Table S1. Geological and petrographic characteristics of andesitic porphyry and quartz porphyry from the Erdaohezi deposit.

Rock	Occurrence		Petrographic Characteristics	Sample
Quartz porphyry	Stock (Figure A,B)	4	The quartz porphyry shows a grayish white color with porphyritic texture in hand specimen (Figure 4C), The phenocrysts in the quartz porphyry (1.0 × 1.5–1.0 × 2.0 mm^2 in size) are mainly made up of quartz (40–45 vol %), orthoclase (0–5 vol %) and plagioclase (10–15 vol %). The quartz phenocrysts are mainly in the form of corrosion-like phenocrysts, and some plagioclase grains are variably sericitized. Quartz, orthoclase and plagioclase (＜0.1mm in size) can be identified in the matrix (30–35 vol %) (Figure 4E), accessory minerals mainly include zircon and altered mineral sericite. Moreover, very small of yellowish-white pyrite can be observed (＜0.1 × 0.1 mm^2 in size), well euhedral and scattered unevenly.	ED10，ED3a ED3b, ED1a-c
Andesitic porphyry	Vein (Figure A,B)	4	The andesitic porphyry shows a light-grey color with porphyritic texture in hand specimen (Figure 4D), The phenocrysts in the andesitic porphyry (0.6 × 1.0–1.0 × 1.2 mm^2 in size) are mainly made up of orthoclase (20–25 vol %) , plagioclase (35–40 vol %), biotite (0–5 vol %), and hornblende (5–10 vol %). Orthoclase and plagioclase (＜0.1mm in size) can be identified in the matrix (15–20 vol %) (Figure 4F). The crystals are euhedral to subhedral with accessory zircon, apatite, titanite, etc.	ED9 ED9a, ED4, ED2a-d

Table S2. LA-ICP-MS zircon U-Pb data of andesitic porphyry (ED4) and quartz porphyry (ED10) from the Erdaohezi lead-zinc deposit.

Spot	Th	U	Th/U	Pb^{207}/Pb^{206}		Pb^{207}/U^{235}		Pb^{206}/U^{238}		Pb^{208}/Th^{232}		Pb^{207}/Pb^{206}		Pb^{207}/U^{235}		Pb^{206}/U^{238}		Pb^{208}/Th^{232}	
	ppm			Ratio	1sigma	Ratio	1sigma	Ratio	1sigma	Ratio	1sigma	Age/Ma	1sigma	Age/Ma	1sigma	Age/Ma	1sigma	Age/Ma	1sigma
ED4-02	926	1172	0.79	0.04904	0.00154	0.16834	0.00528	0.02490	0.00036	0.00816	0.00040	150	72	158	5	159	2	164	8
ED4-03	794	595	1.33	0.05013	0.00107	0.14609	0.00318	0.02114	0.00028	0.00729	0.00035	201	49	139	3	135	2	147	7
ED4-04	203	229	0.89	0.05159	0.00130	0.15016	0.00381	0.02111	0.00029	0.00715	0.00035	267	57	142	3	135	2	144	7
ED4-05	968	1543	0.63	0.04983	0.00173	0.14491	0.00498	0.02110	0.00031	0.00674	0.00035	187	79	137	4	135	2	136	7
ED4-06	419	538	0.78	0.04890	0.00113	0.14164	0.00333	0.02101	0.00028	0.00765	0.00040	143	53	135	3	134	2	154	8
ED4-07	453	488	0.93	0.05274	0.00118	0.15225	0.00346	0.02094	0.00028	0.00731	0.00035	318	50	144	3	134	2	147	7
ED4-08	3182	2077	1.53	0.04878	0.00086	0.14221	0.00255	0.02115	0.00026	0.00755	0.00042	137	41	135	2	135	2	152	8
ED4-09	1092	1686	0.65	0.05135	0.00150	0.14924	0.00428	0.02108	0.00029	0.00694	0.00040	256	66	141	4	135	2	140	8
ED4-10	681	631	1.08	0.04890	0.00117	0.14203	0.00337	0.02107	0.00027	0.00676	0.00039	143	55	135	3	134	2	136	8
ED4-11	3582	2778	1.29	0.04978	0.00121	0.14443	0.00349	0.02105	0.00028	0.00685	0.00040	185	56	137	3	134	2	138	8
ED4-12	913	1145	0.80	0.05014	0.00117	0.14535	0.00338	0.02103	0.00027	0.00699	0.00041	201	53	138	3	134	2	141	8
ED4-13	1548	2523	0.61	0.04907	0.00098	0.14200	0.00286	0.02099	0.00026	0.00715	0.00040	151	46	135	3	134	2	144	8
ED4-14	1621	1419	1.14	0.04898	0.00121	0.14120	0.00345	0.02091	0.00027	0.00689	0.00039	147	57	134	3	133	2	139	8
ED4-15	1234	1023	1.21	0.04825	0.00092	0.13862	0.00267	0.02083	0.00026	0.00705	0.00041	112	44	132	2	133	2	142	8
ED4-16	1227	3054	0.40	0.04774	0.00099	0.13692	0.00285	0.02080	0.00026	0.00683	0.00039	85	49	130	3	133	2	138	8
ED4-17	982	459	2.14	0.04786	0.00102	0.13672	0.00293	0.02072	0.00026	0.00661	0.00038	91	51	130	3	132	2	133	8
ED10-03	400	432	0.93	0.06010	0.00238	0.20935	0.00818	0.02527	0.00039	0.00831	0.00038	607	83	193	7	161	2	167	8
ED10-04	363	323	1.12	0.05187	0.00237	0.18051	0.00814	0.02524	0.00041	0.00816	0.00039	280	101	169	7	161	3	164	8
ED10-05	296	283	1.05	0.04852	0.00175	0.16870	0.00604	0.02522	0.00038	0.00860	0.00040	125	83	158	5	161	2	173	8
ED10-06	319	298	1.07	0.05729	0.00198	0.19908	0.00679	0.02521	0.00038	0.00873	0.00040	502	75	184	6	161	2	176	8
ED10-07	951	909	1.05	0.04686	0.00248	0.16288	0.00850	0.02521	0.00043	0.00818	0.00041	42	122	153	7	161	3	165	8
ED10-08	365	432	0.85	0.05409	0.00178	0.18776	0.00614	0.02518	0.00037	0.00792	0.00036	375	72	175	5	160	2	160	7
ED10-09	2287	2099	1.09	0.05018	0.00087	0.17402	0.00317	0.02516	0.00032	0.00743	0.00030	203	40	163	3	160	2	150	6
ED10-10	353	402	0.88	0.05790	0.00179	0.20089	0.00613	0.02516	0.00037	0.00869	0.00037	526	67	186	5	160	2	175	7
ED10-11	583	478	1.22	0.05159	0.00183	0.17885	0.00627	0.02514	0.00038	0.00858	0.00039	267	79	167	5	160	2	173	8
ED10-12	152	144	1.05	0.04935	0.00130	0.17110	0.00451	0.02515	0.00035	0.00767	0.00033	165	60	160	4	160	2	154	7
ED10-13	903	628	1.44	0.05641	0.00248	0.19546	0.00843	0.02513	0.00041	0.00783	0.00040	468	95	181	7	160	3	158	8
ED10-14	286	299	0.95	0.0512	0.00234	0.17744	0.00799	0.02514	0.00041	0.00758	0.00036	250	102	166	7	160	3	153	7

