# AMIS 0559
# Gold Ore – Greenstone Belt

## SUMMARY

The application note summarizes the digestion of AMIS 0559, a Gold Ore Certified Reference Material from the Greenstone Belt using ColdBlock™ Digestion Pro Series Technology.

| | |
|---|---|
| **Instrument:** | Equipment: ColdBlock CBM sample digester, chiller, HF compatible liners, ICP-MS & ICP-OES |
| **Published:** | January 2023 |
| **Digestion Time:** | 30 Minutes |
| **Acid Used:** | Aqua Regia, HF & $H_3BO_3$ |
| **Average ColdBlock Recovery vs. CRM:** | ■ 101% Arsenic<br>■ 101% Chromium<br>■ 97% Tellurium |

## METHODOLOGY

1. Chiller temperature was set to -5°C
2. 0.25g of each sample was weighed and placed into a ColdBlock™ Digestion vessel
3. 20 mL of Aqua Regia + 3 mL HF was added
4. Sample was digested at 80% power for 20 minutes
5. 20mL of 4%$_{v/v}$ Boric acid was added
6. Samples were digested again at 80% power for 10 minutes
7. Samples were cooled and bulked to 50mL using 2% $HNO_3$ + 0.5% $HCl_{v/v}$

## DISCUSSION

■ The addition of Boric acid will help re-solubilize any insoluble fluorides and will help neutralize any remaining HF in solution.
■ If Silver precipitates out of solution as AgCl, bulk up with >20% $HCl_{v/v}$
■ If the Sulfide content of your sample is >10 wt.% – reverse the ratios of Aqua Regia and use 1:3, $HCl:HNO_3$ – always add the Nitric acid first (reddish brown $NO_2$ fumes might form)
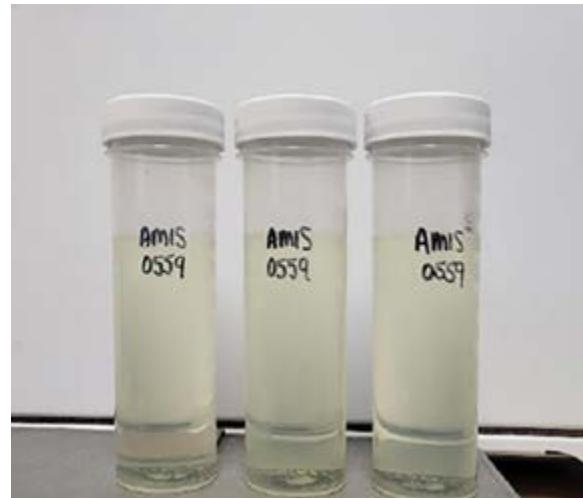


*AMIS 0559 after bulk-up*

Greenstone, South Africa. Greenstone belts are zones of variably metamorphosed mafic to ultramafic volcanic sequences with associate sedimentary rocks that occur within Archaean and Proterozoic cratons between granite and gneiss bodies. Greenstone belts are primarily formed of volcanic rocks, dominated by basalt, with minor sedimentary rocks inter-leaving the volcanic formations. amis.co.za

AMIS0559; Gold Ore, Greenstone Belt; AMIS Matrix Reference Materials; A division of Torre Analytical Services; A part of Torre Industries: Gauteng, South Africa

