16th SGA BIENNIAL MEETING
KEYNOTE SPEAKER

Stuart Simmons

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Advances in the understanding of epithermal ore forming processes from studies of modern environments in the TVZ

Precious metal transport and deposition is an intrinsic feature of hydrothermal activity in the Taupo Volcanic Zone (TVZ). Advances in the understanding of low-sulfidation epithermal ore-forming processes resulted from the drilling of deep wells for geothermal energy, in which information about fluid flow and mineral deposition under known pressure, temperature and fluid composition could be directly measured. For high-sulfidation environments, new knowledge was gained from studies of acid springs, crater lakes and fumarolic gases in active volcanoes. The ability to collect such data and then do a comparative analysis across several co-active hydrothermal systems showed how local and regional geological influences, especially those related to water rock interaction and fluid flow, could be distinguished. Among the important findings, we have learned that: 1) deep hydrothermal fluids transport large amounts of gold and silver in geologically short periods of time; 2) ore-grade concentrations of precious metals accumulate by phase separation (boiling) and chemisorption in distinct parts of the epithermal environment; 3) the trace metal concentrations of deep hydrothermal fluids range widely with a large degree of intersystem variability despite a common geological context; 4) energetic two-phase fluid flow conditions in production wells are directly analogous to those producing low-sulfidation vein mineralisation; 5) hydrothermal alteration and open-space infillings produce mineral-geochemical zonation in volcanic rocks that reflect the thermal and chemical structure of the epithermal environment and proximity to ore-grade mineralisation; and 6) the strong difference in fluid chemistry producing acid alteration in high sulfidation environments in contrast to near neutral pH alteration in low sulfidation environments is directly related to the amount of water-rock interaction as a deep fluids rise. The TVZ has proven to be an unparalleled natural laboratory for resolving the spatial-temporal attributes of epithermal mineralisation, and the resulting advances in understanding have strongly influenced development of current exploration models.

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Stuart is a consulting geologist (Hot Solutions Ltd, New Zealand) and a research professor (University of Utah), and he is primarily known for his work on epithermal Au-Ag deposits and geothermal resources. His work is directed at understanding the geological, hydrological, and geochemical controls on hydrothermal fluid flow, precious metal mineralization and heat transfer. Stuart received his PhD in Geology at from the University Minnesota, and he currently works nearly full time on the Utah FORGE project, which is funded by the US Department of Energy (utahforge.com). Stuart has published over 70 refereed papers and technical reports in a wide range of journals, and he is the former Chair of the SEG Publications Board. In 2014, he was awarded the Silver Medal, and in 2018, the Marsden Medal, both by the Society of Economic Geologists.