Table S3. Whole-rocks geochemical data of the intrusions from the Erdaohezi deposit (major element: wt%; trace elements: ppm).

Rock Type	Andesitic Porphyrite								Quartz Porphyry				Rhyolite Crystal-lithic Tuffs			[162]
Sample No.	ED9	ED4	ED9a	ED2a	ED2b	ED2c	ED2d	ED10	ED3a	ED3b	ED1a	ED1b	ED1c	EDHZ-2a	EDHZ-2b	Ed2-1	Ed2-2
SiO_2	58.72	61.75	61.88	59.04	62.09	61.17	61.42	76.16	74.87	75.05	75.95	76.36	75.07	76.78	76.79	75.47	75.93
Al_2O_3	19.85	18.69	18.25	14.58	13.86	18.09	18.69	12.26	12.35	12.35	13.44	13.11	12.08	11.85	11.77	12.11	12.12
TiO_2	1.11	1.06	1.03	1.31	1.24	1.01	1.10	0.16	0.16	0.16	0.26	0.26	0.16	0.17	0.18	0.15	0.18
Fe_2O_3	7.36	6.16	6.92	7.60	7.08	7.30	6.32	1.67	1.67	1.46	1.98	1.90	1.58	2.29	2.21	2.53	2.01
FeO	5.79	4.72	5.09	6.76	5.29	5.52	4.81	1.02	1.10	0.86	0.45	0.57	1.14	2.45	2.56	1.03	1.05
$Fe_2O_3^T$	12.41	10.26	11.32	2.02	1.54	0.78	0.75	2.52	2.60	2.17	2.23	2.28	2.56	4.52	4.55	3.31	2.86
CaO	0.90	0.84	0.79	7.63	0.05	7.68	1.13	1.07	1.42	1.41	0.26	0.27	1.49	0.22	0.23	2.29	2.72
MgO	1.60	1.54	1.49	1.68	1.48	1.52	1.48	1.02	1.14	1.11	0.63	0.66	1.12	0.51	0.51	0.30	0.28
K_2O	4.56	4.37	4.18	4.16	3.89	4.09	4.29	3.56	3.62	3.63	3.93	3.86	3.58	3.69	3.67	3.83	3.86
Na_2O	0.11	0.11	0.10	0.03	0.03	0.13	0.13	0.05	0.04	0.05	0.09	0.10	0.08	0.13	0.13	0.11	0.13
MnO	0.10	0.11	0.09	4.19	3.92	4.22	4.42	0.13	0.20	0.23	0.02	0.03	0.21	0.49	0.50	0.06	0.07
P_2O_5	0.51	0.47	0.44	0.65	0.54	0.10	0.11	0.04	0.04	0.03	0.08	0.08	0.04	0.04	0.04	0.07	0.08
LOL	1.19	0.88	0.84	1.42	1.89	1.55	1.49	1.83	1.97	1.34	1.77	1.87	1.98	1.25	1.29	1.91	1.42
K_2O+Na_2O	4.67	4.48	4.28	4.19	3.92	4.22	4.42	3.61	3.66	3.68	4.02	3.96	3.66	3.82	3.80	3.94	3.99
A/NCK	3.57	3.51	3.60	2.35	2.54	3.61	3.61	2.62	2.43	2.43	3.14	3.10	2.34	2.93	2.92	1.94	1.81
δ	1.39	1.07	0.97	1.09	0.80	0.98	1.06	0.39	0.42	0.42	0.49	0.47	0.42	0.43	0.43	0.48	0.48
Li	82.00	87.70	93.90	31.00	30.80	93.00	91.80	23.60	23.80	28.20	14.70	15.10	28.90	13.55	15.27	5.89	6.19
Be	3.07	3.20	2.95	4.55	4.31	3.24	3.45	2.37	2.47	2.50	2.45	3.24	2.27	2.74	3.02	2.57	2.53
Sc	12.50	11.90	12.60	16.60	14.60	12.10	11.70	1.66	1.86	1.84	1.75	1.80	1.50	1.83	1.98	5.09	5.12
Cr	30.00	30.40	32.30	89.50	100.00	37.10	55.00	12.40	13.50	15.10	23.60	24.10	18.30	13.44	13.68	8.58	9.45
Co	7.02	5.31	6.29	16.20	15.90	12.50	6.61	2.14	1.91	1.56	111.00	124.00	134.00	1.76	1.73	5.51	5.89
Ni	11.40	8.20	10.40	23.30	20.70	11.10	8.64	2.48	2.58	2.42	2.62	2.63	1.53	2.33	3.09	4.97	4.78
Cu	35.50	37.60	36.70	48.50	47.10	34.70	38.70	9.28	8.32	7.98	3.22	3.40	5.19	4.85	5.88	121.65	131.33
Zn	136.00	95.60	115.00	299.00	332.00	103.00	107.00	44.90	41.60	35.70	25.10	10.10	8.28	1800.90	1978.20	7725.00	7575.00