# AMIS 0559 Gold Ore – Greenstone Belt

# Results

| AMIS 0559 – Gold Ore – Greenstone Belt | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Method:** | .25g | 20mL Aqua Regia + 3 mL HF digested at 80% for 20 minutes, add 20mL of 4% Boric Acid – and digest again at 80% for another 10 minutes | | | | | | | | |
| **Element** | **AMIS Certified 4-acid Value (ppm)** | **95% Confidence Limits** | | **Sample A** | **Sample B** | **Sample C** | **Average (ppm)** | **Stdev** | **% RSD** | **% Recovery vs 4-acid value** |
| | | **Low** | **High** | | | | | | | |
| Ag | 0.625 | 0.425 | 0.825 | 0.727 | 0.729 | 0.724 | 0.7 | 0.00 | 0.30% | 116% |
| Al | 77120 | 73670 | 80570 | 78593 | 75956 | 75303 | 76617.5 | 1422.22 | 1.90% | 99% |
| As | 4740 | 4212 | 5268 | 4743 | 4846 | 4791 | 4793.4 | 42.07 | 0.90% | 101% |
| Ba | 434 | 393 | 475 | 472 | 467 | 466 | 468.3 | 2.63 | 0.60% | 108% |
| Be | 1 | 0.87 | 1.13 | 1.02 | 0.92 | 1.06 | 1 | 0.06 | 5.90% | 100% |
| Bi | 0.2 | 0.14 | 0.26 | 0.2 | 0.3 | 0.2 | 0.2 | 0.05 | 20.20% | 117% |
| Ca | 11660 | 11659.94 | 11660.06 | 11917 | 11590 | 11283 | 11596.7 | 258.71 | 2.20% | 99% |
| Cd | 0.2 | 0.16 | 0.24 | 0.24 | 0.22 | 0.22 | 0.2 | 0.01 | 4.20% | 113% |
| Ce | 45 | 38 | 52 | 46 | 46 | 45 | 45.9 | 0.53 | 1.10% | 102% |
| Co | 43 | 40 | 46 | 43 | 42 | 41 | 41.8 | 0.56 | 1.30% | 97% |
| Cr | 888 | 729 | 1047 | 897 | 893 | 895 | 895.3 | 1.63 | 0.20% | 101% |
| Cs | 5 | 4 | 6 | 5.3 | 5.2 | 5.2 | 5.2 | 0.05 | 0.90% | 105% |
| Cu | 64 | 53 | 75 | 67.1 | 64.3 | 62.3 | 64.5 | 1.97 | 3.10% | 101% |
| Dy | 2 | 1 | 3 | 1.99 | 2.01 | 1.88 | 2 | 0.06 | 2.90% | 98% |
| Er | 1 | 0.6 | 1.4 | 1.35 | 1.08 | 1.11 | 1.2 | 0.12 | 10.20% | 118% |
| Eu | 1 | 0.93 | 1.07 | 0.96 | 0.95 | 0.91 | 0.9 | 0.02 | 2.20% | 94% |
| Fe | 79070 | 74430 | 83710 | 77544 | 79837 | 77320 | 78233.8 | 1137.50 | 1.50% | 99% |
| Ga | 19 | 17 | 21 | 20.04 | 18.94 | 19.16 | 19.4 | 0.47 | 2.40% | 102% |
| Gd | 3 | 2.8 | 3.2 | 2.8 | 2.9 | 2.9 | 2.9 | 0.05 | 1.60% | 96% |
| Hf | 3 | 2.9 | 3.1 | 2.7 | 2.6 | 2.6 | 2.6 | 0.05 | 1.80% | 88% |
| Ho | 0.5 | 0.4 | 0.6 | 0.42 | 0.45 | 0.45 | 0.4 | 0.01 | 3.20% | 88% |
| K | 33610 | 31760 | 35460 | 33466 | 31441 | 31845 | 32250.7 | 874.95 | 2.70% | 96% |
| La | 22 | 18 | 26 | 23.6 | 23.5 | 22.9 | 23.3 | 0.31 | 1.30% | 106% |
| Li | 42 | 35 | 49 | 41.9 | 40.1 | 39.5 | 40.5 | 1.02 | 2.50% | 96% |
| Lu | 0.2 | 0.16 | 0.24 | 0.23 | 0.21 | 0.2 | 0.2 | 0.01 | 5.80% | 107% |
| *Mg | 36410 | 33530 | 39290 | 36688 | 36555 | 36150 | 36464.2 | 228.70 | 0.60% | 100% |
| Mn | 1450 | 1285 | 1615 | 1543 | 1551 | 1560 | 1551.3 | 6.94 | 0.40% | 107% |
| Na | 1240 | 1077 | 1403 | 1373 | 1354 | 1377 | 1368 | 10.03 | 0.70% | 110% |
| Nd | 19 | 17 | 21 | 19.4 | 19.1 | 19.1 | 19.2 | 0.14 | 0.70% | 101% |

