Rhenium

The element Rhenium (Re) occurs most frequently in mineral deposits as the mineral molybdenite (MoS_2), a metallic luster, grey-black, non-magnetic, non-fluorescent opaque mineral which smears greenish gray, has a high specific gravity (5.5), and is somewhat hydrophobic in mineral processing (Figure 1).

Figure 1: Mineral Molybdenite

Re in molybdenite is best analyzed using the 4-acid "near-total" digestion. It should be noted that the aqua regia digestion may not provide complete dissolution of molybdenite. Figure 2 shows a sample data set for which the 4-acid digestion provides 10-30% higher concentrations for samples with > 200 ppm Mo (average 17% higher Mo in the 4-acid digestion for samples with Mo> 200 ppm). One may assume a similar difference in Re data if the molybdenite is not adequately in solution. Because Re concentrations are typically very low, determination by ICP-MS is necessary.

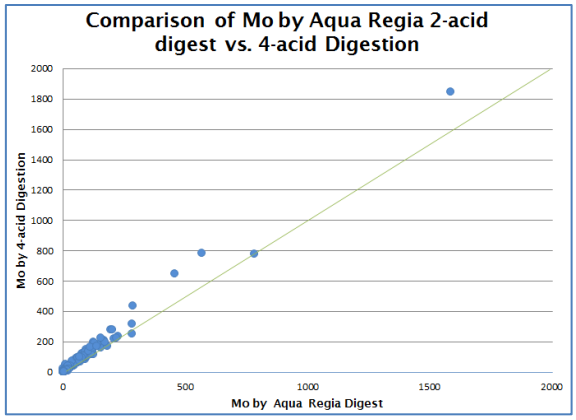
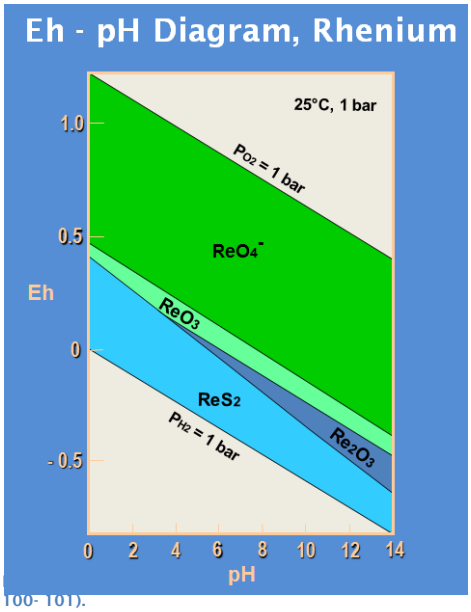


Figure 2: Mo comparison, aqua regia and 4- acid digestions

The recommended multi-element geochemical method for Re is ME-MS61 (Re concentrations 0.002 to 50 ppm). High concentrations may be analyzed by the 4-acid assay grade method Re-OG62 (Re range 10 ppb – 500 ppm). Concentrate samples may be analyzed by the multi- 4-acid concentrate method ME-MS61c with a range of 20 ppb – 1500 ppm Re.

In soil, sediment and regolith samples, Re may be weakly bound within the sample matrix in colloid, oxide, hydroxide, or organic phases. Super-trace Re in these materials can be analyzed using the super-trace aqua regia multi-element geochemical method (ME-MS41L, range 1 ppb – 50 ppm), or using one of the available selective leaches such as Ionic leach (ME-MS23, Re detection limit 0.1ppb), or oxide specific leaches (ME-MS05, 06, Re detection limit 1 ppb).



The mobility of Re in the secondary environment is very high, as it can be transported long distances as a mobile ReO4- complex and as a Cl complex. It is a mobile geochemical pathfinder for porphyry Mo and porphyry Cu deposits.

Rhenium is a siderophile element, occurring with Fe and S, with primary element association being that with Mo and also associated with Cu and Se, and in some Au deposits. (Rose, Hawkes and Webb, 1979, p. 571-572). Re accompanies Mo through the hydrothermal process and may constitute up to 1.88% within molybdenite.

Re has proven invaluable as a tool for age dating of sulphide mineral occurrences. The ^{187}Re isotope decays to ^{187}Os, with age estimation based on the Re/Os isotope ratios. Molybdenite mineral separates from ore deposit systems may be dated at ALS via a Sector Field ICP-MS (Re-ISTP01).

100- 101).

Rhenium Analytical Methods, ALS Minerals

Method Type	Description	Re Range	ALS Code
Assay	Ore Grade 4 acid near total digestion and ICP-AES finish.	10ppb - 500ppm	Re-OG62
Concentrate	Multi-element 4 acid near total digestion, Concentrate analysis.	20ppb - 1500ppm	ME-MS61C
Multi-element Geochemical	Multi-element 4 acid near total digestion, 48 elements determined by combined ICP-AES and ICP-MS.	2ppb - 50ppm	ME-MS61
Super- trace Soil/Regolith Multi-element	'Super-trace' aqua regia digestion, 51 elements determined by combined ICP-AES and ICP-MS.	1ppb - 50ppm	ME-MS41L
	'Ionic Leach' selective leach to pH 8.5, 60 elements and Pb isotopes determined by ICP-MS.	0.1ppb - 1000ppm	ME-MS23
	'Mn-oxide' selective leach Hyroxylamine-HCl, 63 elements and final leach pH determined by ICP-MS.	1ppb - 1000ppm	ME-MS05
	'Fe-oxide' selective leach Hyroxylamine-HCl, 63 elements and final leach pH determined by ICP-MS.	1ppb - 1000ppm	ME-MS06
Isotope	Re/Os Isotope ratio for Age Dating on molybdenite mineral separate		Re-ISTP01