

Supplementary Materials: Mineralogical and Geochemical Characteristics of the H-Pit of the Gold Deposit, Central Thailand: A Case Study for Assessment of Acid Rock Drainage and Heavy Metal Sources

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Table S1. X-ray characteristics of each element in EPMA analysis.

| Element | Spectral line | Peak position (mm) | Voltage (kV) | Current (nA) | Crystal | Analysis time (s) | Background time (s) | Background intensity (cps) | Characteristic X-ray intensity (cps) | Detection Limit (wt.%) |
|---------|---------------|--------------------|--------------|--------------|---------|-------------------|---------------------|----------------------------|--------------------------------------|------------------------|
| As | L α | 106.792 | 15 | 25 | TAP | 10 | 10 | 91.7 | 4565.3 | 0.04 |
| Ag | L α | 133.019 | 15 | 25 | PETJ | 10 | 10 | 27.1 | 7864.8 | 0.04 |
| Au | L α | 89.079 | 15 | 25 | LIF | 10 | 10 | 30.6 | 8165.3 | 0.45 |
| Cd | L α | 126.844 | 15 | 25 | PETJ | 10 | 20 | 177.3 | 22767.2 | 0.07 |
| Co | K α | 124.378 | 15 | 25 | LIFH | 30 | 20 | 22.4 | 4767 | 0.02 |
| Cr | K α | 159.786 | 15 | 25 | LIF | 15 | 20 | 1196 | 39893 | 0.02 |
| Cu | K α | 107.08 | 15 | 25 | LIFH | 30 | 20 | 45.4 | 6995.5 | 0.05 |
| Fe | K α | 134.801 | 15 | 25 | LIF | 15 | 20 | 14.8 | 4035.3 | 0.05 |
| Mn | K α | 146.239 | 15 | 25 | LIFH | 15 | 20 | 15.1 | 4182.5 | 0.02 |
| Ni | K α | 115.228 | 15 | 25 | LIFH | 10 | 20 | 27.7 | 8699.8 | 0.02 |
| Pb | L α | 169.231 | 15 | 25 | PETJ | 10 | 20 | 34.2 | 8110.4 | 0.05 |
| Zn | K α | 99.931 | 15 | 25 | LIF | 15 | 20 | 37.4 | 7209.2 | 0.05 |
| S | K α | 172.474 | 15 | 25 | PETJ | 30 | 20 | 149.5 | 101543.7 | 0.01 |

Table S2. Spot analysis results of Galena, sphalerite, and chalcopyrite.

| No. | As | Cd | Co | Cr | Cu | Mn | Ni | Pb | Zn | Fe | S | Au | Ag | Total | Comment |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------------------|
| 1 | <0.04 | <0.07 | <0.02 | 0.02 | <0.05 | <0.02 | <0.02 | 86.20 | <0.05 | 0.37 | 12.11 | <0.45 | <0.04 | 98.70 | 453-85-galena-1 |
| 2 | 0.93 | <0.07 | <0.02 | 0.03 | <0.05 | <0.02 | 0.02 | 86.63 | <0.05 | 0.83 | 12.81 | <0.45 | <0.04 | 101.25 | 453-85-galena-2 |
| 3 | 0.32 | <0.07 | <0.02 | <0.02 | <0.05 | 0.04 | 0.02 | 86.64 | <0.05 | 1.52 | 12.52 | <0.45 | <0.04 | 101.06 | 453-85-galena-3 |
| 4 | <0.04 | <0.07 | <0.02 | <0.02 | <0.05 | 0.04 | <0.02 | 87.30 | <0.05 | 0.26 | 12.41 | <0.45 | <0.04 | 100.01 | 453-85-galena-4 |
| 5 | <0.04 | <0.07 | <0.02 | <0.02 | 0.07 | <0.02 | 0.02 | 86.71 | <0.05 | 0.24 | 12.26 | <0.45 | <0.04 | 99.31 | 453-85-galena-5 |
| 6 | <0.04 | <0.07 | <0.02 | <0.02 | 0.06 | <0.02 | 0.02 | 85.79 | <0.05 | 0.20 | 12.21 | 1.28 | <0.04 | 99.55 | 453-85-galena-6 |
| 7 | <0.04 | <0.07 | <0.02 | 0.02 | 0.54 | <0.02 | <0.02 | 86.80 | 0.69 | 0.97 | 11.24 | 0.70 | <0.04 | 100.97 | 453-85-galena-7 |
| 8 | 0.05 | <0.07 | <0.02 | 0.02 | 0.05 | <0.02 | <0.02 | 86.72 | <0.05 | 0.33 | 12.69 | <0.45 | <0.04 | 99.85 | 453-85-galena-8 |
| 9 | <0.04 | <0.07 | <0.02 | 0.03 | 1.54 | <0.02 | <0.02 | 86.14 | <0.05 | 0.50 | 11.07 | 0.94 | <0.04 | 100.22 | 453-85-galena-9 |
| 10 | <0.04 | <0.07 | <0.02 | <0.02 | <0.05 | <0.02 | <0.02 | 86.13 | <0.05 | 0.61 | 11.99 | <0.45 | <0.04 | 98.73 | 397-124.6-galena-1 |
| 11 | 0.90 | <0.07 | <0.02 | <0.02 | <0.05 | <0.02 | <0.02 | 87.29 | <0.05 | 0.96 | 10.00 | 0.55 | <0.04 | 99.70 | 397-124.6-galena-2 |
| 12 | 0.98 | <0.07 | 0.02 | <0.02 | 0.06 | <0.02 | 0.04 | 86.42 | <0.05 | 0.59 | 12.54 | 0.61 | 0.13 | 101.39 | 397-124.6-galena-3 |
| 13 | 0.82 | <0.07 | <0.02 | <0.02 | <0.05 | 0.09 | 0.03 | 87.74 | <0.05 | <0.05 | 10.44 | <0.45 | <0.04 | 99.12 | 397-124.6-galena-4 |
| 14 | 0.05 | <0.07 | <0.02 | 0.02 | <0.05 | 0.04 | <0.02 | 87.05 | <0.05 | 0.10 | 10.76 | <0.45 | <0.04 | 98.02 | 397-124.6-galena-5 |
| 15 | <0.04 | <0.07 | <0.02 | 0.02 | 0.05 | <0.02 | <0.02 | 88.03 | <0.05 | 0.12 | 11.14 | <0.45 | <0.04 | 99.36 | 397-124.6-galena-6 |

| | | | | | | | | | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------------------------|
| 16 | 0.07 | <0.07 | <0.02 | 0.05 | <0.05 | 0.07 | <0.02 | 86.70 | 0.08 | 0.88 | 12.42 | <0.45 | <0.04 | 100.27 | 397-124.6-galena-7 |
| 17 | <0.04 | <0.07 | <0.02 | 0.02 | <0.05 | 0.03 | <0.02 | 87.13 | <0.05 | 0.79 | 12.12 | 0.46 | <0.04 | 100.55 | 397-124.6-galena-8 |
| 18 | <0.04 | <0.07 | <0.02 | 0.02 | <0.05 | <0.02 | <0.02 | 86.00 | <0.05 | 0.05 | 12.54 | <0.45 | <0.04 | 98.61 | 397-124.6-galena-9 |
| 19 | <0.04 | <0.07 | <0.02 | <0.02 | 1.21 | <0.02 | 0.02 | <0.05 | 61.83 | 3.77 | 32.31 | 0.93 | <0.04 | 100.08 | 453-85--sphalerite-1 |
| 20 | <0.04 | 0.08 | <0.02 | <0.02 | 1.65 | 0.06 | <0.02 | 0.08 | 61.41 | 3.85 | 32.70 | <0.45 | <0.04 | 99.82 | 453-85--sphalerite-2 |
| 21 | <0.04 | 0.07 | <0.02 | <0.02 | 1.88 | 0.02 | <0.02 | <0.05 | 61.64 | 3.34 | 32.85 | 0.77 | <0.04 | 100.57 | 453-85--sphalerite-3 |
| 22 | <0.04 | <0.07 | <0.02 | 0.02 | 1.99 | <0.02 | <0.02 | 0.09 | 62.50 | 1.79 | 33.92 | 0.74 | 0.07 | 101.12 | 453-85--sphalerite-4 |
| 23 | <0.04 | <0.07 | <0.02 | <0.02 | 1.45 | <0.02 | <0.02 | 0.08 | 62.88 | 1.53 | 33.35 | 0.70 | 0.15 | 100.14 | 453-85--sphalerite-5 |
| 24 | <0.04 | <0.07 | <0.02 | 0.02 | 0.92 | 0.06 | <0.02 | 0.08 | 61.72 | 1.69 | 33.52 | 0.78 | <0.04 | 98.79 | 453-85--sphalerite-6 |
| 25 | <0.04 | 0.07 | <0.02 | <0.02 | 0.83 | <0.02 | <0.02 | <0.05 | 61.96 | 2.81 | 33.29 | 0.96 | <0.04 | 99.90 | 397-124.6-sphalerite-1 |
| 26 | <0.04 | 0.12 | <0.02 | <0.02 | 0.80 | 0.07 | <0.02 | <0.05 | 61.96 | 2.83 | 33.65 | 1.39 | <0.04 | 100.83 | 397-124.6-sphalerite-2 |
| 27 | <0.04 | 0.18 | <0.02 | 0.04 | 0.98 | 0.02 | <0.02 | <0.05 | 61.70 | 2.19 | 33.49 | 0.54 | <0.04 | 99.15 | 397-124.6-sphalerite-3 |
| 28 | <0.04 | <0.07 | <0.02 | 0.02 | 1.65 | <0.02 | <0.02 | 0.05 | 61.69 | 2.50 | 33.35 | 0.99 | <0.04 | 100.25 | 397-124.6-sphalerite-4 |
| 29 | <0.04 | 0.15 | <0.02 | <0.02 | 1.11 | <0.02 | <0.02 | <0.05 | 61.79 | 2.28 | 33.38 | 0.96 | <0.04 | 99.67 | 397-124.6-sphalerite-5 |
| 30 | <0.04 | 0.17 | <0.02 | <0.02 | 0.05 | <0.02 | <0.02 | 0.04 | 61.76 | 2.44 | 33.87 | 1.36 | <0.04 | 99.68 | 397-124.6-sphalerite-6 |
| 31 | <0.04 | <0.07 | <0.02 | 0.03 | 0.54 | <0.02 | <0.02 | <0.05 | 62.53 | 2.57 | 33.52 | <0.45 | <0.04 | 99.19 | 1121-164.5-sphalerite-1 |
| 32 | <0.04 | 0.13 | <0.02 | <0.02 | 0.71 | <0.02 | 0.02 | <0.05 | 62.40 | 2.76 | 33.59 | <0.45 | <0.04 | 99.61 | 1121-164.5-sphalerite-2 |
| 33 | <0.04 | <0.07 | <0.02 | <0.02 | 1.55 | <0.02 | <0.02 | <0.05 | 62.06 | 2.75 | 33.38 | <0.45 | <0.04 | 99.74 | 1121-164.5-sphalerite-3 |
| 34 | <0.04 | <0.07 | <0.05 | <0.02 | 33.14 | <0.02 | <0.02 | <0.05 | 0.06 | 32.72 | 32.49 | <0.45 | <0.04 | 98.39 | 453-85-chalcopy-1 |
| 35 | <0.04 | <0.07 | <0.05 | <0.02 | 33.87 | <0.02 | <0.02 | <0.05 | 0.10 | 32.61 | 31.91 | 0.66 | <0.04 | 99.15 | 453-85-chalcopy-2 |
| 36 | <0.04 | <0.07 | <0.05 | <0.02 | 33.42 | <0.02 | <0.02 | <0.05 | <0.05 | 32.69 | 32.46 | <0.45 | 0.05 | 98.62 | 453-85-chalcopy-3 |
| 37 | <0.04 | <0.07 | <0.05 | <0.02 | 33.72 | <0.02 | <0.02 | <0.05 | 0.05 | 32.82 | 32.43 | <0.45 | 0.07 | 99.09 | 397-124.5-chalcopy-1 |
| 38 | <0.04 | <0.07 | <0.05 | <0.02 | 33.81 | <0.02 | <0.02 | <0.05 | 0.10 | 32.52 | 32.01 | 0.62 | <0.04 | 99.07 | 397-124.5-chalcopy-2 |
| 39 | <0.04 | <0.07 | <0.05 | <0.02 | 33.52 | <0.02 | <0.02 | <0.05 | <0.05 | 32.63 | 32.49 | <0.45 | 0.06 | 98.70 | 397-124.5-chalcopy-3 |
| 40 | <0.04 | <0.07 | <0.05 | <0.02 | 33.51 | <0.02 | <0.02 | <0.05 | <0.05 | 32.92 | 32.24 | <0.45 | 0.12 | 98.80 | 1121-164.5-chalcopy-1 |
| 41 | <0.04 | <0.07 | <0.05 | <0.02 | 33.29 | <0.02 | <0.02 | <0.05 | 0.23 | 32.12 | 32.43 | 0.76 | <0.04 | 98.84 | 1121-164.5-chalcopy-2 |
| 42 | <0.04 | <0.07 | <0.05 | <0.02 | 33.15 | <0.02 | <0.02 | 0.09 | <0.05 | 32.71 | 32.32 | <0.45 | 0.08 | 98.35 | 1121-164.5-chalcopy-3 |

