

Supplementary Materials

Distribution of “Invisible” Noble Metals between Pyrite and Arsenopyrite Exemplified by Minerals Coexisting in Orogenic Au Deposits of North-Eastern Russia

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Table S1. Analysis of single crystal size selections of coexisting pyrite and arsenopyrite of mineral samples of Natalkinskoe (Nat, UV), Degdekan (DG) and Zolotaya Rechka (ZR) deposits, Northeastern Russia.

Mineral, Sample No.	Number of Cryst. (Starting- Final Sample)	Characteristics of the Final Sample					NM Contents (ppm)*					
		Num. of Cryst.	Range of Mass. (mg)	\bar{m} (mg)	\bar{r} (mm)	\bar{S}_{sp} ($\frac{mm^3}{mg}$)	$\bar{C}_{NM} \pm 1\sigma$ (ppm)	\bar{C}^{tot}	\bar{C}^{ev}	C^{str}	\bar{C}^{sur}	
1	2	3	4	5	6	7	8	9	10	11	12	
Gold, ppm												
Pyrite, Nat-10	60–39	8	0.29–0.51	0.40	0.431	2.787	13 ± 3					
		8	0.55–1.63	0.97	0.579	2.074	8.5 ± 2.2					
		6	1.72–2.57	2.26	0.767	1.562	5.3 ± 2.9	10.5	4.5	1.8	2.7	
		9	2.66–4.14	3.10	0.853	1.406	6.6 ± 2.8					
		8	4.48–16.2	10.65	1.287	0.933	3.1 ± 0.8					
Arseno-pyrite, Nat-10	60–38	7	0.21–0.41	0.32	0.373	2.609	7.2 ± 3.4					
		7	0.42–0.56	0.49	0.431	2.275	7.3 ± 3.8					
		9	0.58–0.98	0.77	0.501	1.956	8.2 ± 1.5	5.1	3.2	1.2	1.9	
		7	1.17–2.31	1.46	0.621	1.585	5.5 ± 1.0					
		8	3.73–14.33	8.28	1.107	0.888	1.9 ± 0.6					
Pyrite, DG-10/14	67–44	8	0.15–0.44	0.35	0.412	2.910	3.9 ± 1.3					
		6	0.46–0.57	0.52	0.470	2.549	3.2 ± 0.9					
		7	0.66–1.22	0.93	0.571	2.103	1.3 ± 0.5					
		9	1.30–1.77	1.52	0.672	1.783	1.4 ± 0.5	2.8	1.2	0.13	1.1	
		6	1.80–2.07	1.89	0.723	1.659	0.7 ± 0.2					
Arseno-pyrite, DG-10/14	79–50	8	2.10–5.10	3.09	0.852	1.410	0.8 ± 0.3					
		12	0.13–0.41	0.35	0.385	2.541	4.4 ± 0.6					
		10	0.43–0.58	0.50	0.434	2.260	2.6 ± 0.6					
		6	0.60–0.94	0.81	0.510	1.927	1.2 ± 0.8					
		9	1.02–1.94	1.30	0.597	1.645	0.5 ± 0.2	8.2	0.4	0.03	0.48	
		7	2.24–6.83	5.06	0.940	1.048	0.2 ± 0.1					
Pyrite, ZR-10/13	66–41	6	7.04–14.15	10.20	1.187	0.829	0.2 ± 0.1					
		8	0.10–0.15	0.14	0.304	3.961	30 ± 19					
		11	0.17–0.23	0.20	0.342	3.509	12 ± 2	25.5	9.5		n/d**	
		9	0.24–0.37	0.29	0.387	3.099	7.9 ± 1.7					