Continued Table S3.

Ga	26.60	26.20	25.50	26.90	24.10	25.40	26.10	14.70	16.10	16.40	781.00	1019.00	38.10	17.73	19.59	16.97	17.36
Rb	179.00	172.00	176.00	224.00	211.00	168.00	172.00	130.00	140.00	144.00	22.30	20.40	16.40	219.30	244.40	209.60	211.80
Sr	274.00	283.00	255.00	90.10	69.50	284.00	298.00	143.00	161.00	171.00	148.00	149.00	143.00	12.46	13.85	11.94	13.76
Zr	232.00	226.00	227.00	255.00	248.00	218.00	232.00	123.00	107.00	125.00	113.00	109.00	172.00	90.13	80.52	81.50	85.80
Nb	11.20	10.30	11.00	13.60	13.00	11.50	12.30	8.10	8.53	8.98	81.30	89.00	65.00	6.35	7.16	11.29	10.81
Cd	0.16	0.09	0.14	224.00	211.00	168.00	172.00	0.02	0.03	0.02	8.49	8.06	9.41	0.16	-	-	-
Cs	48.20	46.60	48.20	39.70	39.10	45.70	44.50	19.40	20.30	23.10	3.88	4.45	0.06	10.79	11.63	12.59	12.91
Ba	346.00	370.00	302.00	405.00	390.00	339.00	401.00	187.00	197.00	226.00	23.90	24.00	20.90	102.65	113.18	100.80	111.50
Hf	5.30	5.23	5.46	5.94	5.37	5.37	5.58	3.86	3.34	3.66	393.00	434.00	223.00	4.00	3.35	3.27	3.42
Ta	0.69	0.67	0.67	0.62	0.61	0.64	0.67	0.67	0.72	0.77	2.70	2.69	2.38	0.50	0.58	1.03	0.99
Pb	5.07	8.30	6.47	29.90	64.10	7.13	8.47	21.10	28.60	26.80	0.60	0.52	0.63	377.10	429.10	5625.00	7227.00
Th	9.57	9.69	9.47	4.28	4.09	8.54	9.12	12.20	12.90	12.60	1375.00	906.00	38.80	13.74	14.63	14.82	16.30
U	1.49	1.41	1.61	1.39	1.38	1.85	1.64	1.76	1.77	1.87	9.43	9.57	11.90	1.70	1.96	4.56	4.68
Y	27.60	29.90	27.80	22.30	22.70	22.70	24.00	7.07	7.49	7.53	1.86	1.84	1.70	5.17	5.75	7.53	7.82
La	26.20	35.60	29.70	38.10	38.20	37.40	36.90	27.70	28.40	29.90	6.80	8.20	6.38	31.02	31.82	30.05	32.59
Ce	56.30	73.70	62.50	75.50	73.60	71.50	67.20	44.70	48.80	51.40	32.40	34.40	32.00	51.19	52.70	50.31	53.15
Pr	7.21	9.02	7.91	10.30	9.58	9.45	9.10	4.53	5.13	5.11	61.20	63.80	49.50	5.23	5.14	5.47	5.79
Nd	33.50	39.80	31.70	43.20	40.60	38.20	37.30	14.60	16.40	17.10	6.05	6.38	4.85	15.96	15.73	16.15	17.18
Sm	7.52	8.42	7.03	7.53	6.95	6.86	6.96	2.02	2.14	2.32	21.30	22.00	16.20	1.90	2.10	2.36	2.41
Eu	2.16	2.47	2.04	1.87	1.85	1.66	1.80	0.35	0.34	0.37	3.19	3.15	2.26	0.43	0.43	0.45	0.46
Gd	6.12	7.01	6.07	6.19	5.89	5.71	5.70	1.98	2.13	2.19	0.58	0.61	0.37	1.92	1.99	2.12	2.21
Tb	1.05	1.12	1.02	1.02	0.96	0.955	0.917	0.26	0.28	0.29	2.90	3.03	2.30	0.22	0.24	0.27	0.28
Dy	5.00	5.56	4.81	4.88	4.64	4.43	4.68	1.25	1.35	1.34	0.37	0.40	0.30	0.87	0.95	1.25	1.28
Ho	0.95	1.06	0.96	0.813	0.79	0.79	0.825	0.24	0.27	0.25	1.71	1.90	1.31	0.16	0.17	0.23	0.24
Er	2.79	2.84	2.57	2.29	2.31	2.25	2.26	0.75	0.76	0.82	0.26	0.27	0.22	0.50	0.56	0.70	0.72
Tm	0.45	0.44	0.44	0.293	0.347	0.345	0.359	0.12	0.13	0.13	0.81	0.91	0.73	0.10	0.11	0.12	0.13
Yb	2.39	2.67	2.63	2.12	2.22	2.31	2.4	0.74	0.76	0.84	0.12	0.12	0.11	0.58	0.69	0.82	0.88

