



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 331

Copper Ore, Mill Tails

This material is in the form of fine powder intended for use both in checking chemical methods of analysis and in calibration with instrumental methods of analysis.

This SRM is issued primarily for use in evaluation of the critically important "material balance" in the copper mining and metallurgical industries.

CAUTION: The bottle should be kept tightly closed except when in direct use. Store in a desiccator over desiccant.

Table 1. Certified Values

<u>Constituent</u>	<u>Certified Value</u> ^{a,b}	<u>Estimated Uncertainty</u> ^c
	<u>Percent by Weight</u>	
Total Copper	0.091	0.001
Molybdenum	0.0022	0.0002
	<u>ppm by Weight</u>	
Rhenium	0.04	0.02

^aBased on samples dried at 105 °C for two hours. Separate samples are used for rhenium and calculated to a dry-weight basis.

^bThe certified value is the *best estimate* of the "true" value.

^cEstimated uncertainty includes both method imprecision and material variability with samples: 10 g (or more) for total copper, and molybdenum, and 2.5 g (or more) for rhenium.

Homogeneity testing of selected samples representative of the lot of SRM 331 was performed simultaneously with the analytical program for certification. At NIST maximum variability for total copper was determined to be ± 0.0008 percent (15 determinations with 1 g samples).

This Certificate of Analysis has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate value or any technical data presented in this certificate.

Gaithersburg, MD 20899
September 15, 1991
(Revision of Certificate
dated 1-20-77)

William P. Reed, Chief
Standard Reference Materials Program

(over)

PLANNING, PREPARATION, TESTING, ANALYSIS: The material for this SRM (331) was carefully selected and provided to NIST by Magma Copper Company, San Manuel, Arizona, through the courtesy of T.L. Young.

At NIST this material was sieved and thoroughly blended, which involved several independent procedures.

Analyses were performed in the NIST Analytical Chemistry Division by E.L. Garner, J.W. Gramlich, L.A. Machlan, E.J. Maienthal, J.R. Moody, and T.J. Murphy.

The following values indicate the results of the analytical tests made at NIST and the Magma Copper Company.

<u>Constituent/Method</u>	<u>Average</u>	<u>Standard Deviation</u> ¹	<u>Number of Determinations</u>
<u>Total Copper</u>			
<u>Percent by Weight</u>			
Isotopic dilution mass spectrometry ² (1.0 g samples)	0.0915	0.0005	15
Polarographic (2.5 g samples) ³	0.091	0.001	4
<u>Molybdenum</u>		<u>Range</u>	
Isotopic dilution mass spectrometry ² (1.0 g samples)	0.0022	0.0001	2
<u>ppm by Weight</u>			
<u>Rhenium</u>			
Isotopic dilution mass spectrometry ² (2.5 g samples)	0.043	0.016	6

¹Of single determinations for total Cu; range given for Mo and Re.

²This method has been studied extensively and the data are considered free from systematic errors [1].

³Results from Magma Copper Company.

The overall direction and coordination of the technical measurements at NIST leading to certification were performed under the direction of W.R. Shields and I.L. Barnes.

The technical and support aspects involved in the original preparation, certification, and issuance of this Standard Reference Material were coordinated through the Standard Reference Materials Program by R.E. Michaelis. Revision of the certificate was coordinated through the Standard Reference Materials Program by J.S. Kane.

ADDITIONAL INFORMATION ON THE COMPOSITION: Certification is made *only* for total Cu, Mo, and Re. Although NOT CERTIFIED, the following additional information on the composition may be of interest.

Gold and Silver

Fire assay determinations for Au and Ag were made at Magma Copper Company:

	<u>ppm by Weight</u>	
	<u>Gold</u>	<u>Silver</u>
Fire assay	(0.034)	(0.243)

"Acid-Soluble" Copper

The total copper content includes "recoverable" sulfide copper and "nonrecoverable" oxide copper. Industrial practice is to determine "acid-soluble" copper and to relate this result to the oxide copper content. Investigation at NIST provided additional information on "acid-soluble" copper that may be useful, but is not certified:

<u>Constituent/Method</u>	<u>Average</u>	<u>Range</u>	<u>Number of Determinations</u>
	<u>Percent by Weight</u>		
"Acid-Soluble" Copper Isotopic dilution mass spectrometry (2.5 g samples)	(0.051)	(0.051-0.052)	3

REFERENCES

[1] W.R. Shields, Editor, Nat. Bur. Stand. Tech. Note 546, (1970).