		7	0.40–0.67	0.49	0.461	2.602	8.2 ± 2.7				
		6	0.68–5.51	2.52	0.796	1.509	8.6 ± 6.0				
Arseno-pyrite, ZR-10/13	55–37	9	0.10–0.15	0.12	0.271	3.672	135 ± 33				
		8	0.16–0.23	0.20	0.321	3.091	124 ± 28				
		7	0.24–0.46	0.38	0.396	2.476	85 ± 31	85.6	59.3	13.7	47.1
		6	0.47–0.66	0.60	0.461	2.125	65 ± 28				
		7	0.76–1.71	1.33	0.602	1.635	33 ± 10				
Pyrite, UV-3/13	80–52	10	0.10–0.18	0.15	0.311	3.869	6.0 ± 1.1				
		9	0.20–0.29	0.26	0.373	3.211	2.7 ± 0.7				
		9	0.31–0.39	0.34	0.408	2.938	2.6 ± 0.7				
		7	0.41–0.52	0.54	0.476	2.518	2.0 ± 0.5	2.7	1.6	0.29	1.4
		8	0.60–1.00	0.75	0.531	2.256	1.7 ± 0.3				
		9	1.05–3.60	2.14	0.754	1.594	1.0 ± 0.3				
Arseno-pyrite, UV-3/13	78–54	10	0.11–0.24	0.18	0.330	3.630	5.9 ± 1.3				
		9	0.25–0.35	0.33	0.404	2.968	2.0 ± 0.5				
		9	0.36–0.51	0.42	0.438	2.741	2.0 ± 0.5				
		8	0.52–0.59	0.64	0.504	2.381	1.2 ± 0.4	8.3	1.4	0.12	1.3
		9	0.76–1.10	0.96	0.577	2.081	1.2 ± 0.3				
		9	1.19–2.16	1.59	0.683	1.760	0.8 ± 0.2				

Table S1. Cont.

1	2	3	4	5	6	7	8	9	10	11	12	
Platinum, ppm 10⁻²												
Pyrite, Nat-10	54-34	8	0.30-0.55	0.45	0.448	2.676	2.4 ± 0.2					
		8	0.60-1.96	1.46	0.663	1.806	1.0 ± 0.2					
		7	2.24-2.71	2.51	0.795	1.511	0.6 ± 0.1	0.56	0.33	0.036	0.35	
		6	2.84-4.14	3.65	0.900	1.332	0.3 ± 0.1					
		5	4.48-16.20	11.50	1.320	0.909	0.13 ± 0.05					
Arseno-pyrite, Nat-10	60-39	8	0.21-0.41	0.30	0.366	2.679	6.7 ± 0.8					
		8	0.42-0.56	0.49	0.431	2.275	4 ± 1					
		9	0.58-0.98	0.74	0.495	1.987	2.7 ± 0.5	1.35	0.78	0.042	0.89	
		8	1.17-2.31	1.65	0.646	1.518	1.3 ± 0.4					
		6	3.73-14.33	9.21	1.147	0.857	0.2 ± 0.1					
Pyrite, DG-10/14	34-22	4	0.15-0.41	0.34	0.408	2.938	2.6 ± 0.9					
		7	0.42-0.49	0.46	0.451	2.653	2.6 ± 0.6					
		6	0.51-0.71	0.59	0.490	2.442	1.5 ± 0.4	1.40	1.02	0.051	1.03	
		5	0.91-5.10	2.58	0.802	1.496	0.4 ± 0.1					
Arseno-pyrite, DG-10/14	86-59	10	0.13-0.41	0.34	0.383	2.589	36 ± 10					
		8	0.43-0.58	0.50	0.434	2.260	1.8 ± 0.5					
		9	0.60-1.02	0.81	0.510	1.927	1.2 ± 0.3	0.46	0.33	0.021	0.29	
		12	1.05-1.94	1.44	0.618	1.591	0.8 ± 0.1					
		9	2.06-6.52	5.17	0.947	1.041	0.17 ± 0.02					
Pyrite, ZR-10/13	65-47	11	6.83-14.45	10.47	1.197	0.821	0.10 ± 0.02					
		12	0.10-0.15	0.13	0.296	4.044	12 ± 1					
		12	0.17-0.23	0.20	0.342	3.509	9 ± 1					
		9	0.24-0.37	0.30	0.391	3.058	4.8 ± 1.1	2.95	2.17	0.12	2.59	
		7	0.40-0.68	0.62	0.499	2.410	2.4 ± 0.5					
Arseno-pyrite, ZR-10/13	55-36	7	0.69-5.51	2.40	0.783	1.533	0.6 ± 0.3					
		9	0.10-0.15	0.12	0.271	3.672	7 ± 2					
		7	0.16-0.23	0.19	0.314	3.114	5 ± 1					
		7	0.24-0.46	0.29	0.363	2.726	4 ± 1	3.78	2.49	0.37	2.28	
		7	0.47-0.66	0.57	0.453	2.160	2.7 ± 0.8					
Pyrite,	79-52	10	0.76-1.71	1.25	0.590	1.671	1.3 ± 0.5					
Pyrite,	79-52	10	0.10-0.18	0.16	0.317	3.768	7 ± 1	3.22	2.08	0.37	1.89	