Table S3. Spot analysis results of pyrite in vein (sample no. 397-124.6).

| No. | As | Cd | Co | Cr | Cu | Mn | Ni | Pb | Zn | Fe | S | Au | Ag | Total |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.05 | <0.02 | <0.05 | <0.05 | 45.18 | 53.02 | <0.45 | <0.04 | 98.26 |
| 2 | <0.04 | <0.07 | <0.02 | 0.02 | <0.03 | 0.04 | <0.02 | <0.05 | <0.05 | 44.09 | 53.00 | <0.45 | 2.76 | 97.14 |
| 3 | 0.22 | <0.07 | <0.02 | 0.01 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.87 | 53.68 | <0.45 | <0.04 | 99.79 |
| 4 | 0.51 | <0.07 | <0.02 | <0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 45.36 | 53.61 | <0.45 | <0.04 | 99.52 |
| 5 | 0.27 | <0.07 | <0.02 | <0.02 | 0.06 | 0.03 | <0.02 | <0.05 | <0.05 | 46.06 | 52.21 | 0.27 | <0.04 | 98.90 |
| 6 | 0.25 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 45.68 | 52.54 | <0.45 | 0.27 | 98.48 |

| | | | | | | | | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 7 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.74 | 52.85 | <0.45 | <0.04 | 98.59 |
| 8 | <0.04 | <0.07 | <0.02 | 0.02 | 0.06 | <0.02 | <0.02 | <0.05 | <0.05 | 45.25 | 52.17 | <0.45 | 1.34 | 97.50 |
| 9 | 0.45 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | 0.02 | <0.05 | <0.05 | 45.41 | 52.63 | <0.45 | <0.04 | 98.53 |
| 10 | 0.02 | <0.07 | <0.02 | <0.02 | 0.74 | 0.02 | <0.02 | <0.05 | <0.05 | 46.22 | 53.27 | <0.45 | <0.04 | 100.27 |
| 11 | 0.49 | <0.07 | <0.02 | <0.02 | 0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 44.93 | 52.72 | <0.45 | 2.14 | 98.18 |
| 12 | 0.35 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.41 | 53.02 | <0.45 | <0.04 | 98.78 |
| 13 | 0.07 | <0.07 | <0.02 | <0.02 | 0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 46.31 | 52.19 | <0.45 | 1.07 | 98.62 |
| 14 | 0.27 | <0.07 | <0.02 | <0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 46.58 | 52.02 | <0.45 | <0.04 | 98.90 |
| 15 | 0.15 | <0.07 | <0.02 | 0.02 | <0.03 | 0.04 | <0.02 | <0.05 | <0.05 | 45.51 | 53.91 | <0.45 | 0.13 | 99.64 |
| 16 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 44.93 | 53.84 | 1.53 | <0.04 | 100.30 |
| 17 | 0.02 | <0.07 | <0.02 | <0.02 | <0.03 | 0.05 | <0.02 | <0.05 | <0.05 | 45.41 | 53.90 | <0.45 | <0.04 | 99.38 |
| 18 | 0.17 | <0.07 | <0.02 | 0.05 | 0.04 | 0.03 | <0.02 | <0.05 | <0.05 | 44.90 | 52.74 | <0.45 | 2.80 | 97.91 |
| 19 | <0.04 | <0.07 | <0.02 | 0.02 | 0.12 | 0.04 | <0.02 | <0.05 | 0.07 | 45.44 | 52.61 | <0.45 | <0.04 | 98.29 |
| 20 | 0.35 | <0.07 | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 | <0.05 | <0.05 | 44.71 | 52.97 | 0.46 | 1.74 | 98.53 |
| 21 | 0.61 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.25 | 52.93 | <0.45 | <0.04 | 99.79 |
| 22 | 0.45 | <0.07 | <0.02 | <0.02 | 0.04 | 0.04 | 0.02 | <0.05 | <0.05 | 46.21 | 52.90 | <0.45 | <0.04 | 99.65 |
| 23 | 0.45 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.60 | 53.11 | <0.45 | <0.04 | 100.15 |
