

Table S1. supplemental data table for concentration of trace element by EPMA and the results obtained by NanoSIMS.

⁷⁵ As/ ³⁴ S	±SE	As(%)	±SE	¹⁹⁷ Au/ ³⁴ S	±SE	Au(%)	±SE	⁶³ Cu ³² S/ ³⁴ S	±SE	Cu (%)	±SE	²⁰⁸ Pb ³² S	±SE	Pb (%)	±SE
9.0	0.17	1.1E-02	5.3E-05	0.20	0.12	7.7E-03	2.0E-05	0.03	0.039	1.1E-03	1.3E-05	0.19	0.043	8.4E-06	9.6E-07
8.9	0.17	1.1E-02	5.2E-05	NA	NA	NA	NA	NA	NA	NA	NA	0.26	0.050	7.9E-06	4.6E-07
7.5	0.16	9.0E-03	4.8E-05	NA	NA	NA	NA	0.07	0.040	1.2E-03	1.5E-05	0.20	0.050	5.8E-06	6.4E-07
4.0	0.12	6.5E-03	4.0E-05	0.05	0.12	1.5E-03	4.7E-05	0.03	0.040	9.1E-04	1.2E-05	0.15	0.049	5.0E-06	4.6E-07
4.3	0.12	6.4E-03	4.0E-05	0.15	0.12	4.1E-03	3.2E-05	0.25	0.047	3.2E-03	2.3E-05	0.15	0.049	5.6E-06	6.8E-07
3.5	0.17	4.4E-03	3.4E-05	NA	NA	NA	NA	NA	NA	NA	NA	0.16	0.043	6.9E-06	4.6E-07
5.1	0.13	6.9E-03	4.0E-05	NA	NA	NA	NA	0.23	0.046	2.9E-03	2.2E-05	0.12	0.050	1.5E-06	6.4E-07
4.2	0.12	6.1E-03	3.9E-05	NA	NA	NA	NA	0.34	0.047	5.2E-03	3.2E-05	0.16	0.050	4.8E-07	6.8E-07
4.4	0.15	5.9E-03	3.8E-05	NA	NA	NA	NA	0.37	0.047	5.5E-03	3.2E-05	0.13	0.049	6.3E-07	9.6E-07
4.3	0.12	3.9E-03	4.9E-05	NA	NA	NA	NA	0.28	0.046	3.5E-03	2.6E-05	0.12	0.051	2.0E-06	4.6E-07
4.2	0.12	4.6E-03	5.4E-05	0.05	0.12	2.2E-03	1.8E-05	NA	NA	NA	NA	0.17	0.049	4.6E-07	6.4E-07
3.8	0.12	4.1E-03	4.8E-05	0.13	0.12	5.1E-03	4.9E-05	0.21	0.041	3.9E-03	2.1E-05	0.17	0.048	3.2E-07	6.8E-07
2.7	0.10	3.9E-03	5.0E-05	NA	NA	NA	NA	0.15	0.042	3.5E-03	2.0E-05	0.15	0.049	3.2E-07	6.4E-07
3.7	0.12	3.8E-03	4.8E-05	NA	NA	NA	NA	NA	NA	NA	NA	0.13	0.050	2.1E-06	9.6E-07
4.9	0.13	4.8E-03	5.0E-05	0.11	0.12	4.8E-03	4.9E-05	0.07	0.041	1.7E-03	1.7E-05	0.14	0.043	6.3E-06	4.6E-07
4.6	0.13	3.5E-03	4.6E-05	NA	NA	NA	NA	0.16	0.042	2.2E-03	2.0E-05	0.08	0.050	1.5E-06	6.4E-07
5.7	0.14	7.4E-03	4.0E-05	NA	NA	NA	NA	0.04	0.041	1.3E-03	1.4E-05	0.19	0.050	3.6E-06	6.8E-07
4.0	0.12	6.3E-03	3.7E-05	0.27	0.12	7.8E-03	3.3E-05	0.09	0.041	1.6E-03	1.6E-05	0.16	0.049	4.2E-06	6.4E-07
2.9	0.10	4.0E-03	2.9E-05	0.15	0.12	5.9E-03	4.9E-05	NA	NA	1.2E-03	1.4E-05	0.12	0.051	4.9E-06	9.6E-07
3.7	0.12	3.5E-03	2.8E-05	NA	NA	NA	NA	0.05	0.041	1.9E-03	1.7E-05	0.24	0.049	3.4E-06	4.6E-07
3.1	0.11	3.4E-03	3.3E-05	0.13	0.12	5.0E-03	3.5E-05	0.09	0.040	1.2E-03	1.4E-05	0.11	0.048	2.9E-06	9.6E-07
3.9	0.12	4.1E-03	3.6E-05	0.19	0.12	6.7E-03	4.9E-05	0.02	0.042	1.3E-03	1.9E-05	0.21	0.049	1.9E-06	4.6E-07
3.2	0.11	2.4E-03	2.9E-05	0.21	0.12	5.1E-03	4.7E-05	NA	NA	NA	NA	0.05	0.050	1.2E-06	6.4E-07
5.3	0.13	6.2E-03	5.1E-05	0.32	0.12	6.5E-03	4.7E-05	0.10	0.040	1.7E-03	2.2E-05	0.10	0.043	4.5E-07	6.8E-07

