

Ta-Nb (Coltan), Sn, and W Exploration & Mining Using Thermo Scientific Portable XRF Instruments



Introduction

Tantalum (Ta), niobium (Nb), tungsten (W), and tin (Sn) are mainly used in high-end technology products. Because Ta is a very robust metal with a high fusion point, it is used in missiles, airplanes, and throughout the nuclear industry. However, the world resources available today are not meeting the increased demand for Ta. W has similar properties and is commonly used in the semiconductor industry. Nb is used in the steel industry, as well as in super-alloys and super-conductors. Sn has been used for thousands of years in numerous applications due to its low fusion point. Since 2006 when lead (Pb) was forbidden in welding products in some countries, the demand for Sn has increased dramatically for its use in solders.

Application

Geologically, Ta, Nb, W, and Sn are found in the late stage magmatic products, such as pegmatites and high-temperature veins. Common minerals of these elements are tantalite ($(\text{FeMn})\text{Ta}_2\text{O}_6$), columbite ($(\text{FeMn})\text{Nb}_2\text{O}_6$), wolframite ($(\text{FeMn})\text{WO}_4$), scheelite (CaWO_4), and cassiterite (SnO_2). Tantalite is commonly found with columbite ($(\text{FeMn})\text{Nb}_2\text{O}_6$). This close association is called columbite-tantalite or coltan. These dense minerals can be reworked, eroded, transported by water, and accumulated due to gravity separation during sedimentary processes. Such deposits are called placer deposits, which are common deposits for the mining of Ta, Nb, and Sn in some countries.

Portable x-ray fluorescence (XRF) instruments are great tools not only for prospecting, but also for grade control of these metals. Accuracy is a key factor in the evaluation of ore concentrates, particularly due to their high trading values.

Portable XRF Analyzers in Mining

Portable XRF is a technique with the ability to deliver fast and accurate results with little or no sample preparation in various stages of mining activity from grass root exploration to exploitation, ore grade control, and even environmental investigations.

There are more than 3,000 Thermo Scientific portable XRF analyzers that are used extensively in the mining industry worldwide. A broad range of elements from magnesium (Mg) to uranium (U) can be analyzed using these instruments.

The handheld Thermo Scientific Niton XL2 GOLDD and Niton XL3t GOLDD+ Series analyzers, and the Niton FXL field-mobile x-ray lab deliver fast, accurate elemental analysis with unmatched efficiency for companies across all stages of mining and exploration. These benefits derive from our Thermo Scientific geometrically optimized large area drift detector (GOLDD™) technology, and the high-power x-ray tube.



The Thermo Scientific Niton XL3t GOLDD+ XRF analyzer delivers fast analysis of coltan minerals.

Methodology

Prepared (pulped) high-grade samples were used for this investigation. These samples were analyzed with a Niton XL3t GOLDD+ portable XRF analyzer, as well as laboratory methods (ICP and AAS) for comparison purposes. Analyses were carried out on 17 samples using Mining Calibration. This is a fundamental parameters model that is able to quantify more than 30 elements, typically without the requirement of user calibrations. However, when required, a simple post calibration adjustment can be made to improve accuracy using your previously characterized lab samples.

Results

The coefficient of determination, the R^2 value, is a measure of how closely the data sets correlate with each other, where a perfect correlation would have an R^2 of 1. The study shows high correlation between data from the Niton XL3t GOLDD+ XRF analyzer and the lab methods (see Table 1 and Figure 1).

Conclusions

Many minerals occur as dark gray to black grains which may look like coltan in fine grains. The high correlation between assay results from the handheld Niton XL3t GOLDD+ and lab data indicates that it is possible to successfully identify high- and low-grade concentrates of coltan samples in seconds using portable XRF. Whether you choose the Niton FXL, Niton XL3t GOLDD+, or Niton XL2 GOLDD XRF analyzer, all Thermo Scientific portable XRF analyzers deliver fast and accurate elemental analysis for intensive metal exploration and production, from base metals to precious metals and even rare earth elements (REE).

To discuss your particular applications and performance requirements, or to schedule an on-site demonstration, please contact your local Thermo Scientific portable analyzer representative or contact us directly by email at niton@thermofisher.com, or visit our website at www.thermoscientific.com/niton.