UV-3/13		10	0.20–0.29	0.24	0.363	3.294	3.7 ± 0.4				
		8	0.31–0.39	0.35	0.412	2.910	3.6 ± 1.1				
		9	0.41–0.58	0.52	0.470	2.549	3.2 ± 0.7				
		8	0.60–1.00	0.78	0.538	2.227	3.4 ± 0.5				
		7	1.05–3.60	2.69	0.813	1.474	0.8 ± 0.3				
Arseno-pyrite, UV-3/13	78–50	11	0.11–0.24	0.18	0.330	3.630	7 ± 1				
		8	0.25–0.35	0.31	0.396	3.035	4 ± 1				
		8	0.36–0.51	0.41	0.434	2.756	4 ± 1	2.52	1.88	0.14	1.90
		9	0.52–0.75	0.67	0.512	2.348	2.1 ± 0.4				
		7	0.76–1.10	0.99	0.583	2.060	1.2 ± 0.3				
		7	1.19–2.16	1.70	0.698	1.720	0.9 ± 0.2				
Palladium, ppm											
Pyrite, Nat-10	60–41	8	0.29–0.51	0.42	0.438	2.741	35 ± 6				
		7	0.55–1.63	1.24	0.628	1.908	14 ± 3				
		8	1.72–2.57	2.17	0.757	1.584	11 ± 3	8.7	6.3	1.1	4.9
		9	2.66–4.14	3.23	0.864	1.387	7.9 ± 0.8				
		9	4.48–16.20	10.66	1.287	0.932	2.7 ± 0.5				
Arseno-pyrite, Nat-10	60–39	9	0.21–0.41	0.27	0.353	2.769	96 ± 18				
		8	0.42–0.56	0.51	0.438	2.257	33 ± 9				
		8	0.58–0.98	0.77	0.501	1.956	18 ± 5	12.4	7.7	0.4	8.1
		7	1.17–2.31	1.64	0.646	1.527	10 ± 4				
		7	3.73–14.33	8.42	1.113	0.883	1.9 ± 0.8				
Pyrite, DG-10/14	43–33	8	0.15–0.44	0.40	0.431	2.787	31 ± 6				
		9	0.46–0.66	0.53	0.473	2.533	18 ± 2				
		7	0.71–1.96	1.62	0.687	1.748	9 ± 1	10.4	9.4	1.2	8.2
		9	2.00–5.10	3.27	0.868	1.382	6 ± 1				

Table S1. Cont.