4.5	0.13	4.4E-03	4.7E-05	0.05	0.12	4.1E-03	NA	0.12	0.040	1.6E-03	2.1E-05	0.18	0.050	3.5E-06	9.6E-07
6.0	0.14	6.6E-03	5.3E-05	0.14	0.12	6.7E-03	2.2E-05	0.15	0.045	2.8E-03	2.9E-05	0.09	0.050	3.0E-06	4.6E-07
7.2	0.15	8.0E-03	5.7E-05	NA	NA	NA	NA	0.25	0.043	3.8E-03	3.4E-05	0.15	0.051	1.6E-06	9.6E-07
7.2	0.15	8.5E-03	5.9E-05	0.32	0.12	7.9E-03	4.3E-05	0.20	0.044	4.3E-03	3.5E-05	0.15	0.049	3.1E-06	4.6E-07
9.0	0.17	9.9E-03	6.3E-05	0.29	0.12	7.4E-03	3.8E-05	NA	NA	NA	NA	0.22	0.049	4.9E-06	9.6E-07
8.1	0.16	9.4E-03	6.0E-05	NA	NA	NA	NA	NA	NA	NA	NA	0.14	0.050	7.0E-06	4.6E-07
7.6	0.16	8.8E-03	5.8E-05	NA	NA	NA	NA	0.12	0.041	3.7E-03	3.3E-05	0.22	0.043	6.2E-06	6.4E-07
8.0	0.16	9.7E-03	6.2E-05	0.10	0.08	4.0E-03	4.9E-05	0.06	0.041	2.7E-03	2.8E-05	0.17	0.050	4.5E-06	9.6E-07

Table S2. Sulfur isotope and trace element data of pyrite from Lannigou Carlin type gold deposit