Continued Table S3.

Lu	0.36	0.41	0.39	0.25	0.32	0.31	0.32	0.12	0.12	0.12	0.82	0.91	0.76	0.15	0.17	0.22	0.22
ΣREE	152.00	190.12	159.77	194.36	188.26	182.17	176.72	99.35	107.01	112.17	131.81	137.99	111.03	110.24	112.82	110.50	117.54
LREE	132.89	169.01	140.88	176.50	170.78	165.07	159.26	93.90	101.21	106.20	124.72	130.34	105.18	105.73	107.93	104.80	111.58
HREE	19.11	21.11	18.89	17.86	17.48	17.10	17.46	5.45	5.80	5.97	7.09	7.65	5.85	4.50	4.89	5.71	5.96
LREE/HREE	6.95	8.01	7.46	9.88	9.77	9.65	9.12	17.22	17.44	17.78	17.59	17.03	17.98	23.49	22.08	18.36	18.73
La_N/Yb_N	7.39	8.99	7.61	12.12	11.60	10.92	10.37	25.20	25.16	23.91	26.70	25.63	28.24	36.30	31.03	24.83	25.05
δEu	0.95	0.96	0.93	0.81	0.86	0.79	0.85	0.53	0.47	0.49	0.58	0.59	0.49	0.68	0.64	0.60	0.60
Zr/Hf	43.77	43.21	41.58	42.93	46.18	40.60	41.58	31.87	32.04	34.15	30.11	33.09	27.31	22.55	24.01	24.95	25.11
Nb/Ta	16.35	15.33	16.47	21.79	21.31	18.05	18.41	12.04	11.83	11.71	14.27	15.44	14.94	12.62	12.45	10.99	10.94
Th/Nd	0.29	0.24	0.30	0.10	0.10	0.22	0.24	0.84	0.79	0.74	0.44	0.44	0.73	0.86	0.93	0.92	0.95

Continued Table S3.

