Natural deep earth pump fuels earthquakes

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For the first time scientists have discovered the presence of a natural deep earth pump that is a crucial element in the formation of ore deposits and earthquakes.

The process, called creep cavitation, involves fluid being pumped through pores in deformed rock in mid-crustal sheer zones, which are approximately 15 km below the Earth's surface.

The fluid transfer through the middle crust also plays a key role in tectonic plate movement and mantle degassing.

The discovery was made by examining one millimetre sized cubes of exposed rock in Alice Springs, which was deformed around 320 million years ago during a period of natural mountain formation.

The evidence is described in a paper published in the latest edition of *Nature* entitled Creep cavitation can establish a dynamic granular fluid pump in ductile shear zones.

One of the paper's author's CSIRO Exploration and Mining scientist Dr Rob Hough said that this was the first direct observation of fluids moving through the mid-crustal shear zone.

"We are seeing the direct evidence for one of the processes that got ore forming fluids moving up from the mantle to the shallow crust to form the ore deposits we mine today, it is also one of the mechanisms that can lead to earthquakes in the middle crust," Dr Hough said.

Research leader Dr Florian Fusseis, from the University of Western Australia, said that the discovery could provide valuable information in understanding how earthquakes are formed.

"While we understand reasonably well why earthquakes happen in general, due to stress build-up caused by motions of tectonic plates, the triggering of earthquakes is much more complex," Dr Fusseis said.

"To understand the 'where' and 'when' of earthquakes, the 'how' needs to be understood first. We know that earthquakes nucleate by failure on a small part of a shear zone."

Dr Fusseis said that while their sample did not record an earthquake it gave them an insight into the structures that could be very small and localized precursors of seismic failure planes.

The discovery was made possible through the use of high-resolution Synchrotron X-ray tomographic, scanning electron microscope observations at the nanoscale and advanced visualisation using iVEC in Western Australia.

The authors of the paper propose that the fluid movement, described as the granular fluid pump, is a self sustaining process where pores open and close allowing fluid and gas to be pumped out.

Source: CSIRO Australia