| 24 | 0.49 | <0.07 | <0.02 | 0.04 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 45.46 | 53.50 | <0.45 | <0.04 | 99.51 |
| 25 | 0.00 | <0.07 | <0.02 | <0.02 | 0.04 | 0.03 | <0.02 | <0.05 | <0.05 | 40.20 | 52.99 | <0.45 | 5.70 | 93.25 |
| 26 | 0.03 | <0.07 | <0.02 | 0.03 | 0.34 | <0.02 | 0.02 | <0.05 | 0.10 | 45.68 | 53.11 | <0.45 | <0.04 | 99.28 |
| 27 | 0.25 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.98 | 53.16 | <0.45 | <0.04 | 99.40 |
| 28 | 0.91 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.61 | 53.51 | <0.45 | <0.04 | 100.02 |
| 29 | 0.06 | <0.07 | <0.02 | 0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 44.69 | 52.20 | <0.45 | 2.80 | 96.99 |
| 30 | 0.68 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 45.35 | 53.22 | <0.45 | <0.04 | 99.27 |
| 31 | 0.14 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 42.75 | 52.03 | <0.45 | 4.91 | 94.92 |
| 32 | 0.31 | <0.07 | <0.02 | 0.02 | <0.03 | <0.02 | <0.02 | <0.05 | 0.11 | 43.74 | 52.74 | <0.45 | 2.95 | 96.92 |
| 33 | 0.44 | <0.07 | <0.02 | <0.02 | 0.01 | <0.02 | <0.02 | <0.05 | <0.05 | 45.62 | 52.67 | <0.45 | 0.40 | 98.73 |
| 34 | <0.04 | <0.07 | <0.02 | 0.03 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 43.23 | 53.16 | <0.45 | 3.74 | 96.42 |
| 35 | 0.07 | <0.07 | <0.02 | <0.02 | 0.01 | 0.02 | <0.02 | <0.05 | <0.05 | 45.79 | 53.05 | <0.45 | <0.04 | 98.94 |
| 36 | 0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 42.72 | 53.45 | <0.45 | 3.59 | 96.20 |
| 37 | 0.03 | <0.07 | <0.02 | <0.02 | 0.02 | 0.03 | <0.02 | <0.05 | <0.05 | 44.03 | 53.11 | <0.45 | 1.34 | 97.23 |
| 38 | 0.01 | <0.07 | <0.02 | <0.02 | 0.21 | <0.02 | <0.02 | <0.05 | <0.05 | 42.67 | 52.82 | <0.45 | 3.20 | 95.71 |
| 39 | 0.17 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 44.61 | 53.10 | <0.45 | 1.47 | 97.88 |
| 40 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 42.38 | 52.71 | <0.45 | 4.91 | 95.12 |
| 41 | 0.10 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 44.94 | 53.40 | <0.45 | 1.47 | 98.44 |
| 42 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | 0.04 | 45.65 | 53.29 | <0.45 | <0.04 | 98.97 |
| 43 | 0.05 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 45.28 | 52.83 | <0.45 | <0.04 | 98.18 |
| 44 | 0.04 | <0.07 | <0.02 | 0.02 | 0.18 | <0.02 | 0.02 | <0.05 | <0.05 | 44.95 | 53.13 | <0.45 | 1.34 | 98.34 |
| 45 | <0.04 | <0.07 | <0.02 | <0.02 | 0.05 | 0.02 | <0.02 | <0.05 | <0.05 | 45.34 | 52.66 | <0.45 | <0.04 | 98.08 |
| 46 | 0.03 | <0.07 | <0.02 | <0.02 | 0.03 | 0.03 | 0.02 | <0.05 | <0.05 | 45.37 | 53.42 | <0.45 | <0.04 | 98.90 |
| 47 | 0.02 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.63 | 53.19 | <0.45 | <0.04 | 98.84 |
| 48 | 0.17 | <0.07 | <0.02 | 0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 45.81 | 52.65 | <0.45 | <0.04 | 98.65 |