Rock type	Quartz porphyry [141]		Quartz porphyry [66]												Quartz porphyry [98]	Andesitic porphyry [66]				Andesitic porphyry [98]	
Sample No.	BJ58-1	BJ58-2	NJ-83	NJ-85	NJ-90	NJ-92	NJ-93	NJ-82	NJ-89	NJ-86	NJ-87	NJ-94	NJ-91	NJ-135	1220	NJ-97	NJ-100	NJ-106	NJ-107	45	1302
SiO_2	75.62	75.80	68.11	67.92	67.86	68.91	69.70	68.10	69.06	68.11	67.92	68.91	69.70	68.10	77.47	57.52	57.76	57.21	56.83	62.52	59.08
Al_2O_3	13.33	13.32	14.81	14.47	14.43	14.90	14.32	14.74	14.64	14.81	14.47	14.90	14.32	14.74	12.42	16.29	16.33	16.44	17.22	16.76	15.73
TiO_2	0.12	0.11	0.52	0.48	0.53	0.51	0.49	0.56	0.56	0.52	0.48	0.51	0.49	0.56	0.13	0.94	0.92	0.96	1.07	0.75	0.95
Fe_2O_3	0.23	0.37	2.80	3.19	2.93	2.85	2.69	3.35	3.52	2.80	3.19	2.85	2.69	3.35	0.53	6.51	6.50	6.79	6.94	4.92	6.68
FeO	0.25	0.15	2.05	1.90	1.85	1.85	2.25	2.15	1.95	2.05	1.90	1.85	2.25	2.15	0.08	4.45	3.60	3.40	4.95	2.49	3.70
CaO	0.10	0.11	1.16	1.38	1.49	1.03	1.16	1.19	0.69	1.16	1.38	1.03	1.16	1.19	0.44	3.98	2.52	3.24	2.55	3.01	4.42
MgO	0.28	0.30	0.88	0.80	0.78	0.82	0.71	0.93	0.91	0.88	0.80	0.82	0.71	0.93	0.27	2.57	2.91	3.49	2.64	1.62	3.58
K_2O	7.11	7.13	4.60	7.42	4.65	4.87	5.15	4.95	4.36	4.60	7.42	4.87	5.15	4.95	6.80	2.63	2.96	2.71	2.71	2.65	1.75
Na_2O	1.49	1.58	4.80	1.40	4.29	4.14	4.18	4.23	4.37	4.80	1.40	4.14	4.18	4.23	0.19	4.30	5.12	4.59	5.11	4.79	4.33
MnO	0.10	0.10	0.16	0.10	0.24	0.15	0.19	0.17	0.15	0.16	0.10	0.15	0.19	0.17	0.01	0.11	0.11	0.10	0.15	0.12	0.10
P_2O_5	0.01	0.02	0.16	0.14	0.17	0.16	0.15	0.18	0.20	0.16	0.14	0.16	0.15	0.18	0.02	0.26	0.26	0.27	0.29	0.24	0.27
LOL	1.25	0.87	1.98	2.56	2.49	1.66	1.24	1.60	1.44	1.98	2.56	1.66	1.24	1.60	1.55	4.78	4.47	4.07	4.40	3.12	3.82
K_2O+Na_2O	8.60	8.71	9.40	8.82	8.94	9.01	9.33	9.18	8.73	9.40	8.82	9.01	9.33	9.18	6.99	6.93	8.08	7.30	7.82	7.44	6.08
A/NCK	1.53	1.51	1.40	1.42	1.38	1.48	1.37	1.42	1.55	1.40	1.42	1.48	1.37	1.42	1.67	-	-	-	-	1.60	1.50
δ	2.27	2.31	3.52	3.12	3.21	3.13	3.26	3.36	2.92	3.52	3.12	3.13	3.26	3.36	1.42	-	-	-	-	2.84	2.30
Li	15.60	15.30	-	-	-	-	-	-	-	-	-	-	-	-	16.60	-	-	-	-	27.30	29.20
Be	7.84	7.22	-	-	-	-	-	-	-	-	-	-	-	-	1.57	-	-	-	-	1.28	1.12
Sc	1.29	1.22	-	-	-	-	-	-	-	-	-	-	-	-	2.63	-	-	-	-	12.30	16.00
Cr	2.43	2.40	4.50	4.91	5.09	3.56	4.15	5.97	7.32	4.50	4.91	3.56	4.15	5.97	12.00	20.40	19.80	38.40	43.60	3.63	41.30
Co	0.15	0.17	2.98	4.50	3.01	2.87	2.54	4.64	3.26	2.98	4.50	2.87	2.54	4.64	0.21	19.30	17.00	21.30	17.40	8.19	13.70
Ni	2.08	1.96	2.52	2.68	2.28	2.47	2.19	3.45	2.66	2.52	2.68	2.47	2.19	3.45	4.74	14.70	13.20	24.80	23.60	3.06	21.00
Cu	5.05	3.32	-	-	-	-	-	-	-	-	-	-	-	-	7.86	-	-	-	-	7.23	16.00
Zn	385.00	360.00	-	-	-	-	-	-	-	-	-	-	-	-	59.50	-	-	-	-	96.50	80.50

Continued Table S3.

