The Evolving Role of Mineralogy and Mineralogists in Mineral exploration

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The business of mineral exploration is implicitly linked to the discipline of mineralogy. The nature of this association has evolved dramatically throughout the past 200 years as new technologies and new understanding of mineralising processes have transformed mineral exploration from a small group of pioneering prospectors into a complex business drawing on the skills and expertise of a wide range of disciplines. All exploration geologists need to be able to identify minerals and understand the manner in which they occur in and around orebodies. But more recently, new micro-analytical technologies and a greater appreciation of the role mineral chemistry has to play in successful mineral exploration, has led to a growing requirement to have professional mineralogists supporting exploration teams.

The last decade has seen some dramatic improvements in our ability to identify and map the distribution of minerals at all scales. Space-borne remote sensing platforms have been supporting mineral exploration since the 80"s. These systems use the visible and near infra-red (VNIR) and short wave infra-red (SWIR) electromagnetic spectrum to identify minerals exposed on the earth's surface. The more recent platforms such as WorldView3 have sufficient spectral and spatial resolution to deliver new exploration opportunities to the entire industry. On the ground, hand held hyperspectral spectral devices can not only identify spectrally active minerals in a hand specimen or outcrop, they can also measure some compositional and crystallinity characteristics of important alteration minerals distributed in an around mineral deposits. At a smaller scale again, there are now hyperspectral scanning technologies for drill core that can map spectrally active minerals and mineral compositions at 500um resolution in entire drill holes that may be many hundreds of metres deep. Small sections of those drill cores can be chemically mapped at 30um resolution, making it possible to examine the deportment of microscopic minerals and metals such as gold and platinum. And at even smaller scale, the new generation automated electron microscopes can identify and map minerals at resolutions of just a few microns. Technology has armed the modern mineral explorer with the tools to map and identify minerals at the macro, meso and micro scale, generating data and insights never before available.

However, perhaps the most significant advance in the past decade has been the widespread emergence of Laser Ablation Inductively Coupled Mass Spectroscopy (LA-CP-MS). This remarkable technology delivers major and trace element mineral chemistry from individual grains and crystals. Whilst typically confined to university laboratories and dedicated to research applications, some exploration companies are making increasing use of LA-ICP-MS mineral chemistry to support mineral exploration for porphyry copper deposits. This style of mineralisation accounts for the vast majority of copper production on earth, but economically viable deposits are increasingly difficult to find. Ground breaking research completed at CODES, University of Tasmania and co-researchers is delivering trace element mineral chemistry-based exploration tools that show enormous promise. However the operational application of such tools is complex and it is without question, the skills of professional mineralogist that are required to refine, advance and apply these sophisticated exploration tools.