

SUPPLEMENTARY FILE

Boiling, Degassing, and Mixing of Fluids in the Trans-Himalayan Geothermal Systems, India

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Table S1. Chemical composition of surface-discharged geothermal waters of Trans-Himalayas, India. All values are in mg/l, except pH and E_H . The pH and E_H are measured at 25°C (Mishra et al., 2024a; Dutta et al., 2023a; Dutta et al., 2025).

Sample	Location	Temp. (°C)	pH/25°C	E_H (mV)	TDS	Na	K	Ca	Mg	SiO ₂	B	Cl	F	SO ₄	CO ₂
PG/1–22	Puga	84	8.0	−470	2931	664	80	8	24	198	133	520	12.3	72	1220
PG/2–22	Puga	84	8.1	−479	2748	630	90	16	1	216	135	543	12.3	138	967
PG/3–22	Puga	84	8.3	−488	2561	570	82	8	15	207	104	485	13.8	100	976
PG/4–22	Puga	84	7.8	−459	2598	605	87	24	1	151	123	500	12.3	119	976
PG/5–22	Puga	84	8.0	−473	2421	568	86	16	5	150	135	513	13	81	854
PG/6–22	Puga	82	8.2	−483	2418	542	77	8	10	209	109	470	13	90	890
PG/7–22	Puga	80	8.6	−506	2627	620	92	16	10	232	99	705	12.9	136	704
PG/8–22	Puga	84	8.5	−500	2611	614	79	18	5	190	131	566	13.7	114	880
PG/9–22	Puga	78	8.3	−489	2387	580	80	16	5	207	126	525	13	103	732
PG/10–22	Puga	82	8.3	−488	2525	565	77	16	10	218	144	545	11.6	64	874
PG/11–22	Puga	81	8.2	−486	2367	530	78	8	20	185	139	600	12.8	68	726
PG/12–22	Puga	80	7.8	−462	2495	582	72	16	5	208	87	540	11.9	88	885
PG/13–22	Puga	72	6.7	−397	1240	285	40	16	5	54	138	375	5	56	266
CH/01–22	Chumathang	80	7.2	−426	1547	290	25	24	34	180	30	135	8	186	635
CH/02–22	Chumathang	83	7.4	−437	1696	300	30	56	15	220	36	140	7	182	710
CH/03–22	Chumathang	87	8.7	−514	1153	260	35	8	5	105	32	130	8.4	189	381
CH/04–22	Chumathang	62	7.5	−443	1485	295	25	24	24	161	39	145	9.4	201	562
CH/05–22	Chumathang	83	8.5	−502	1364	325	20	8	15	168	34	75	9	190	520
CHL-01	Changlung	75	7.7	−455	2115	692	48	16	1	82	35	164	10.5	52	1574
CHL-02	Changlung	78	8.9	−526	2024	640	42	8	5	98	31	114	11.8	60	1599
CHL-03	Changlung	66	7.7	−455	1840	621	49	12	2	130	8	82	10	54	1608
CHL-04	Changlung	65	7.7	−455	2156	712	50	18	1	125	10	100	12.5	92	1821
CHL-05	Changlung	61	7.3	−431	2278	725	58	20	4	133	11	118	12.5	175	1818
PNK-01	Panamik	77	7.7	−455	618	185	8	34	1	82	28	30	12.6	104	321
PNK-02	Panamik	76	7.7	−455	574	136	6	15	2	101	2	40	12.5	102	258
PNK-03	Panamik	68	7.8	−461	569	150	6	10	1	100	2	20	12.5	100	280
PNK-04	Panamik	75	8.0	−473	578	167	6	15	2	87	3	35	12.5	121	295
PNK-05	Panamik	70	7.7	−455	525	156	6	13	1	97	5	30	12.5	96	285
PNK-06	Panamik	65	7.8	−461	595	158	6	12	1	97	6	18	12.5	105	288
PNK-07	Panamik	70	7.8	−461	585	169	7	11	1	95	6	30	12.5	113	296

Table S2. Gas composition emanated from steam vents of Trans-Himalayan geothermal waters, India. All condensable and non-condensable gases compositions are measured in mmol/kg.

Sample ID	Location	CO ₂	Ar	N ₂	CH ₄	H ₂	He	H ₂ S
CH-03	Chumathang	28.1	71.6	888.4	11.7		0.251	
CH-05	Chumathang	104.5	53.2	829	10.4		0.069	
CH-07	Chumathang	118.7	26.5	824	10	0.104	0.264	
PG-01	Puga	44.3	67.7	876.6	11.2		0.808	6.1
PG-02	Puga	110.4	188.1	701.5				
PG-03	Puga	98.2	192.1	709.6		0.312	0.516	
PG-04	Puga	112.9	23.4	844	0.2	0.113	0.26	
PG-05	Puga	192.4	170.1	633.4	4		0.1	
PG-07	Puga	132.1	52	799.5	11.7	0.243	0.647	
PG-14	Puga	312.4	9	618.5	10.7	0.234	0.638	8.4
PG-HS-01	Puga	32.2	78.4	889	0.2		0.151	
PNK-GAS-01	Panamik	182.4	7	761.2	1.7	0.042	0.104	
CHL/CS/G-3	Changlung	166.6	4	821.9	2	0.357	1.498	
CHL/G-2	Changlung	151.1	14	791.2	3	0.04	0.066	22
CHL/G-1	Changlung	103.9	18	843.6	12	0.054	0.366	12
CH-01/25G	Changlung	275.3	5.6	657.1	32.9	0.068	0.422	2.6
CH-02/25G	Changlung	190	7	784.9	11.9	0.089	0.212	14