Ga	24.10	22.50	19.20	25.80	21.70	22.70	22.70	23.80	23.10	19.20	25.80	22.70	22.70	23.80	19.60	19.10	18.10	17.60	17.70	21.30	17.70
Rb	551.00	513.00	311.00	664.00	287.00	377.00	370.00	361.00	320.00	311.00	664.00	377.00	370.00	361.00	351.00	92.50	94.80	81.40	88.80	99.80	47.00
Sr	29.50	27.90	174.00	182.00	201.00	148.00	156.00	233.00	149.00	174.00	182.00	148.00	156.00	233.00	72.40	655.00	541.00	665.00	482.00	564.00	497.00
Zr	299.00	275.00	337.00	400.00	357.00	411.00	413.00	457.00	423.00	337.00	400.00	411.00	413.00	457.00	160.00	295.00	281.00	285.00	284.00	252.00	177.00
Nb	24.40	22.80	-	-	-	-	-	-	-	-	-	-	-	-	27.50	-	-	-	-	14.00	8.94
Cd	2.76	2.30	-	-	-	-	-	-	-	-	-	-	-	-	0.17	-	-	-	-	0.23	0.17
Cs	19.30	17.40	-	-	-	-	-	-	-	-	-	-	-	-	9.35	-	-	-	-	11.30	6.80
Ba	453.00	409.00	662.00	994.00	855.00	711.00	910.00	803.00	641.00	662.00	994.00	711.00	910.00	803.00	514.00	732.00	792.00	967.00	1127.00	761.00	482.00
Hf	12.00	10.60	9.60	11.10	10.40	11.30	11.80	11.80	11.50	9.60	11.10	11.30	11.80	11.80	6.41	6.51	6.04	6.44	6.78	6.67	4.11
Ta	2.06	1.88	1.47	1.74	1.60	1.67	1.77	1.73	1.58	1.47	1.74	1.67	1.77	1.73	2.02	0.70	0.70	0.72	0.70	0.97	0.55
Pb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	77.80	-	-	-	-	13.50	9.79
Th	7.70	7.03	15.60	19.10	26.90	18.70	19.50	18.20	16.80	15.60	19.10	18.70	19.50	18.20	23.70	9.18	8.46	10.20	8.90	6.60	7.70
U	2.99	2.62	4.45	5.75	59.10	17.20	5.76	5.26	7.91	4.45	5.75	17.20	5.76	5.26	5.28	2.34	2.15	2.75	1.87	1.62	1.96
Y	26.50	23.90	35.10	37.70	42.80	43.50	45.80	40.50	37.50	35.10	37.70	43.50	45.80	40.50	28.50	32.10	26.40	28.90	25.50	29.60	24.40
La	66.30	63.20	63.40	64.70	71.90	76.70	73.60	79.30	66.70	63.40	64.70	76.70	73.60	79.30	36.10	33.60	35.50	36.90	26.30	40.00	32.50
Ce	71.30	66.40	136.00	138.00	152.00	160.00	154.00	167.00	140.00	136.00	138.00	160.00	154.00	167.00	76.00	72.40	71.70	76.00	63.00	84.50	67.40
Pr	9.79	9.07	16.60	16.90	19.00	19.60	19.10	20.40	17.30	16.60	16.90	19.60	19.10	20.40	9.17	9.21	8.88	9.65	7.57	10.90	8.64
Nd	39.60	36.30	64.60	64.50	70.90	74.30	71.80	78.40	64.50	64.60	64.50	74.30	71.80	78.40	32.20	37.80	35.30	38.90	31.90	44.10	35.70
Sm	7.43	7.33	12.20	11.30	13.40	14.10	13.30	14.90	12.10	12.20	11.30	14.10	13.30	14.90	6.42	7.10	6.98	7.42	6.45	8.23	6.89
Eu	0.50	0.47	1.64	1.76	1.99	1.93	1.98	2.16	1.76	1.64	1.76	1.93	1.98	2.16	0.28	1.87	1.35	1.91	1.83	1.69	1.63
Gd	6.03	5.54	9.18	9.14	10.30	10.70	10.60	11.20	9.51	9.18	9.14	10.70	10.60	11.20	5.09	6.71	5.81	6.46	5.55	6.57	5.13
Tb	1.08	0.93	1.40	1.46	1.61	1.69	1.69	1.76	1.45	1.40	1.46	1.69	1.69	1.76	0.95	1.09	0.95	1.03	0.87	1.13	0.91
Dy	5.81	5.24	8.00	8.01	8.87	9.39	9.24	8.80	7.75	8.00	8.01	9.39	9.24	8.80	4.33	6.08	4.82	5.56	5.05	5.60	4.92
Ho	1.51	1.54	1.40	1.51	1.58	1.59	1.58	1.58	1.39	1.40	1.51	1.59	1.58	1.58	0.90	1.17	0.99	1.07	0.99	1.04	0.85
Er	3.13	2.86	3.52	4.03	4.21	4.28	4.35	4.27	3.74	3.52	4.03	4.28	4.35	4.27	2.87	3.48	2.90	3.10	2.63	2.90	2.29
Tm	0.54	0.49	0.59	0.65	0.68	0.70	0.73	0.65	0.57	0.59	0.65	0.70	0.73	0.65	0.53	0.54	0.47	0.47	0.39	0.40	0.36

Continued Table S3.

Yb	0.57	0.53	3.59	3.92	4.32	4.04	4.34	3.96	4.07	3.59	3.92	4.04	4.34	3.96	3.19	3.19	3.02	3.14	2.71	2.81	2.28
Lu	0.57	0.53	0.52	0.58	0.61	0.61	0.63	0.62	0.59	0.52	0.58	0.61	0.63	0.62	0.48	0.50	0.49	0.47	0.40	0.44	0.32
ΣREE	189.01	175.55	322.64	326.45	361.37	379.62	366.94	395.00	331.43	322.64	326.45	379.62	366.94	395.00	158.63	184.74	179.16	192.09	155.63	156.63	157.63
LREE	167.32	155.97	156.97	157.97	158.97	159.97	160.97	161.97	162.97	163.97	164.97	166.97	167.97	168.97	175.97	169.97	170.97	171.97	172.97	173.97	174.97
HREE	21.69	19.59	20.59	21.59	22.59	23.59	24.59	25.59	26.59	27.59	28.59	30.59	31.59	32.59	39.59	33.59	34.59	35.59	36.59	37.59	38.59
LREE/HREE	7.71	7.96	7.62	7.32	7.04	6.78	6.55	6.33	6.13	5.94	5.77	5.46	5.32	5.18	4.44	5.06	4.94	4.83	4.73	4.63	4.53
La_N/Yb_N	78.42	80.39	11.91	11.13	11.22	12.80	11.43	13.50	11.05	11.91	11.13	12.80	11.43	13.50	7.63	7.10	7.93	7.92	6.54	9.60	9.61
δEu	0.22	0.22	0.46	0.51	0.50	0.46	0.49	0.49	0.48	0.46	0.51	0.46	0.49	0.49	0.15	0.82	0.63	0.83	0.91	0.68	0.80
Zr/Hf	24.92	25.94	35.10	36.04	34.33	36.37	35.00	38.73	36.78	35.10	36.04	36.37	35.00	38.73	24.96	45.31	46.52	44.25	41.89	37.78	43.07
Nb/Ta	11.84	12.13	-	-	-	-	-	-	-	-	-	-	-	-	13.61	-	-	-	-	14.45	16.25
Th/Nd	0.19	0.19	0.24	0.30	0.38	0.25	0.27	0.23	0.26	0.24	0.30	0.25	0.27	0.23	0.74	0.24	0.24	0.26	0.28	0.15	0.22

Table S4. In situ or para position Hf isotopic analyses of zircons from the Erdaohezi deposit.

