ALS Minerals offers isotopic measurements of carbonate minerals using a process developed by the Mineral Deposit Research Unit (MDRU) at the University of British Columbia (UBC). Carbon and oxygen isotopes may have diagnostic alteration signatures of carbonate-bearing ore deposits. They are measured on gases generated by a weak acid digestion in a specialized instrument developed and modified by the MDRU research team.

Hydrothermally-altered host rocks surround many ore deposit types, and may contain large, up to kilometer-scale, haloes of visibly altered rocks that define the alteration footprints of some ore deposit types (e.g. porphyry and epithermal deposits). In contrast, mineral deposits that form in carbonate host rocks typically have narrower and less-intensely developed alteration footprints, and less obvious geochemical footprints. However, carbonate-hosted deposits may have much broader “cryptic” alteration footprints, that can be easily detected by utilizing light stable isotopes.

Light stable isotopes of common elements in ore systems, such as carbon, oxygen, hydrogen and sulphur, have been utilized to understand fluid:rock interactions in and around mineral deposits. Carbon and oxygen isotopes in carbonate minerals identify cryptic isotopic alteration haloes around different mineral deposit types, for which trace element anomalies may not be as easily identified.
ore deposits for more than 40 years[3]. Typically, the relatively “heavy” isotopic composition of the host rocks are shifted towards lighter values during interactions with hydrothermal fluids. Stable isotope ratios can provide information about fluid flow during hydrothermal ore mineralization, such as mapping the extent of fluid interactions, discerning fracture-controlled versus pervasive flow, determining fluid temperatures, assessing alteration intensity, assessing the sources of mineralizing fluids, as well as contributing to the development of ore deposit and exploration models.

Carbon isotope ratios may be used to assess the source of carbon in carbonate minerals (e.g. mantle carbon, sedimentary rock (e.g. limestone) carbon, biogenic carbon) as well as to assess the role that oxidation may play within hydrothermal systems. Oxygen isotope ratios in carbonate minerals typically vary as a function of the origin of the fluid from which the carbonate mineral formed, as well as the temperature at which mineral formation took place. Commonly during fluid-rock interaction, the relatively 18O-enriched host rock will be depleted in 18O as it interacts with the 16O-depleted hydrothermal fluid, leaving distinctive isotopic ratios in hydrothermally altered vs unaltered host rocks.

Stable isotopes can be utilized as an exploration targeting tool to 1) identify regions of fluid flow in apparently unaltered rocks to identify targets; and 2) to identify the locations, nature and relative intensity of fluid: rock interactions with prospects to recognize and rank targets within an ore system.

ALS Minerals has partnered with MDRU to offer the carbon and oxygen isotope measurements as exploration tools in alteration mapping. The method is recommended for for carbonate rocks which may play host to mineralization and have been altered by hydrothermal fluids. It is not currently possible to analyze samples of high sulphide content (S > 5%).