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E N V I R O N M E N T

Geothermal Systems:

Getting into Hot Water

Water is an essential component of the Earth's crust and is involved in many geological processes that occur over a wide range of temperatures and pressures.

But in spite of its importance, says St. Francis Xavier University Professor Alan Anderson, our understanding of geological fluids and how they interact with the Earth's crust is very basic.

"More detailed knowledge of the chemical properties of these fluids at extreme conditions is needed to more effectively model processes such as the transport and deposition of ore metals," Anderson says. Such an understanding will ultimately enhance our ability to predict where large accumulations of valuable commodities such as gold and other metals may be concentrated in rocks below the surface. In addition, knowing how metals are dissolved in hot water will help to solve problems such as corrosion in boilers.

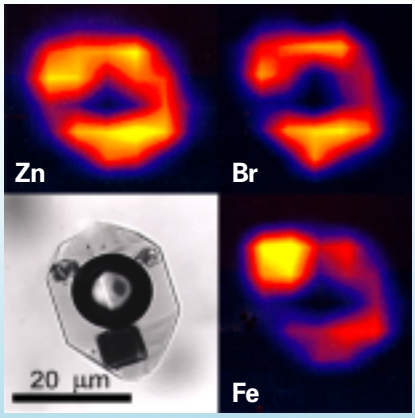
Anderson received his Ph.D. from Queen's University and went on to work at the Fluids Research Laboratory at Virginia Tech for two years before moving to St. Francis Xavier, where he was worked since 1989.

He is trying to learn more about geological processes by using the Canadian Light Source to study experimental fluids at high temperatures and pressures, and to analyse fluid inclusions (tiny bottles of fluids) trapped within crystals.

Synchrotron radiation is used to determine the local structure surrounding metals dissolved in hot water. It is also a powerful tool for measuring the composition of fluid inclusions and small experimental samples. This information, he says, is invaluable to understanding how and where ore metals will be concentrated by hot fluids in nature.

"We want to be able to predict where ore metals will precipitate and where ore deposits may have formed in the crust of the earth," he says.

Using an instrument known as the diamond anvil cell, Anderson can recreate the conditions existent in Nature's laboratory, and he can do direct measurements on hot fluids under great pressures by using synchrotron generated x-rays. "This opens new opportunities to explore how our planet works," he says.



ALAN ANDERSON

A PHOTOGRAPH OF A FLUID INCLUSION (LOWER RIGHT) SURROUNDED BY IMAGES WHICH SHOW THE DISTRIBUTION OF THE ELEMENTS ZINC (Zn), BROMINE (Br) AND IRON (Fe) IN THAT INCLUSION. THE IMAGES WERE OBTAINED BY USING A SYNCHROTRON X-RAY MICROPROBE.

Synchrotron Science Applications

- Reducing corrosion in boiler plant pipes
- Better management of geothermal reserves
- New technologies for toxic waste destruction
- Analyzing ore samples to aid in mineral exploration