Electricity generated by earthquakes might be the secret behind giant gold nuggets

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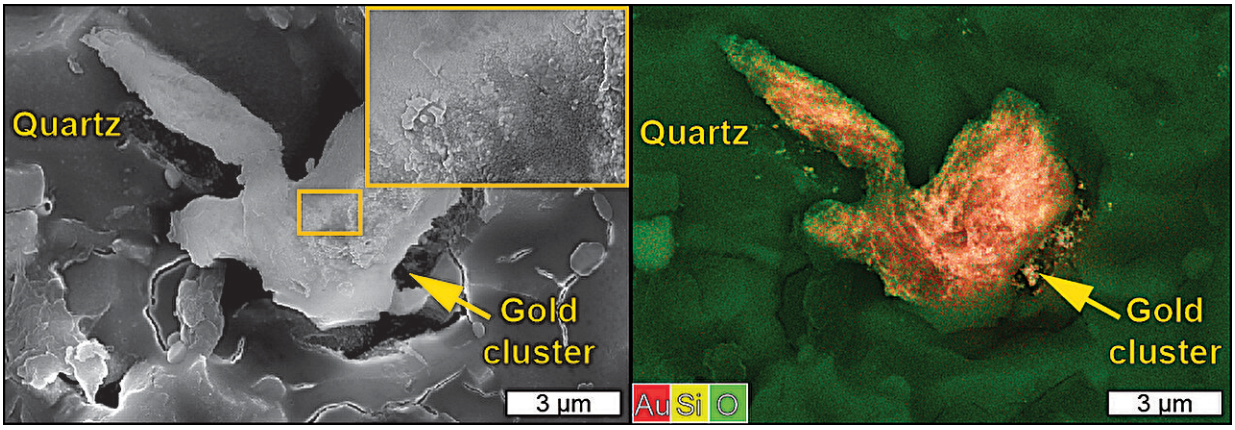

Credit: Dr. Chris Voisey

Scientists have long been fascinated by the formation of gold nuggets, often found nestled within quartz veins. New research led by Monash University geologists suggests that the process might be even more electrifying than we previously thought—literally.

Gold nuggets, prized for their rarity and beauty, have been at the heart of gold rushes for centuries.

The study is led by Dr. Chris Voisey from the Monash University School of Earth Atmosphere and Environment and will be published in *Nature Geoscience*.

"The standard explanation is that gold precipitates from hot, water-rich fluids as they flow through cracks in the Earth's crust," said Dr. Voisey.

"As these fluids cool or undergo chemical changes, gold separates out and becomes trapped in quartz veins," he said.

"While this theory is widely accepted, it doesn't fully explain the formation of large gold nuggets, especially considering that the concentration of gold in these fluids is extremely low."

The research team tested a new concept, piezoelectricity. Quartz, the mineral that typically hosts these gold deposits, has a unique property called piezoelectricity—it generates an electric charge when subjected to stress. This phenomenon is already familiar to us in everyday items like quartz watches and BBQ lighters, where a small mechanical force creates a significant voltage. What if the stress from earthquakes could do something similar within the Earth?

To test this hypothesis, researchers conducted an experiment designed to replicate the conditions quartz might experience during an earthquake. They submerged quartz crystals in a gold-rich fluid and applied stress using a motor to simulate the shaking of an earthquake. After the experiment, the quartz samples were examined under a microscope to see if any gold had been deposited.

"The results were stunning," said study co-author Professor Andy Tomkins, from the Monash University School of Earth, Atmosphere and Environment.

"The stressed quartz not only electrochemically deposited gold onto its surface, but it also formed and accumulated gold nanoparticles," he said.

"Remarkably, the gold had a tendency to deposit on existing gold grains

rather than forming new ones."

This is because, while quartz is an electrical insulator, gold is a conductor.

Once some gold is deposited, it becomes a focal point for further growth, effectively "plating" the gold grains with more gold.

"Our discovery provides a plausible explanation for the formation of large gold nuggets in quartz veins," said Dr. Voisey.

As the quartz is repeatedly stressed by earthquakes, it generates piezoelectric voltages that can reduce dissolved gold from the surrounding fluid, causing it to deposit.

Over time, this process could lead to the formation of significant gold accumulations, ultimately producing the massive nuggets that have captivated treasure hunters and geologists alike.

"In essence, the quartz acts like a natural battery, with gold as the electrode, slowly accumulating more gold with each seismic event," said Dr. Voisey.

This process could explain why large gold nuggets are so often associated with quartz veins formed in earthquake-related deposits.

This new understanding of gold nugget formation not only sheds light on a longstanding geological mystery but also highlights the interrelationship between Earth's physical and chemical processes.

More information: *Nature Geoscience* (2024). www.nature.com/articles/s41561-024-01514-1

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