Supplementary material for

Palaeo-climate and -topography of the continental orogen: Theoretical inversion with initial oxygen isotopes of ancient meteoric water

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supplementary Table 1 Oxygen isotopes of granitoids and gneisses from the Dabie orogen in central-eastern China[1]

Sample number	δ^{18}O Zircon (‰)			δ^{18}O Quartz (‰)			δ^{18}O Alkali feldspar (‰)			GPS data
	Measured	Ave	1SD	Measured	Ave	1SD	Measured	Ave	1SD	
Hepeng pluton (HP)[2]										
Granitoid[3]										
01HP04	4.55, 4.54	4.55	0.01	7.69	7.69	/	6.42	6.42	/	31º13′37″, 116º45′25″
01HP05[4]	4.64, 4.60	4.62	0.03	5.92, 6.06	5.99	0.10	1.99	1.99	/	31º12′42″, 116º47′28″
Sidaohe										
Gneiss[3]										
00DB63	-0.59, -0.67, -0.64	-0.63	0.04	3.11, 2.91	3.01	0.14	1.77	1.77	/	31º22′12″, 115º04′09″
00DB64	-1.75, -1.51	-1.63	0.17	2.53, 2.51	2.52	0.01	1.22	1.22	/	31º22′12″, 115º04′09″
Tiantangzhai batholith (TTZ)										
Granitoid										
01TTZ01	5.26, 5.36	5.31	0.07	8.46	8.46	/	6.10	6.10	/	31º09′32″, 115º45′48″
01TTZ05	5.29, 5.40	5.35	0.08	8.43	8.43	/	4.35	4.35	/	31º09′44″, 115º45′54″
01TTZ06	5.38, 5.46	5.42	0.06	8.51	8.51	/	5.80	5.80	/	31º10′47″, 115º46′24″

Gneiss										
01TTZ03[4]	4.61, 4.75	4.68	0.10	7.18	7.18	/	3.48	3.48	/	31º08´15″, 115º46´27″
Tianzhushan/Yuexi pluton (TZS)										
Granitoid[3]										
03TZ01	4.98	4.98	/	8.14	8.14	/	7.00	7.00	/	30º50´41″, 116º17´14″
03TZ02	5.18	5.18	/	8.01	8.01	/	7.08	7.08	/	30º50´31″, 116º18´09″
03TZ03	5.57	5.57	/	8.53	8.53	/	5.99	5.99	/	30º50´39″, 116º19´05″
03TZ05	5.83	5.83	/	9.16	9.16	/	7.80	7.80	/	30º48´25″, 116º20´45″
03TZ06	5.54	5.54	/	/	/	/	3.76	3.76	/	30º46´41″, 116º20´45″
03TZ08	5.56	5.56	/	8.50	8.50	/	2.14	2.14	/	30º45´42″, 116º20´34″
03TZ09	5.44	5.44	/	8.81	8.81	/	7.40	7.40	/	30º44´20″, 116º22´02″
03TZ10	5.14	5.14	/	7.95	7.95	/	6.50	6.50	/	30º43´25″, 116º23´08″
03TZ11	5.40	5.40	/	8.33	8.33	/	6.69	6.69	/	30º43´23″, 116º26´52″
03TZ12	5.08	5.08	/	7.93	7.93	/	6.27	6.27	/	30º45´22″, 116º26´06″
03TZ16	4.41	4.41	/	7.48	7.48	/	4.18	4.18	/	30º43´51″, 116º28´02″
03TZ17	5.09	5.09	/	7.98	7.98	/	6.44	6.44	/	30º44´26″, 116º27´11″

