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Trace element composition of scheelite as an exploration tool for gold and tungsten deposits

ANA CAROLINA R MIRANDA[1], GEORGES BEAUDOIN[1], BERTRAND ROTTIER[1], JAN PASAVA[2], JAN MALEC[2] AND PETR BOHDÁLEK[2]

[1]Université Laval

[2]Czech Geological Survey

Presenting Author: acrmiranda1@gmail.com

Scheelite is a tungsten ore mineral and has been proposed as an efficient indicator mineral for targeting tungsten and gold deposits [1,2]. It commonly occurs in skarn, stockwork, greisen, Sn-W porphyry, reduced intrusion-related gold systems (RIRGS) and orogenic gold deposits. Scheelite major and trace element composition vary as a function of the origin, composition, and physicochemical conditions of the mineralizing fluids [3,4,5].

Trace element composition of scheelite from 11 oxidized and reduced skarns, 3 greisen, 7 RIRGS, 1 metamorphosed intrusion-related (Felbertal), 2 porphyry and 1 orogenic deposits were acquired by LA-ICP-MS. Our results (n=453 analyses) combined with literature data (n=682 analyses) were investigated using partial least squares-discriminant analysis (PLS-DA) to establish discriminating chemical criteria for scheelite from different deposit types, and thus supporting the application of scheelite as an efficient indicator mineral for mineral exploration targeting.

The PLS-DA results show that scheelite from orogenic gold deposits can be distinguished from those of intrusion-related deposits due to higher Sr, Pb, Ba and REE, and lower Mo, Ta and Nb concentrations (Fig. 1). Scheelite from RIRGS is chemically similar to those from reduced skarns, which may reflect similar magmatic origin and the reduced character of the mineralizing fluids. Scheelite from greisen and oxidized skarn deposits can be discriminated from the remaining deposits due to their higher concentrations of Mn (greisen), and Mo and Ti (oxidized skarns).

Scheelite from Felbertal (Austria), an intrusion-related W deposit that underwent regional metamorphic recrystallization [6], plots at the magmatic-hydrothermal side and is chemically similar to scheelite from porphyry and reduced skarns. Our results show that scheelite chemistry is a function of the physical and chemical characteristics of the mineralizing fluids inherent to each deposit type and thus scheelite can be used as an efficient targeting tool for gold and tungsten deposits.

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[3] Poulin et al (2018) Can Mineral 56, 265–302.

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[6] Kozlik et al (2016) Miner Petrol 110, 11–27

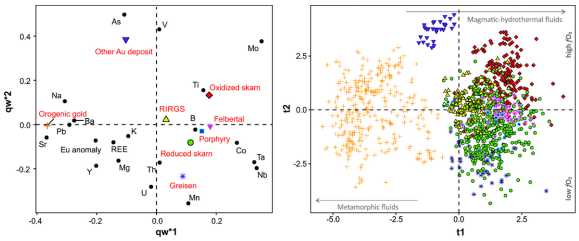

Figure 1. Partial least squares discriminant analysis (PLS-DA) of LA-ICP-MS data for scheelite from several deposit types. The qw*1–qw*2 (first and second loadings) plot shows correlations among the variables (elements) and deposit types classification. The t1–t2 (first and second scores) plot shows the distribution of scheelite analyses in the latent variable space defined by qw*1–qw*2. Scheelite samples classified as 'Other Au deposit' refers to Crusader Au deposit, which is a intrusion-related deposit. However, because of its Archean age and oxidized character, which differ from a typical Reduced Intrusion-Related Gold System (RIRGS), Crusader was classified as 'Other Au deposit'.