NEWS RELEASE
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VOLCANIC ACTIVITY BENEATH PACIFIC OCEAN MAY INDICATE EARTH'S UPPER MANTLE IS MORE "LIQUEFIED" THAN PREVIOUSLY THOUGHT

Study findings by research team including SOEST scientist to be published in Science; available online now through Science Express

HONOLULU – University of Hawai'i at Mānoa researcher Stephanie Ingle and a team of scientists from Japan and California have found evidence for the existence of partial melt in the Earth's upper mantle beneath the Pacific Ocean near Japan. Using geophysical and geochemical data and age dating techniques, the team determined that volcanoes found in this region should only exist if the upper mantle is naturally in a partially molten state.

The study, to be published in the journal *Science* and previewed online now in *Science Express*, reports the discovery and implications of young volcanoes located far from tectonic settings where volcanism normally occurs.

Rigid tectonic plates move around the Earth on top of the ductile asthenosphere, the top of the convecting portion of the mantle which acts as their conveyer belt. Tectonic plates are destroyed as they sink beneath other plates along subduction zones. Although volcanism is expected on the overriding plate, it is not expected on the subducting plate itself, and the team has found volcanoes in just such a location. The study explains their presence by the tapping of pre-existing melt from Earth's asthenosphere as the plate flexes and fractures when entering the subduction zone. The presence of partial melt in the asthenosphere remains controversial.

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"Many of the volcanic rocks from the sea floor that we found and sampled are chock full of holes called vesicles. Vesicles form when gases escape from erupting lava, so this provides strong evidence for gas presence in the upper mantle. The existence of gas permits, if not requires, the asthenosphere be in a partially molten state," says Ingle. "Also, the volcanoes are age-progressive, meaning that as the plate enters a region where stress conditions are ripe for fracturing, there should be new volcanism and older volcanoes would be closer to the subduction zones. This is, in fact, what we observed—a range of older volcanoes closer to the subduction zone with progressively younger ones away from it."

The study adds constraints on the physical state and composition of Earth's upper mantle. If the teams' hypothesis is correct, scientists should expect to find similar volcanoes anywhere these tectonic conditions exist. The discovery of these tiny volcanoes near the Japanese margin is, in part, a result of it being the most closely scrutinized margin in the world. Therefore, it is not so surprising that such tiny features have yet to be observed elsewhere.

The study of these small volcanoes was carried out by the team's principal investigator, Dr. Naoto Hirano of the Tokyo Institute of Technology, who is currently working at Scripps Institution of Oceanography in La Jolla, Calif., and was supported by the Japanese Society for the Promotion of Science and the Japanese Ministry for Science, Technology, and Sport. Co-authors include researchers from Tokyo Institute of Technology, Japan; JAMSTEC, Yokosuka, Japan; the University of Hawai'i; Kyoto University, Japan; University of Tokyo; and Shimane University, Matsue, Japan.

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