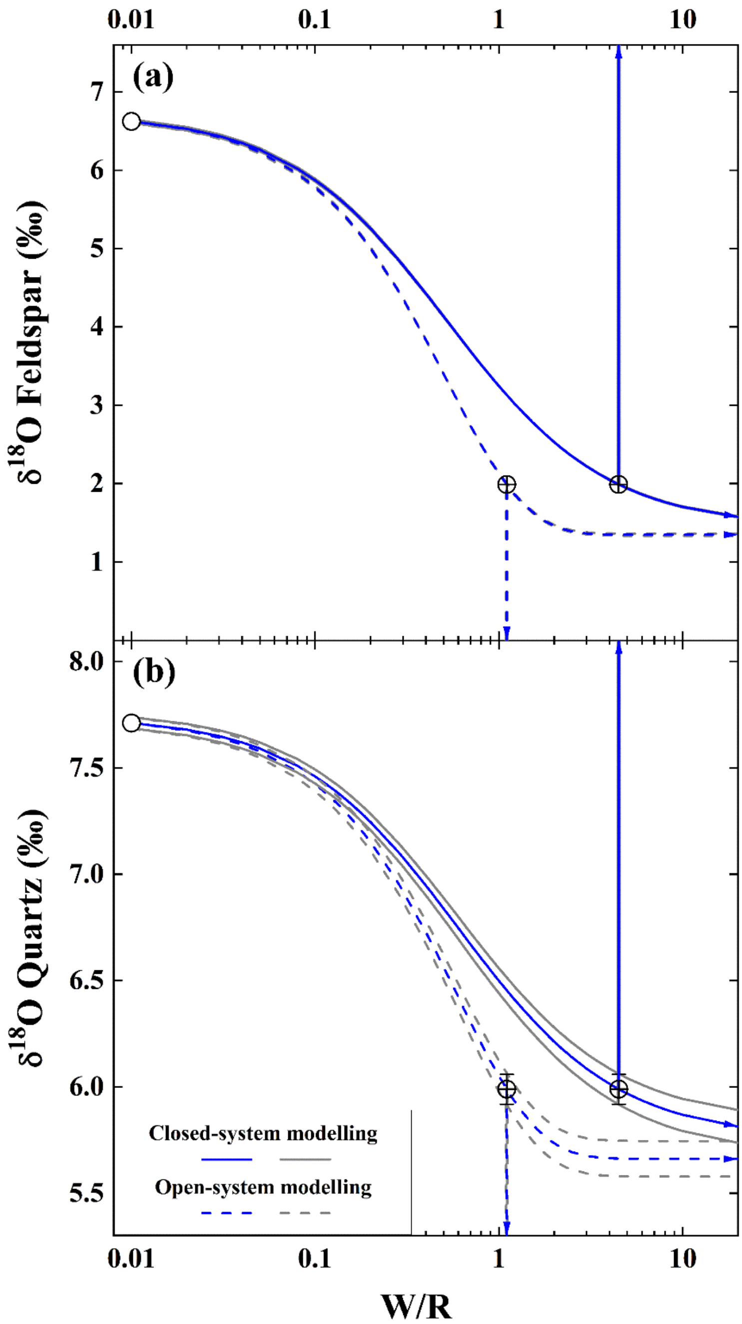
03TZ18	4.94	4.94	/	7.85	7.85	/	6.47	6.47	/	30º44′35″, 116º27′07″
03TZ19	5.47	5.47	/	8.28	8.28	/	6.22	6.22	/	30º44′33″, 116º27′27″
03TZ20	5.29	5.29	/	8.17	8.17	/	6.10	6.10	/	30º43′56″, 116º27′26″
03TZ22	5.44	5.44	/	8.26	8.26	/	7.58	7.58	/	30º44′46″, 116º29′08″
02TZ01	5.32	5.32	/	7.90	7.90	/	5.82	5.82	/	30º43′45″, 116º26′49″
02TZ02	5.37	5.37	/	8.36	8.36	/	6.70	6.70	/	30º43′40″, 116º26′47″
02TZ03	5.17	5.17	/	8.18	8.18	/	6.02	6.02	/	30º43′28″, 116º26′53″
02TZ04	5.37	5.37	/	8.26	8.26	/	3.35	3.35	/	30º43′22″, 116º27′19″
02TZ05	5.00	5.00	/	7.96	7.96	/	2.32	2.32	/	30º43′38″, 116º27′47″
Gneiss[3]										
01TZS06[4]	5.87, 5.88	5.88	0.01	9.45, 9.26, 9.27	9.33	0.11	5.17	5.17	/	30º42′55″, 116º27′48″
01TZS07	-3.78, -3.71	-3.75	0.05	0.29, 0.14, 0.34	0.26	0.10	-0.26, -0.01	-0.14	0.18	30º42′06″, 116º29′13″

[1]Pluton and batholith are alphabetically tabulated throughout this study.