Sample	$^{34}\text{S}/^{32}\text{S}$	$\pm\text{SE}(\%)$	$\delta^{34}\text{S}_{\text{Raw}}$	$\pm\text{SE}$	$\delta^{34}\text{S}_{\text{corr}}$	$\pm\text{SE}$	$^{75}\text{As}/^{34}\text{S}$	$\text{SE}(\%)$	$^{63}\text{Cu}^{32}\text{S}/^{34}\text{S}$	$\text{SE}(\%)$	$^{75}\text{AsS}/^{34}\text{S}$	$\text{SE}(\%)$	$^{197}\text{Au}/^{34}\text{S}$	$\text{SE}(\%)$
Standard(1117)	4.41E-02	2.27E-02	-2.5	0.2	0.6	0.2	1.21E-06	1.83E+00	7.56E-06	7.52E+00	3.43E-06	1.18E+01	2.17E-07	4.44E+01
Standard(1117)	4.40E-02	2.59E-02	-2.8	0.3	0.3	0.3	1.53E-07	5.12E+00	6.44E-06	7.66E+00	3.74E-06	1.11E+01	7.63E-08	7.06E+01
Standard(1117)	4.41E-02	2.65E-02	-2.5	0.3	0.5	0.3	1.42E-07	5.32E+00	6.20E-06	7.72E+00	4.55E-06	9.71E+00	0.00E+00	9.71E+00
Standard(1117)	4.40E-02	3.33E-02	-2.8	0.3	0.2	0.3	5.48E-07	2.95E+00	3.71E-06	1.11E+01	2.99E-06	1.26E+01	9.06E-08	7.06E+01
Standard(1117)	4.40E-02	2.80E-02	-3.1	0.3	-0.1	0.3	9.24E-08	7.15E+00	7.70E-06	7.94E+00	4.37E-06	9.86E+00	8.33E-08	7.06E+01
Standard(1117)	4.41E-02	2.91E-02	-2.1	0.3	0.9	0.3	1.14E-07	6.09E+00	6.01E-06	8.92E+00	5.49E-06	8.34E+00	8.01E-08	7.06E+01
Standard(1117)	4.40E-02	2.79E-02	-3.0	0.3	0.0	0.3	5.36E-07	3.03E+00	3.87E-06	1.16E+01	4.82E-06	9.68E+00	4.50E-08	1.00E+02
Standard(1117)	4.40E-02	2.65E-02	-3.0	0.3	0.1	0.3	1.62E-07	5.14E+00	2.87E-06	1.28E+01	4.68E-06	1.01E+01	1.69E-07	4.97E+01
Sample	4.44E-02	2.69E-02	5.7	0.3	8.8	0.3	2.79E-03	4.18E-01	7.46E-04	7.75E-01	9.09E-02	1.38E-01	9.47E-07	2.21E+01
Sample	4.46E-02	3.16E-02	10.8	0.3	13.9	0.3	4.05E-03	3.60E-01	1.44E-03	6.05E-01	1.51E-01	8.49E-02	1.01E-05	7.11E+00
Sample	4.47E-02	2.90E-02	11.9	0.3	15.0	0.3	4.81E-03	4.06E-01	1.03E-03	7.15E-01	1.29E-01	1.40E-01	1.29E-05	6.82E+00
Sample	4.49E-02	2.92E-02	15.9	0.3	19.0	0.3	1.21E-03	5.71E-01	5.06E-04	9.82E-01	4.56E-02	1.17E-01	1.70E-04	1.65E+00