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|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 49 | 0.66 | <0.07 | <0.02 | 0.04 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 46.07 | 53.26 | <0.45 | <0.04 | 100.05 |
| 50 | 0.39 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 45.70 | 52.86 | <0.45 | <0.04 | 98.97 |
| 51 | 0.03 | <0.07 | <0.02 | <0.02 | 0.06 | <0.02 | <0.02 | <0.05 | <0.05 | 46.06 | 52.58 | <0.45 | 0.81 | 98.73 |
| 52 | 0.01 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | 0.02 | <0.05 | <0.05 | 46.14 | 52.46 | <0.45 | <0.04 | 98.65 |
| 53 | 0.25 | <0.07 | <0.02 | 0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 46.30 | 52.91 | <0.45 | <0.04 | 99.49 |
| 54 | 0.03 | <0.07 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.48 | 53.94 | <0.45 | 0.27 | 100.48 |
| 55 | 0.65 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 42.78 | 52.38 | <0.45 | 3.45 | 95.80 |
| 56 | 0.06 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.26 | 52.50 | <0.45 | <0.04 | 98.82 |
| 57 | 0.03 | <0.07 | <0.02 | <0.02 | 0.09 | 0.06 | <0.02 | <0.05 | <0.05 | 46.07 | 53.30 | <0.45 | 1.19 | 99.54 |
| 58 | 0.02 | <0.07 | <0.02 | <0.02 | 0.06 | <0.02 | 0.02 | <0.05 | <0.05 | 46.59 | 52.43 | <0.45 | <0.04 | 99.12 |
| 59 | 0.74 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.74 | 53.33 | <0.45 | <0.04 | 100.81 |
| 60 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 45.47 | 53.68 | <0.45 | <0.04 | 99.17 |
| 61 | 0.59 | <0.07 | <0.02 | 0.03 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 45.34 | 52.46 | <0.45 | 1.74 | 98.44 |
| 62 | 0.06 | <0.07 | <0.02 | <0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 45.42 | 53.10 | <0.45 | <0.04 | 98.60 |
| 63 | 0.14 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 43.26 | 53.39 | <0.45 | 2.27 | 96.79 |
| 64 | 0.12 | <0.07 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.74 | 52.67 | <0.45 | <0.04 | 98.55 |
| 65 | 0.08 | <0.07 | <0.02 | <0.02 | 0.04 | 0.03 | <0.02 | <0.05 | <0.05 | 46.35 | 53.43 | <0.45 | <0.04 | 99.92 |
| 66 | <0.04 | <0.07 | <0.02 | <0.02 | 0.07 | 0.04 | <0.02 | <0.05 | <0.05 | 42.83 | 53.99 | <0.45 | 3.86 | 96.93 |
| 67 | 0.01 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.21 | 52.57 | <0.45 | <0.04 | 98.79 |
| 68 | <0.04 | <0.07 | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 | <0.05 | <0.05 | 45.89 | 53.54 | <0.45 | <0.04 | 99.47 |
| 69 | 0.00 | <0.07 | <0.02 | <0.02 | 0.39 | 0.06 | 0.02 | <0.05 | <0.05 | 46.16 | 53.37 | <0.45 | <0.04 | 100.00 |
| 70 | 0.19 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 45.67 | 53.53 | <0.45 | <0.04 | 99.39 |
| 71 | 0.94 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | 0.03 | <0.05 | <0.05 | 45.63 | 53.63 | <0.45 | <0.04 | 100.25 |
| 72 | 0.03 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.34 | 53.91 | <0.45 | <0.04 | 100.27 |
| 73 | 0.12 | <0.07 | <0.02 | <0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 46.59 | 53.03 | 0.48 | <0.04 | 100.24 |
| 74 | 0.05 | <0.07 | <0.02 | <0.02 | 0.62 | <0.02 | <0.02 | <0.05 | <0.05 | 46.45 | 52.25 | <0.45 | <0.04 | 99.37 |
| 75 | 0.19 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 44.71 | 52.14 | 0.60 | 2.67 | 97.63 |
| 76 | 0.19 | <0.07 | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 | <0.05 | <0.05 | 45.85 | 52.42 | 0.15 | <0.04 | 98.65 |