In addition to these offices, Thermo Fisher Scientific maintains a network of representative organizations throughout the world.

Americas
Boston, MA USA
+1 978 670 7460
niton@thermofisher.com

Europe
Munich, Germany
+49 89 3681 380
niton.eur@thermofisher.com

Asia Pacific
New Territories, Hong Kong
+852 2885 4613
niton.asia@thermofisher.com
www.thermoscientific.com/niton

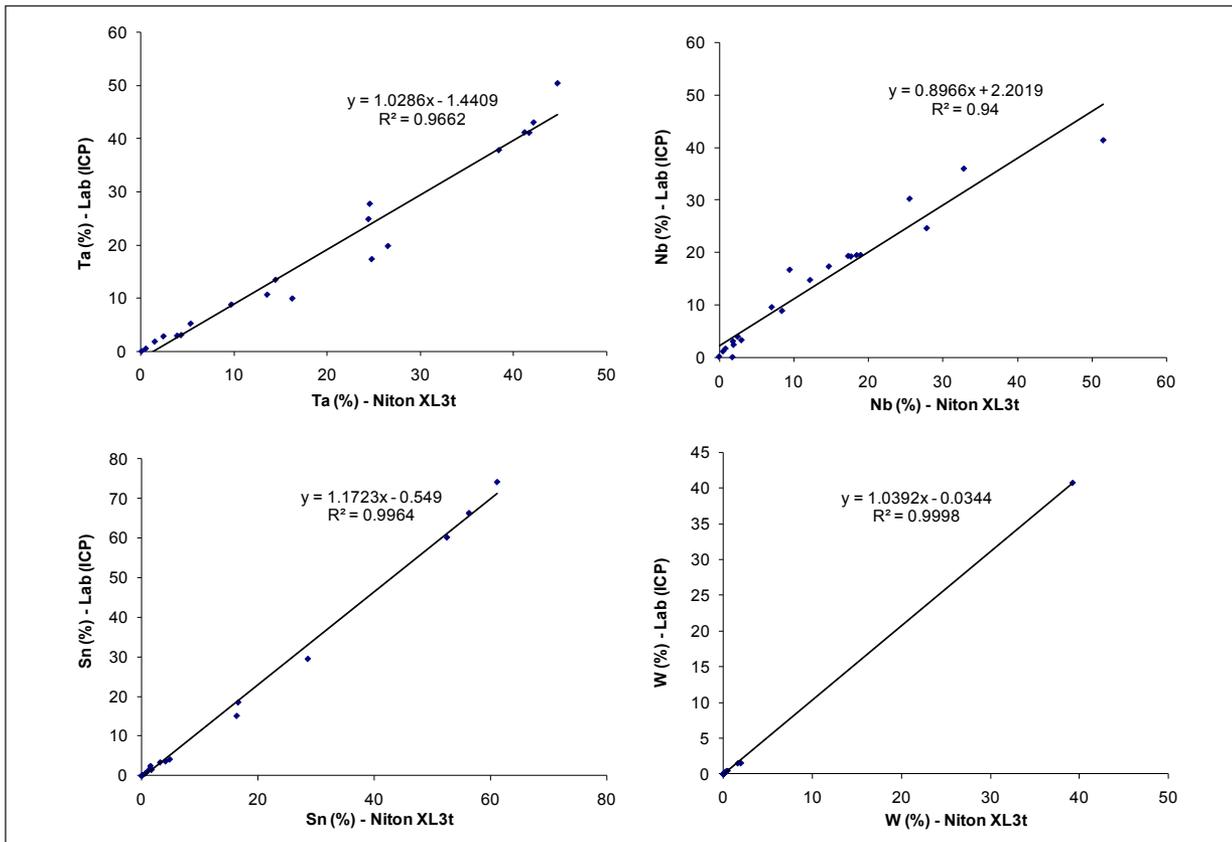


Figure 1. Correlation diagrams for Ta, Nb, Sn, and W analyzed using the Niton XL3t GOLDD+.

Thermo Scientific Portable XRF Analyzer	Lab				
	Ta	Nb	Sn	W	Fe
Niton XL3t GOLDD+	0.97	0.94	1	1	0.97

Table 1: Correlation (R^2) between the Thermo Scientific portable XRF analyzer and lab assays.

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