Sample	4.49E-02	2.76E-02	16.2	0.3	19.3	0.3	1.31E-03	6.84E-01	4.22E-04	1.12E+00	3.94E-02	1.48E-01	2.93E-04	1.38E+00
Sample	4.48E-02	3.11E-02	13.3	0.3	16.4	0.3	5.93E-03	3.14E-01	3.34E-04	1.23E+00	1.99E-01	7.18E-02	1.18E-06	2.18E+01
Sample	4.47E-02	2.76E-02	12.3	0.3	15.4	0.3	4.32E-03	3.79E-01	1.04E-04	2.20E+00	1.45E-01	1.91E-01	9.95E-07	2.09E+01
Sample	4.47E-02	2.88E-02	12.1	0.3	15.2	0.3	5.06E-03	3.52E-01	1.75E-04	1.68E+00	1.64E-01	1.16E-01	1.16E-06	1.99E+01
Sample	4.45E-02	2.53E-02	8.4	0.3	11.5	0.3	1.11E-05	6.40E+00	7.48E-07	2.53E+01	1.93E-04	1.55E+00	2.08E-07	4.44E+01
Sample	4.45E-02	2.36E-02	7.5	0.2	10.6	0.2	2.41E-05	4.35E+00	1.19E-05	6.52E+00	5.27E-04	1.48E+00	2.43E-07	4.04E+01
Standard(1117)	4.41E-02	2.48E-02	-1.8	0.2	1.3	0.2	1.65E-08	1.53E+01	8.23E-07	2.09E+01	4.59E-06	9.31E+00	7.84E-08	7.06E+01
Standard(1117)	4.40E-02	2.51E-02	-3.0	0.3	0.1	0.3	2.06E-08	1.40E+01	1.65E-06	1.44E+01	4.91E-06	8.60E+00	1.50E-07	4.97E+01
Standard(1117)	4.40E-02	2.44E-02	-2.7	0.2	0.4	0.2	1.95E-08	1.32E+01	9.77E-07	2.03E+01	6.98E-06	6.85E+00	1.81E-07	4.44E+01
Standard(1117)	4.40E-02	2.60E-02	-3.1	0.3	-0.1	0.3	1.91E-08	1.48E+01	6.09E-07	2.68E+01	4.34E-06	9.52E+00	8.12E-08	7.06E+01
Standard(1117)	4.40E-02	2.53E-02	-2.6	0.3	0.4	0.3	2.34E-08	1.32E+01	6.03E-07	2.42E+01	7.05E-06	7.64E+00	1.13E-07	5.75E+01
Standard(1117)	4.40E-02	2.51E-02	-3.2	0.3	-0.2	0.3	2.28E-06	1.10E+01	7.28E-07	2.26E+01	7.25E-06	7.58E+00	1.09E-07	5.75E+01
Standard(1117)	4.40E-02	2.59E-02	-2.6	0.3	0.4	0.3	2.86E-08	1.19E+01	8.06E-07	2.15E+01	6.08E-06	8.11E+00	2.01E-07	4.44E+01
Standard(1117)	4.40E-02	2.33E-02	-3.1	0.2	0.0	0.2	2.27E-06	1.08E+01	9.08E-07	2.12E+01	8.25E-06	6.78E+00	2.27E-07	4.04E+01

Figure S1. Identification of isobaric interference through mass peak of $^{75}\text{As}^{32}\text{S}$, ^{107}Ag and $^{75}\text{As}^{34}\text{S}$.

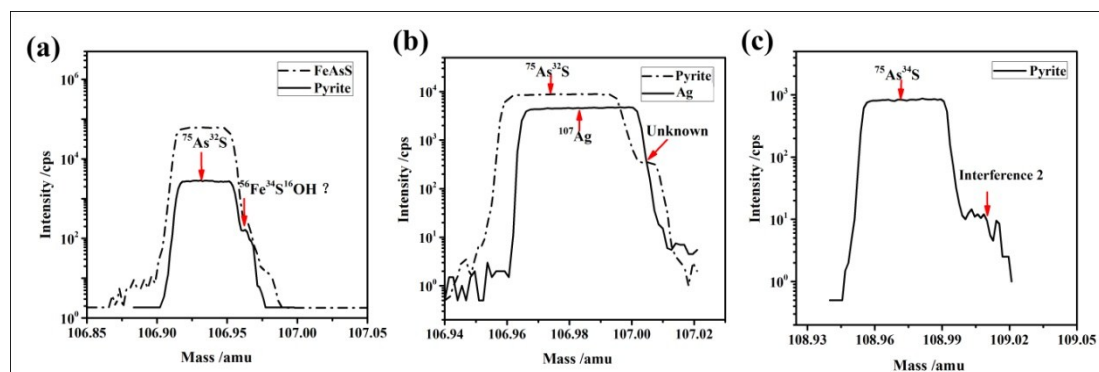


Figure S2 Secondary ion images of ^{34}S , $^{75}\text{As}^{32}\text{S}$, ^{16}O , ^{12}C and isobaric interference