Table S4. Spot analysis results of pyrite in hanging wall (sample no. 5144-179.6).

| No. | As | Cd | Co | Cr | Cu | Mn | Ni | Pb | Zn | Fe | S | Au | Ag | Total |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | <0.04 | <0.07 | <0.02 | 0.02 | 0.05 | <0.02 | <0.02 | <0.05 | <0.05 | 47.13 | 52.76 | <0.45 | <0.04 | 99.96 |
| 2 | <0.04 | <0.07 | <0.02 | 0.03 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.37 | 52.53 | <0.45 | <0.04 | 99.93 |
| 3 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.08 | 50.78 | <0.45 | 3.09 | 96.86 |
| 4 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 48.00 | 51.93 | <0.45 | <0.04 | 99.95 |
| 5 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.56 | 51.06 | <0.45 | 2.11 | 97.62 |
| 6 | <0.04 | <0.07 | <0.02 | 0.02 | 0.04 | 0.02 | <0.02 | <0.05 | <0.05 | 47.95 | 51.93 | <0.45 | <0.04 | 99.96 |
| 7 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.24 | 51.46 | <0.45 | 2.24 | 97.70 |
| 8 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.53 | 50.22 | <0.45 | 2.25 | 97.75 |
| 9 | <0.04 | <0.07 | <0.02 | 0.02 | 0.04 | <0.02 | <0.02 | <0.05 | <0.05 | 47.01 | 50.78 | <0.45 | 2.11 | 97.85 |
| 10 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.46 | 50.04 | <0.45 | 2.44 | 97.50 |
| 11 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.92 | 50.69 | <0.45 | 1.37 | 98.61 |

| | | | | | | | | | | | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 12 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.74 | 51.13 | <0.45 | 1.06 | 98.87 |
| 13 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.04 | <0.02 | <0.05 | <0.05 | 49.65 | 50.24 | <0.45 | <0.04 | 99.93 |
| 14 | <0.04 | <0.07 | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 | <0.05 | <0.05 | 45.87 | 49.73 | <0.45 | 4.35 | 95.64 |
| 15 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 49.74 | 50.19 | <0.45 | <0.04 | 99.94 |
| 16 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.03 | <0.02 | <0.05 | <0.05 | 47.92 | 51.87 | <0.45 | <0.04 | 99.83 |
| 17 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.05 | <0.02 | <0.05 | <0.05 | 47.12 | 51.19 | <0.45 | 1.37 | 98.36 |
| 18 | <0.04 | <0.07 | <0.02 | <0.02 | 0.05 | 0.06 | <0.02 | <0.05 | <0.05 | 47.39 | 51.55 | <0.45 | 0.91 | 99.04 |
| 19 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.16 | 52.82 | <0.45 | <0.04 | 99.98 |
| 20 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 48.08 | 50.98 | 0.85 | <0.04 | 99.92 |
| 21 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 46.44 | 53.27 | <0.45 | <0.04 | 99.74 |
| 22 | <0.04 | <0.07 | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 | <0.05 | <0.05 | 47.56 | 52.37 | <0.45 | <0.04 | 99.97 |
| 23 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.89 | 51.48 | <0.45 | 0.60 | 99.37 |
| 24 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 47.81 | 51.99 | <0.45 | <0.04 | 99.82 |
| 25 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.96 | 51.99 | <0.45 | <0.04 | 99.95 |
| 26 | <0.04 | <0.07 | <0.02 | 0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.16 | 50.69 | <0.45 | 2.10 | 97.87 |
| 27 | <0.04 | <0.07 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.84 | 52.09 | <0.45 | <0.04 | 99.96 |
| 28 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 46.94 | 51.00 | <0.45 | 1.95 | 97.96 |
| 29 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | 0.06 | <0.02 | <0.05 | <0.05 | 47.77 | 52.07 | <0.45 | <0.04 | 99.90 |
| 30 | <0.04 | <0.07 | <0.02 | 0.02 | <0.03 | 0.06 | <0.02 | <0.05 | <0.05 | 47.42 | 52.34 | <0.45 | <0.04 | 99.85 |
| 31 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 48.93 | 51.01 | <0.45 | <0.04 | 99.96 |
| 32 | <0.04 | <0.07 | <0.02 | <0.02 | 0.06 | <0.02 | <0.02 | <0.05 | <0.05 | 47.81 | 52.02 | <0.45 | <0.04 | 99.89 |
| 33 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.21 | 50.89 | <0.45 | 2.81 | 97.10 |
| 34 | <0.04 | <0.07 | <0.02 | <0.02 | 0.03 | 0.02 | <0.02 | <0.05 | <0.05 | 46.79 | 51.37 | <0.45 | 1.51 | 98.21 |
| 35 | 0.07 | <0.07 | <0.02 | <0.02 | 0.03 | 0.06 | <0.02 | <0.05 | <0.05 | 48.08 | 51.75 | <0.45 | <0.04 | 99.98 |
| 36 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 47.36 | 52.55 | <0.45 | <0.04 | 99.93 |
| 37 | 0.01 | <0.07 | <0.02 | 0.02 | 0.26 | 0.05 | <0.02 | <0.05 | <0.05 | 48.25 | 51.36 | <0.45 | <0.04 | 99.95 |
| 38 | <0.04 | <0.07 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.85 | 52.10 | <0.45 | <0.04 | 99.95 |
| 39 | 0.01 | <0.07 | <0.02 | 0.02 | <0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 46.41 | 51.02 | <0.45 | 2.35 | 97.45 |
| 40 | 0.03 | <0.07 | <0.02 | 0.02 | <0.03 | <0.02 | <0.02 | <0.05 | 0.07 | 46.84 | 51.74 | 1.26 | <0.04 | 99.95 |
| 41 | <0.04 | <0.07 | <0.02 | 0.02 | 0.03 | <0.02 | <0.02 | <0.05 | <0.05 | 47.68 | 51.11 | <0.45 | 1.10 | 98.84 |
| 42 | 0.01 | <0.07 | <0.02 | <0.02 | 0.05 | <0.02 | <0.02 | <0.05 | <0.05 | 48.33 | 51.59 | <0.45 | <0.04 | 99.98 |
| 43 | <0.04 | <0.07 | <0.02 | <0.02 | 0.09 | <0.02 | <0.02 | <0.05 | <0.05 | 48.86 | 50.98 | <0.45 | <0.04 | 99.93 |
| 44 | 0.06 | <0.07 | <0.02 | <0.02 | 0.06 | <0.02 | <0.02 | <0.05 | <0.05 | 48.40 | 51.45 | <0.45 | <0.04 | 99.97 |
| 45 | <0.04 | <0.07 | <0.02 | <0.02 | 0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 47.64 | 51.30 | 0.65 | 0.35 | 99.63 |
| 46 | <0.04 | <0.07 | <0.02 | <0.02 | 0.03 | <0.02 | 0.02 | <0.05 | <0.05 | 46.77 | 50.57 | 0.58 | 2.03 | 97.95 |
| 47 | <0.04 | <0.07 | <0.02 | <0.02 | 0.01 | 0.03 | <0.02 | <0.05 | <0.05 | 47.77 | 50.89 | <0.45 | 1.27 | 98.70 |