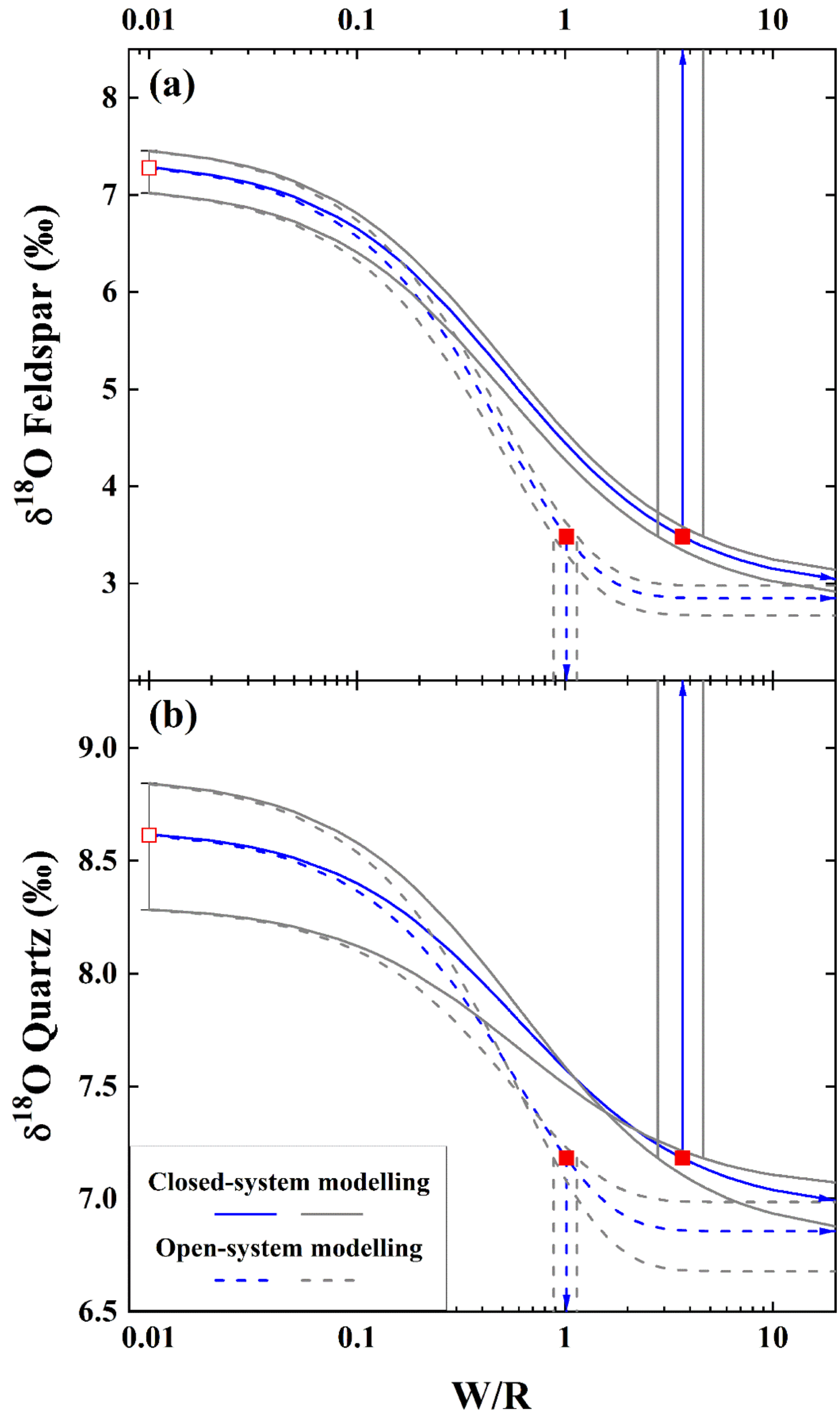
[2]Abbreviation within parenthesis is labelled in Fig. 1, and that after / denotes alternative name adopted by other authors.

[3]Data from Xu *et al*. (2005), Zhao *et al*. (2007) and Wei & Zhao (2017, 2021, 2022).