Spot	$^{176}Hf/^{177}Hf$	1σ	$^{176}Lu/^{177}Hf$	1σ	$^{176}Yb/^{177}Hf$	1σ	Age/Ma	εHf(0)	εHf(t)	T_{DM1}(Ma)	T_{DM2}(Ma)	$f_{Lu/Hf}$
ED4, Andesitic porphyrite, 133.9 ± 0.9Ma												
ED4-03	0.282824	0.000009	0.001257	0.000020	0.037487	0.000619	135	1.8	4.7	612	1206	-0.96
ED4-04	0.282780	0.000008	0.001018	0.000018	0.026922	0.000409	135	0.3	3.1	670	1343	-0.97
ED4-05	0.282792	0.000008	0.001367	0.000051	0.039796	0.001461	135	0.7	3.6	659	1307	-0.96
ED4-06	0.282796	0.000008	0.000636	0.000022	0.015447	0.000561	134	0.9	3.8	640	1288	-0.98
ED4-07	0.282815	0.000010	0.000768	0.000018	0.019720	0.000398	134	1.5	4.4	616	1230	-0.98
ED4-08	0.282792	0.000009	0.000868	0.000013	0.024162	0.000417	135	0.7	3.6	651	1305	-0.97
ED4-09	0.282781	0.000009	0.000683	0.000012	0.019418	0.000414	135	0.3	3.2	662	1336	-0.98
ED4-10	0.282832	0.000009	0.001720	0.000027	0.051712	0.001047	134	2.1	4.9	608	1184	-0.95
ED4-11	0.282810	0.000009	0.000821	0.000010	0.020803	0.000267	134	1.4	4.2	624	1246	-0.98
ED4-12	0.282787	0.000008	0.000943	0.000020	0.027356	0.000623	134	0.5	3.4	658	1321	-0.97
ED4-13	0.282854	0.000020	0.000722	0.000030	0.018276	0.000952	134	2.9	5.8	561	1106	-0.98
ED4-14	0.282821	0.000008	0.001140	0.000010	0.033030	0.000465	133	1.7	4.6	614	1215	-0.97
ED4-15	0.282825	0.000008	0.000928	0.000015	0.024620	0.000474	133	1.9	4.7	605	1201	-0.97
ED4-16	0.282804	0.000010	0.001088	0.000007	0.032610	0.000232	133	1.1	4.0	637	1269	-0.97
ED4-17	0.282825	0.000008	0.000872	0.000012	0.021583	0.000357	132	1.9	4.7	604	1203	-0.97
ED10, Quartz porphyry, 160.3 ± 1.4Ma												
ED10-01	0.282852	0.000010	0.000706	0.000022	0.021590	0.000673	168	2.8	6.4	563	1068	-0.98
ED10-02	0.282864	0.000008	0.001063	0.000020	0.027188	0.000535	168	3.2	6.8	552	1034	-0.97
ED10-03	0.282854	0.000009	0.001247	0.000029	0.036836	0.000899	161	2.9	6.3	569	1077	-0.96
ED10-04	0.282862	0.000008	0.001076	0.000028	0.028441	0.000636	161	3.2	6.6	555	1050	-0.97
ED10-05	0.282847	0.000009	0.001136	0.000025	0.033556	0.000749	161	2.7	6.1	576	1096	-0.97
ED10-06	0.282866	0.000008	0.001066	0.000033	0.031154	0.001010	161	3.3	6.7	549	1036	-0.97
ED10-07	0.282837	0.000008	0.001126	0.000021	0.030835	0.000552	161	2.3	5.7	591	1130	-0.97
ED10-08	0.282902	0.000011	0.000884	0.000008	0.023331	0.000185	160	4.6	8.0	495	920	-0.97

Continued Table S4.

ED10-09	0.282852	0.000008	0.001163	0.000010	0.030931	0.000207	160	2.8	6.2	569	1081	-0.96
ED1010	0.282863	0.000009	0.001529	0.000032	0.044749	0.001051	160	3.2	6.6	560	1052	-0.95
ED10-11	0.282857	0.000009	0.001284	0.000014	0.033463	0.000402	160	3.0	6.4	564	1067	-0.96
ED10-12	0.282865	0.000009	0.001307	0.000053	0.040398	0.001665	160	3.3	6.7	554	1043	-0.96
ED10-13	0.282856	0.000009	0.001263	0.000058	0.037242	0.001740	160	3.0	6.3	566	1072	-0.96
ED10-14	0.282886	0.000009	0.000867	0.000012	0.025855	0.000261	160	4.0	7.4	518	971	-0.97

Table S5. Lead Isotopic compositions of the Erdaohezi lead-zinc deposit.