1	2	3	4	5	6	7	8	9	10	11	12
Arseno-pyrite, DG-10/14	89-54	9	0.13-0.41	0.36	0.389	2.522	43 ± 12	5.9	4.3	0.23	3.7
		11	0.43-0.58	0.51	0.438	2.257	34 ± 5				
		7	0.60-1.02	0.83	0.514	1.910	14 ± 5				
		7	1.05-1.94	1.52	0.629	1.562	6 ± 1				
		9	2.06-6.01	4.51	0.904	1.087	3.3 ± 0.8				
		11	6.51-14.45	10.87	1.212	0.811	1.0 ± 0.2				
Pyrite, ZR-10/13	64-45	10	0.10-0.15	0.13	0.296	4.044	142 ± 16	37.8	29.5	3.2	29.6
		8	0.17-0.21	0.19	0.336	3.565	91 ± 10				
		10	0.2-0.30	0.26	0.373	3.211	64 ± 5				
		10	0.33-0.67	0.52	0.470	2.549	33 ± 7				
		7	0.68-5.51	2.35	0.777	1.541	14 ± 7				
Arseno-pyrite, ZR-10/13	55-37	8	0.10-0.15	0.12	0.271	3.672	118 ± 20	61.1	40.5	4.1	37.8
		8	0.16-0.23	0.20	0.321	3.091	121 ± 38				
		7	0.24-0.46	0.37	0.394	2.517	50 ± 16				
		7	0.47-0.66	0.57	0.453	2.160	42 ± 11				
		7	0.76-1.71	1.25	0.590	1.671	17 ± 4				
Pyrite, UV-3/13	79-56	10	0.10-0.18	0.17	0.324	3.705	77 ± 11	21.9	14.7	1.0	18.4
		9	0.20-0.29	0.25	0.368	3.250	45 ± 12				
		11	0.31-0.39	0.35	0.412	2.910	37 ± 4				
		12	0.41-0.58	0.51	0.467	2.566	24 ± 2				
		9	0.60-1.00	0.83	0.550	2.187	18 ± 3				
		5	1.05-3.60	3.20	0.862	1.393	4 ± 1				
Arseno-pyrite, UV-3/13	76-58	12	0.11-0.24	0.17	0.324	3.705	82 ± 11	20.8	17.9	0.8	24.5
		10	0.25-0.35	0.31	0.396	3.035	44 ± 5				
		9	0.35-0.51	0.41	0.434	2.756	35 ± 6				
		10	0.52-0.75	0.68	0.514	2.331	17 ± 3				
		8	0.76-1.10	0.99	0.583	2.060	10 ± 2				
		9	1.19-2.16	1.61	0.685	1.749	7 ± 1				
Rutenium, ppm 10⁻²											
Pyrite, Nat-10	58-40	6	0.29-0.55	0.42	0.438	2.741	1.9 ± 0.9	0.48	0.34	0.049	0.3
		10	0.60-1.72	1.23	0.627	1.918	1.1 ± 0.2				
		7	1.81-2.66	2.32	0.774	1.549	0.6 ± 0.1				
		9	2.71-4.48	3.58	0.895	1.343	0.33 ± 0.04				

Table S1. Cont.

1	2	3	4	5	6	7	8	9	10	11	12	
Arseno-pyrite, ZR-10/13	55-40	10	0.10-0.15	0.12	0.271	3.672	18 ± 2					
		11	0.16-0.23	0.19	0.314	3.114	11 ± 2					
		6	0.24-0.46	0.40	0.404	2.448	3 ± 1	4.65	2.97	0.077	3.69	
		7	0.47-0.66	0.56	0.451	2.179	2.2 ± 0.7					
		6	0.76-1.71	1.40	0.613	1.610	0.9 ± 0.3					
Pyrite, UV-3/13	79-55	10	0.10-0.18	0.16	0.317	3.768	18 ± 4					
		11	0.20-0.29	0.24	0.363	3.294	11 ± 1					
		10	0.31-0.39	0.36	0.416	2.884	6 ± 1	4.54	2.72	0.1	3.30	
		9	0.41-0.58	0.52	0.470	2.549	3.8 ± 0.7					
		9	0.60-1.00	0.83	0.558	2.187	2.5 ± 0.4					
		6	1.05-3.60	2.90	0.834	1.439	0.7 ± 0.2					
Arseno-pyrite, UV-3/13	78-58	10	0.11-0.24	0.18	0.330	3.630	9 ± 2					
		9	0.25-0.35	0.32	0.400	3.000	4.3 ± 0.7					
		10	0.36-0.51	0.40	0.431	2.787	3.7 ± 0.6	3.29	2.38	0.19	2.18	
		10	0.52-0.75	0.66	0.509	2.355	2.4 ± 0.5					
		9	0.76-1.10	0.98	0.581	2.067	2.1 ± 0.6					
		10	1.19-2.16	1.63	0.688	1.742	1.0 ± 0.2					
Silver, ppm 10⁻²												
Pyrite, Nat-10	60-38	7	0.29-0.51	0.41	0.434	2.756	19 ± 5					
		8	0.55-1.63	1.32	0.642	1.873	7 ± 2					
		8	1.72-2.57	2.24	0.765	1.568	4 ± 1	3.5	2.3	0.12	2.2	
		8	2.66-4.14	3.06	0.849	1.413	1.7 ± 0.4					
		7	4.48-16.20	8.91	1.212	0.989	0.5 ± 0.1					
Arseno-pyrite, Nat-10	60-41	8	0.21-0.41	0.30	0.366	2.679	12 ± 3					
		7	0.42-0.56	0.49	0.431	2.275	10 ± 5					
		9	0.58-0.98	0.74	0.495	1.987	6 ± 1	8.6	3.8	1.2	2.5	
		8	1.17-2.31	1.47	0.622	1.579	5.0 ± 0.9					
		9	3.73-14.33	7.88	1.089	0.903	2.6 ± 0.4					
Pyrite, DG-10/14	67-42	6	0.15-0.44	0.32	0.400	3.000	6 ± 1					
		6	0.46-0.57	0.54	0.476	2.518	4 ± 2	5.2	3.2	1.2	2.0	
		7	0.66-1.22	0.92	0.569	2.112	4 ± 2					