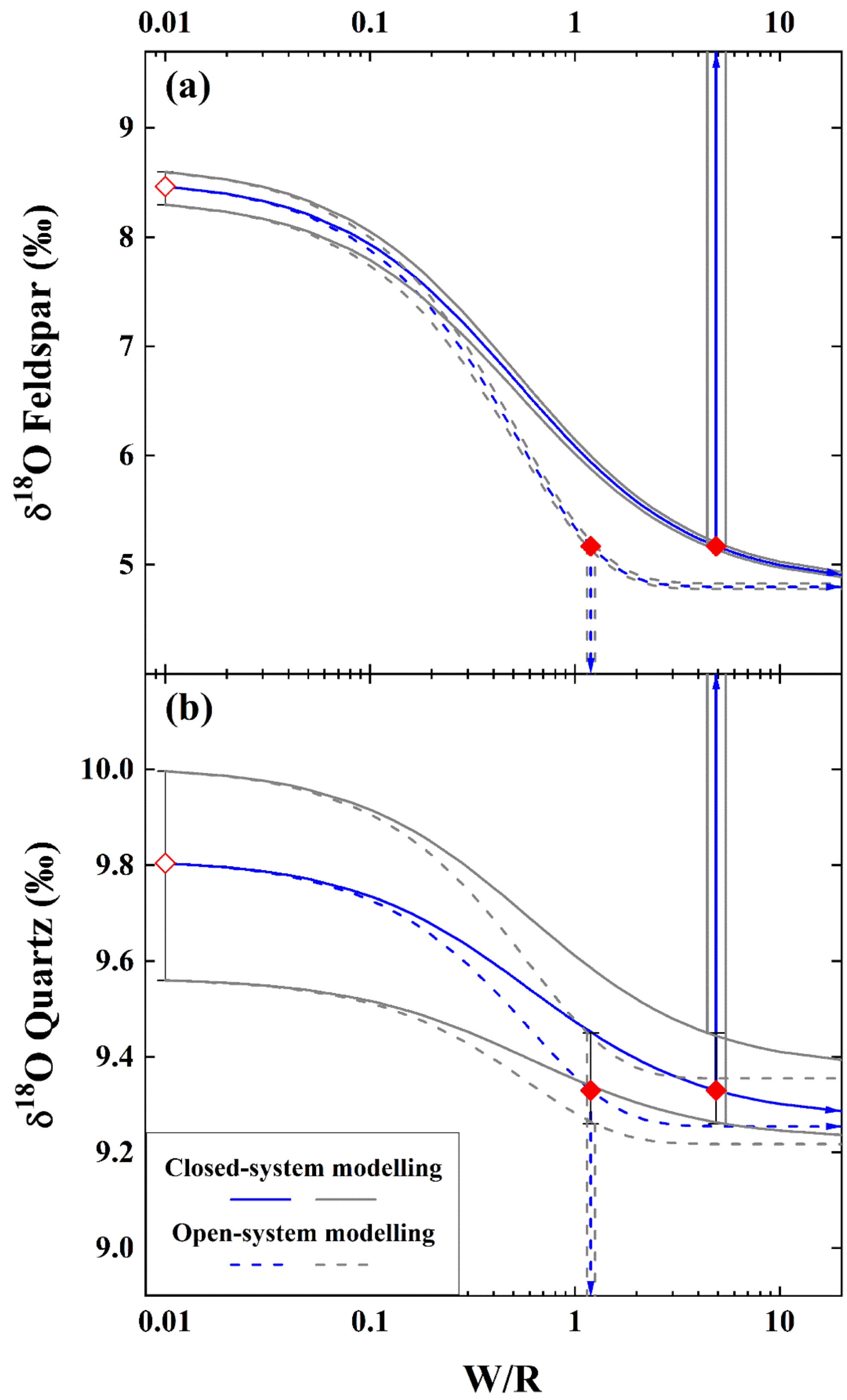
[4]Elevation of 147m for sample 01HP05, 912m for sample 01TTZ03 and 495m for sample 01TZS06, respectively.