Sample No.	Mineral	$^{208}Pb/^{204}Pb$	2σ	$^{207}Pb/^{204}Pb$	2σ	$^{206}Pb/^{204}Pb$	2σ	Source
EDH-13	Sphalerite	38.237	0.0040	15.561	0.0020	18.439	0.0020	[70]
EDH-14	Sphalerite	38.256	0.0030	15.567	0.0010	18.443	0.0010	[70]
EDH-25	Sphalerite	38.224	0.0030	15.558	0.0010	18.436	0.0010	[70]
EDH-3	Pyrite	38.203	0.0040	15.553	0.001	18.428	0.0020	[70]
EDH-4	Pyrite	38.078	0.0030	15.528	0.001	18.308	0.0010	[70]
ED9	Adesitic porphry	38.263	0.0019	15.572	0.0007	18.443	0.0008	This paper
ED2a	Adesitic porphry	38.319	0.0010	15.576	0.0003	18.476	0.0004	This paper
EDH10-33-3	Adesitic porphry	38.224	0.0030	15.543	0.0010	18.475	0.0010	[70]
EDH10-35-2	Adesitic porphry	38.286	0.0040	15.548	0.0020	18.475	0.0020	[70]
ED3a	Quartz porphyry	38.257	0.0023	15.622	0.0008	18.440	0.0009	This paper
ED10	Quartz porphyry	38.249	0.0025	15.577	0.0007	18.438	0.0010	This paper

Table S6. Compilation of intrusions and lead-zinc polymetallic mineralization ages in Great Xing'an Range.

Deposit/Pluton	Side	Lithology	Measured Objects	Method	Age (Ma)	Reference
Erdaohezi	Large	Andesitic porphry	Zircon	LA-ICP-MS U–Pb	133.9±0.9	This paper
		Quartz porphyry	Zircon	LA-ICP-MS U–Pb	160.3±1.4	
		/	Metal sulfide	Rb-Sr	130.5±3.6	[161]
Biliya	Large	/	Metal sulfide	Rb-Sr	131.3±2.4	Being published
Derbur	Large	/	Metal sulfide	Rb-Sr	141.6±1.9	[187]
Dongjun	Large	/	Metal sulfide	Rb-Sr	130.2±4.4	[166]
Jiawula	Large	Quartz porphyry	Zircon	LA-ICP-MS U–Pb	143-150	[66]
		Andesitic porphry	Zircon	SHRIMP U–Pb	145-148	[99]
		/	Sphalerite and pyrite	Rb-Sr	142-143	[67]
Changanbulagen	Large	Quartz porphyry	Zircon	LA-ICP-MS U–Pb	150.1 ± 1.8	[99]
		Andesitic porphry	Zircon	SHRIMP U–Pb	133-144	
		/	Sericite	Ar-Ar	137.7 ±0.9	[66]
Erentaolegai	Large	Quartz porphyry	Zircon	LA-ICP-MS U–Pb	138.6±2.3	[159]
Weilasituo	Large	/	Muscovite	Ar-Ar	133.4±0.8	[105]
		/	Cassiterite	LA-ICP-MS U–Pb	136.0±6.1	[77]
Bianjiadayuan	Large	Quartz porphyry	Zircon	LA-ICP-MS U–Pb	140.2±0.6	[174]
		/	Sericite	Ar-Ar	138.7 ± 1.0	
Baiyinnuo	Large	Rhyolite porphyry	Zircon	LA-ICP-MS U–Pb	133.6±0.7	[166]
Haobugao	Large	K-feldspar granite	/	Rb-Sr	132.2	[190]

Table S7. The classification and main features of the low-sulfidation, medium-sulfidation and high-sulfidation epithermal deposits.

Deposit	Deposit Type	Ore Type	Ore Minerals	Wallrock Alteration	Rock Series	Rock Association	Magma Related to Mineralization	Ore-Control Structure	Regional Geological Background	Reference
Broken Hill (Au-Ag polymetallic), Tolukuma (Au-Ag polymetallic), Acupan (Au-Ag polymetallic), etc.	Low sulfidation	Quartz vein type is dominant.	Galena, pyrite, chalcopyrite, sphalerite, tetrahedrite, natural gold, etc.	Quartz, sericite, calcite, illite, adularia, fluorite, chlorite, etc.	High-K calc-alkaline and shoshonite series	Andesitic, rhyolitic and trachyandesitic rock	Andesitic magma	Various types related to volcanic activities	Active continental margin/ mature island arc	[7], [13], [12]
Palai-Islica (Au-Cu)	Medium sulfidation	/	Pyrite, arsenopyrite, chalcopyrite, sphalerite, natural gold, etc.	/	/	/	/	/	/	[44]
Yanacocha (Au-Ag polymetallic), Veladero (Au-Ag polymetallic), etc.	High sulfidation	Various types (hydrothermal breccia+quartz vein +siliceous rock).	Pyrite, enargite, tennantite, natural gold, telluride, etc.	Quartz, alunite, barite, kaolinite, pyrophyllite, etc.	Calc-alkaline series	Rhyolitic, dacitic, quartz trachyandesitic rock	Rhyolitic magma	Volcanic center and dome system.	Volcanic arc or uplift area of continental active zone	[7], [14] ,[43]
Erdaohezi	Low sulfidation	Quartz vein type is dominant	Galena, pyrite, chalcopyrite, sphalerite , tetrahedrite, etc.	Quartz, sericite, calcite, illite, adularia, fluorite, chlorite, etc	High-K calc-alkaline and shoshonite series	Andesitic, rhyolitic and trachyandesitic rock	Andesitic magma	Tensional-torsional faults related to volcanic activity	Active continental margin/continental volcanic arc	This paper