		8	1.30–1.77	1.51	0.672	1.783	4 ± 1				
		7	1.80–2.07	1.90	0.724	1.655	3.1 ± 0.9				
		8	2.10–5.10	3.02	0.845	1.719	2.2 ± 0.8				
Arseno-pyrite, DG-10/14	89–54	9	0.13–0.41	0.33	0.378	2.598	8 ± 3				
		8	0.43–0.58	0.52	0.440	2.234	3.5 ± 0.9				
		9	0.60–1.02	0.82	0.512	1.918	1.6 ± 0.5	1.4	0.7	0.07	0.6
		10	1.05–1.94	1.44	0.618	1.591	0.9 ± 0.1				
		9	2.06–6.01	4.07	0.874	1.126	0.6 ± 0.1				
		9	6.51–14.45	10.31	1.191	0.825	0.30 ± 0.07				
Pyrite, ZR-10/13	32–20	4	0.10–0.15	0.14	0.288	4.148	587 ± 344				
		6	0.20–0.60	0.32	0.400	3.000	202 ± 33	155	82.2	11.0	70.0
		5	0.62–0.85	0.73	0.527	2.283	97 ± 33				
		5	0.88–5.51	2.87	0.831	1.444	44 ± 40				
Arseno-pyrite, ZR-10/13	55–38	9	0.10–0.15	0.12	0.271	3.672	14 ± 3				
		8	0.16–0.23	0.19	0.314	3.114	11 ± 3				
		6	0.24–0.46	0.34	0.383	2.589	5 ± 2	13.6	4.4	0.59	4.0
		8	0.47–0.66	0.58	0.456	2.151	3.7 ± 0.7				
		7	0.76–1.71	1.32	0.600	1.636	3 ± 1				
Pyrite, UV-3/13	80–54	10	0.10–0.18	0.16	0.317	3.768	22 ± 6				
		9	0.20–0.29	0.24	0.363	3.294	14 ± 3				
		11	0.31–0.39	0.36	0.416	2.884	23 ± 6	30.4	12.1	4.5	8.0
		9	0.41–0.58	0.53	0.473	2.533	16 ± 4				
		7	0.60–1.00	0.77	0.536	2.239	20 ± 9				
		8	1.05–3.60	2.25	0.766	1.565	6 ± 3				
Arseno-pyrite, UV-3/13	78–54	10	0.11–0.24	0.18	0.330	3.630	16 ± 4				
		9	0.25–0.35	0.32	0.400	3.000	11 ± 2				
		9	0.36–0.51	0.41	0.434	2.756	8 ± 1	19.4	4.6	0.30	4.5
		10	0.52–0.75	0.64	0.504	2.381	5 ± 1				
		8	0.76–1.10	1.00	0.585	2.053	3.3 ± 0.8				
		8	1.19–2.16	1.57	0.680	1.767	1.9 ± 0.8				

* \bar{C}^{tot} – average total content; \bar{C}^{ev} – evenly distributed NM content for all size fractions; C^{sir} – structurally bound form concentration (\bar{S}_{sp} – extrapolation to zero);

\bar{C}^{sur} – average superficially bound form concentration. ** – Not determined (poor size correlation).