holds and organizes information needed for tasks such as reading or driving a car.

A new study places two distinct types of working memory, one for objects and the other for spatial relations, in separate parts of the prefrontal cortex. The exact location of spatial working memory in humans had escaped notice in the past because it lies some distance from the location of spatial working memory in monkeys, which had already been identified, according to neuroscientist Susan M. Courtney of the National Institute of Mental Health in Bethesda, Md., and her colleagues.

Brain tissue involved in spatial working memory was pushed up and back during human evolution as other prefrontal regions grew in size, the researchers theorize. Prefrontal expansion apparently aided complex problem solving and planning for the future.

Building on prior work (SN: 4/26/97, p. 258), Courtney's group used functional magnetic resonance imaging to measure second-by-second oxygen consumption in the brains of 11 volunteers during memory tasks. Rises in oxygen use signal heightened neural activity.

On a spatial memory task, participants saw a series of three faces presented at various spots on a computer screen for 2 seconds each; after waiting 9 seconds, they viewed another face and indicated whether its location matched that of any of the prior faces. On a face memory task, volunteers indicated whether the final face was the same as any of the earlier faces.

Different prefrontal areas showed activity hikes during each task, the scientists report in the Feb. 27 SCIENCE. As in monkeys, the human spatial memory area straddles a neural site that controls eye movements, they say.

Some scientists, such as Patricia S. Goldman-Rakic of Yale University, agree that separate prefrontal regions handle working memory for objects and spatial relations in monkeys and humans.

Others, like Michael Petrides of McGill University in Montreal, argue instead that separate prefrontal areas in humans foster either immediate applications of all types of working memory or more extended manipulation of working memory contents. —*B. Bower*

J. Haxby/NIMH

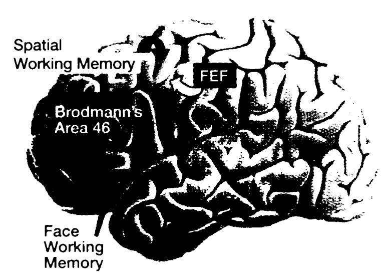


Image shows human brain areas involved in spatial and face working memory and control of eye movements (FEF). Brodmann's area 46 is linked to spatial working memory in monkeys.