Table S5. Chemical composition (.wt%) of Calcite. Formula calculated on the basis of sum cations = 1, CO₂ calculated by stoichiometry.

| Label | 5144-195- cc1 | 5144-195- cc2 | 5144-195- cc3 | 5144-195- cc4 | 5144-195- cc5 | 5144-195- cc6 | 5144-195- cc7 |
|-------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| MgO | 0.19 | 0.13 | 0.21 | 0.15 | 0.17 | 0.30 | 0.19 |
| MnO | 1.00 | 1.35 | 1.28 | 0.86 | 1.02 | 1.27 | 1.12 |

| | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|
| CaO | 52.56 | 51.96 | 51.46 | 52.65 | 52.12 | 52.13 | 52.16 |
| FeO | 0.01 | 0.07 | 0.02 | 0.00 | 0.00 | 0.02 | 0.02 |
| CO2* | 46.03 | 46.34 | 46.76 | 46.10 | 46.42 | 46.08 | 46.29 |
| Total | 99.78 | 99.85 | 99.73 | 99.76 | 99.73 | 99.79 | 99.77 |
| Mg | 0.005 | 0.003 | 0.006 | 0.004 | 0.005 | 0.008 | 0.005 |
| Mn | 0.015 | 0.020 | 0.019 | 0.013 | 0.015 | 0.019 | 0.017 |
| Ca | 0.980 | 0.976 | 0.975 | 0.983 | 0.980 | 0.973 | 0.978 |
| Fe | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CO2 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Total | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |

Table S6. Mole% of FeS in sphalerite.

| AsS | CdS | CoS | CrS | CuS | MnS | NiS | PbS | ZnS | FeS | AuS | AgS | total |
|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|---------|
| 0.000 | 0.000 | 0.000 | 0.000 | 1.842 | 0.000 | 0.028 | 0.000 | 91.168 | 6.508 | 0.454 | 0.000 | 100.000 |
| 0.000 | 0.069 | 0.000 | 0.000 | 2.506 | 0.105 | 0.000 | 0.035 | 90.632 | 6.653 | 0.000 | 0.000 | 100.000 |
| 0.000 | 0.060 | 0.000 | 0.000 | 2.850 | 0.035 | 0.000 | 0.000 | 90.917 | 5.761 | 0.376 | 0.000 | 100.000 |
| 0.000 | 0.000 | 0.000 | 0.045 | 3.063 | 0.000 | 0.000 | 0.044 | 93.295 | 3.122 | 0.366 | 0.065 | 100.000 |
| 0.000 | 0.000 | 0.000 | 0.000 | 2.243 | 0.000 | 0.000 | 0.039 | 94.547 | 2.687 | 0.347 | 0.136 | 100.000 |
| 0.000 | 0.000 | 0.000 | 0.033 | 1.459 | 0.110 | 0.000 | 0.037 | 94.917 | 3.045 | 0.399 | 0.000 | 100.000 |
| 0.000 | 0.061 | 0.000 | 0.000 | 1.279 | 0.000 | 0.000 | 0.000 | 93.239 | 4.942 | 0.478 | 0.000 | 100.000 |
| 0.000 | 0.105 | 0.000 | 0.000 | 1.238 | 0.125 | 0.000 | 0.000 | 92.869 | 4.972 | 0.692 | 0.000 | 100.000 |
| 0.000 | 0.160 | 0.000 | 0.082 | 1.543 | 0.036 | 0.000 | 0.000 | 93.997 | 3.910 | 0.273 | 0.000 | 100.000 |
| 0.000 | 0.000 | 0.000 | 0.040 | 2.546 | 0.000 | 0.000 | 0.023 | 92.513 | 4.386 | 0.492 | 0.000 | 100.000 |
| 0.000 | 0.132 | 0.000 | 0.000 | 1.735 | 0.000 | 0.000 | 0.000 | 93.606 | 4.044 | 0.483 | 0.000 | 100.000 |
| 0.000 | 0.152 | 0.000 | 0.000 | 0.079 | 0.000 | 0.000 | 0.019 | 94.683 | 4.373 | 0.694 | 0.000 | 100.000 |
| 0.000 | 0.000 | 0.000 | 0.061 | 0.834 | 0.000 | 0.000 | 0.000 | 94.556 | 4.549 | 0.000 | 0.000 | 100.000 |
| 0.000 | 0.114 | 0.000 | 0.000 | 1.101 | 0.000 | 0.035 | 0.000 | 93.895 | 4.855 | 0.000 | 0.000 | 100.000 |
| 0.000 | 0.000 | 0.000 | 0.000 | 2.379 | 0.000 | 0.000 | 0.000 | 92.806 | 4.815 | 0.000 | 0.000 | 100.000 |