# AMIS 0559 Gold Ore – Greenstone Belt

# Results

| | | AMIS 0559 – Gold Ore – Greenstone Belt | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
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| **Element** | **AMIS Certified 4-acid Value (ppm)** | **95% Confidence Limits** | | **Sample A** | **Sample B** | **Sample C** | **Average (ppm)** | **Stdev** | **% RSD** | **% Recovery vs 4-acid value** |
| | | **Low** | **High** | | | | | | | |
| Ni | 378 | 358 | 398 | 353.56 | 363.6 | 361.74 | 359.6 | 4.36 | 1.20% | 95% |
| Pb | 28 | 25 | 31 | 29 | 30 | 30 | 29.7 | 0.47 | 1.60% | 106% |
| Pr | 5 | 4 | 6 | 5.1 | 5.1 | 4.9 | 5 | 0.09 | 1.90% | 101% |
| Rb | 139 | 128 | 150 | 138.4 | 138.1 | 136.2 | 137.6 | 1.00 | 0.70% | 99% |
| S | 30000 | 27000 | 33000 | 30766 | 30361 | 29370 | 30166 | 586.25 | 1.90% | 101% |
| Sb | 17 | 14 | 20 | 17.7 | 18.4 | 18.1 | 18.1 | 0.29 | 1.60% | 106% |
| Sc | 21 | 18 | 24 | 22.8 | 21.3 | 21.5 | 21.9 | 0.68 | 3.10% | 104% |
| Sm | 4 | 3.8 | 4.2 | 3.8 | 3.7 | 3.9 | 3.8 | 0.08 | 2.10% | 95% |
| Sn | 2 | 1 | 3 | 1.8 | 1.7 | 1.8 | 1.8 | 0.05 | 2.70% | 88% |
| Sr | 56 | 51 | 61 | 53.2 | 53 | 52.4 | 52.9 | 0.33 | 0.60% | 94% |
| Tb | 0.4 | 0.36 | 0.44 | 0.4 | 0.5 | 0.4 | 0.4 | 0.05 | 10.90% | 108% |
| Te | 2 | 1.6 | 2.4 | 1.8 | 1.9 | 2.1 | 1.9 | 0.13 | 6.50% | 97% |
| Th | 7 | 5 | 9 | 8.1 | 7.9 | 8 | 8 | 0.08 | 1.00% | 114% |
| Tl | 1 | 0.9 | 1.1 | 0.95 | 0.96 | 0.98 | 1 | 0.01 | 1.30% | 96% |
| Tm | 0.2 | 0.15 | 0.25 | 0.25 | 0.2 | 0.25 | 0.2 | 0.02 | 10.10% | 117% |
| U | 8 | 7 | 9 | 8.1 | 8.6 | 8.1 | 8.3 | 0.24 | 2.90% | 103% |
| V | 142 | 130 | 154 | 158 | 147 | 145 | 150 | 5.62 | 3.70% | 106% |
| Y | 11 | 8 | 14 | 9.6 | 9.6 | 9.5 | 9.6 | 0.05 | 0.50% | 87% |
| Yb | 1 | 0.7 | 1.3 | 1.3 | 1.4 | 1.3 | 1.3 | 0.05 | 3.50% | 133% |
| Zn | 125 | 106 | 144 | 119 | 125 | 126 | 123 | 3.02 | 2.50% | 98% |
| Zr | 103 | 85 | 121 | 97 | 97 | 90 | 94.7 | 3.30 | 3.50% | 92% |

*Element is certified by fusion  - Recovery (%) is calculated vs certified Fusion value

info@coldblock.ca
coldblock.ca/contact-us