A novel portable simulated rover platform (SimRP) for astrobiology exploration rover development

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A novel simulated rover platform (SimRP) has been developed as part of an effort to provide a portable, stable instrument testing platform for space flight instrument development and remote sensing in extreme environments. Sample acquisiton, handling, extraction and contamination control issues are all addressed by this platform. This will allow the laboratory methods of biology and biotechnology to be applied to terrestrial environments and provide instrument development for solar system exploration. The SimRP platform consists of an aluminum frame that breaks down for travel, with a standard threaded hole pattern to mount a wide variety of instruments and systems. Commercially available products are used to provide power, control and data handling, and imagery. Control and monitoring of all devices and instruments is performed through a single user interface. The software is written in a modular fashion which simplifes the process of changing devices in the instrument suite. An ultrasonic drill that both cores and meters sample to a sample handling chamber is attached to a robotic arm. Robot arm operator training can be performed in field conditions using this system. Aseptic conditions for microbiological experiments can be maintained through the use of sterile-air-inflatable glove bags, which enclose the instrument suite while allowing user access.

Future work on upgrading the SimRP platform includes remote operation of the platform through a web page interface, as well as automated sample handling. The web page format allows near-real-time operation of the platform in a field environment by researchers from any location with Internet access. In addition, the interface allows outreach participation by students or other observers during actual operation of the platform in field locations around the world.

Information presented will include description of the SimRP and its systems, the instrument suite, and relevant collected data, including intial results of field-based DNA extraction, amplication and visualization of target microbial genes coupled with ATP luminometry.

Copper carried in CO_2-bearing vapour? Microanalytical characterization of fluid inclusions from the Grasberg porphyry copper-gold deposit, Irian Jaya, Indonesia

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Brine-vapour separation is widely accepted to play a key role in metal transport and deposition in porphyry copper systems. Recently the vapour phase has been determined to carry significant amounts of copper and gold compared with the coexisting brine (e.g., Ulrich et al., 1999). Our laser Raman results indicate that most vapour inclusions in the Grasberg porphyry copper-gold deposit, Irian Jaya, Indonesia are CO_2-bearing, and that they contain one or more solid phases such as chalcopyrite. Coexisting brine inclusions may contain up to seven different solid phases including anhydrite, calcite, magnetite, hematite, chalcopyrite and/or other unknown minerals in addtion to halite and sylvite. Both PIXE (proton-induced X-ray emission) and laser ablation ICP-MS results indicate greater amounts of Na, K, Ca, Mn, Fe, Zn, Ba and Pb in brine inclusions than in CO_2-bearing inclusions, which are enriched in Cu. In some brine inclusions, the vapour bubble disappears upon heating to a few tens to hundreds of degrees above halite dissolution at about 600ºC (appoximately 70 wt.% NaCl equiv.). Very high entrapment temperatures (> 800ºC) and direct derivation from magma of these high-salinity brine inclusions have been controversial. In this study, however, the coexistence of very high-temperature, high-salinity brines and CO_2-bearing fluids is believed to indicate immiscibility at low pressures from magma-derived fluids from a deep chamber. Comparison of PIXE images of CO_2 (without visible water) and CO_2-H_2O inclusions indicates the presence of copper in CO_2-bearing fluids and sulphides. It is unclear what kind of Cu speciation was stable in the solution. Possibilities include $[Cu(H_2O)_6]^{2+}$, $[CuCl_2]^{1-}$, or $[CuCl(H_2O)]$ below 400ºC (Mavrogenes et al., 2002), or even sulphate as shown in Raman spectra.

References

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