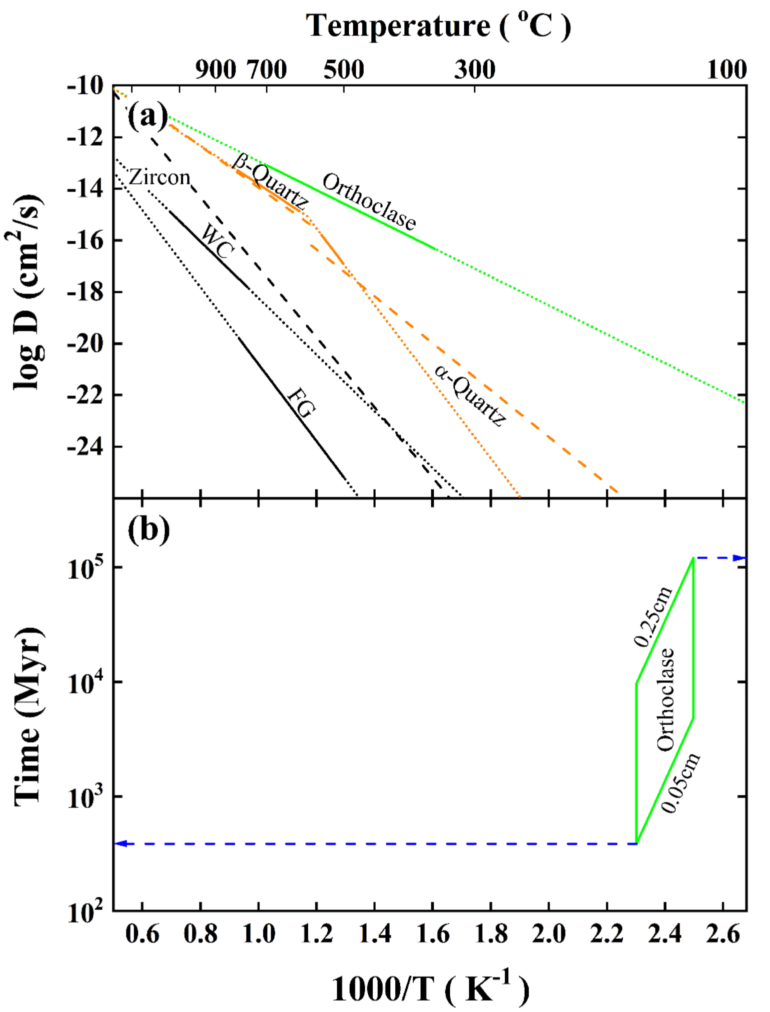
supplementary Figure 1 The concurrent lowering of oxygen isotopes with W/R ratios for alkali feldspar (a) and quartz (b) by the ancient meteoric water for sample 01HP05 from the early Cretaceous postcollisional Hepeng granitoid pluton. Due to the limited variability of the observed and initial oxygen isotopes, the grey envelopes are almost invisible for alkali feldspar within (a). Arrowed vertical lines illustrate W/R ratios required to reproduce the observed $\delta^{18}O$ values. Note that log10 scale of X axes and different scales of Y axes in (a) and (b) are adopted for clarity. Other details refer to Fig. 2.



supplementary Figure 2 The concurrent lowering of oxygen isotopes with W/R ratios for alkali feldspar (a) and quartz (b) by the ancient meteoric water for sample 01TTZ03 from the Triassic gneissic country rock intruded by the Tiantangzhai batholith.



supplementary Figure 3 The concurrent lowering of oxygen isotopes with W/R ratios for alkali feldspar (a) and quartz (b) by the ancient meteoric water for sample 01TZS06 from the Triassic gneissic country rock intruded by the Tianzhushan pluton.



supplementary Figure 4 Modelling of diffusive oxygen exchange. (a) Arrhenius plot of oxygen diffusion in minerals under wet conditions ($D = D_0 \bullet e^{E_a/RT}$, where D_0 is pre-exponential factor, E_a is activation energy, R is gas constant and T is thermodynamic temperature in Kelvin, respectively). Dashed lines are theoretical calculations (Zheng & Fu 1998), whereas dotted lines with solid segments are experimental determinations. For zircon, WC is from Watson & Cherniak (1997) and FG is from Fortier & Giletti (1989), respectively. Quartz data are from Giletti & Yund (1984), and orthoclase is after Giletti *et al.* (1978). (b) Diffusive oxygen exchange for orthoclase with two radii. Model of the spherical mineral is adopted ($D \bullet t/a^2 = 0.03$, where D is diffusion rate, t is time and a is grain size, respectively), and arrowed lines denote the timescale of alkali feldspar diffusively exchanging oxygen with ancient meteoric water in this study.