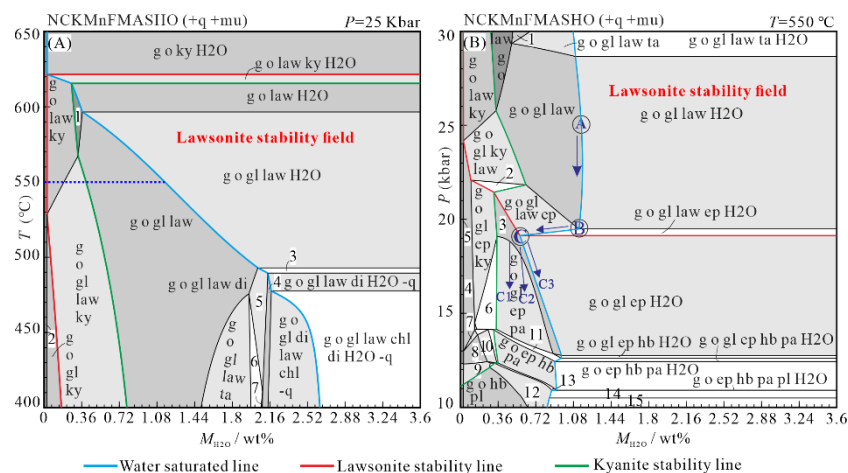
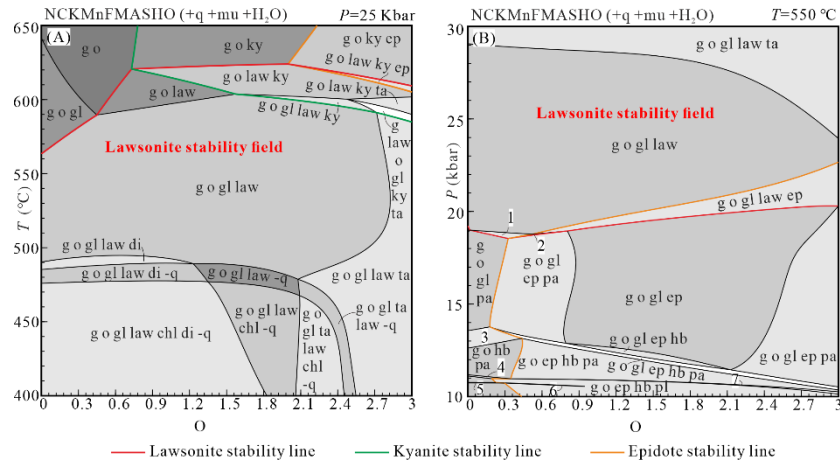


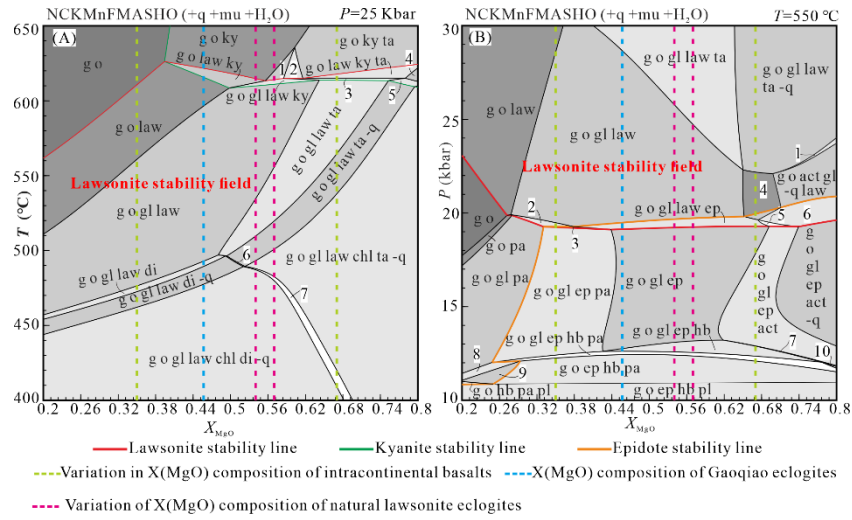
Supplementary Data Figures and Tables



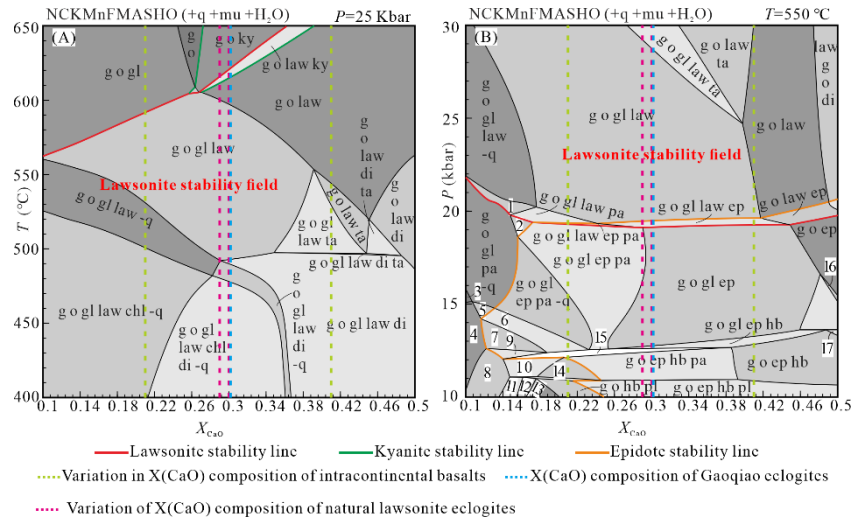
Supplementary Figure 1. $T-X(\text{H}_2\text{O})$ and $P-X(\text{H}_2\text{O})$ pseudosections calculated in the NCKMnFMASHO system at 25 kbar and 550 °C, respectively. The whole rock composition is given in Table S1. The dark blue dashed line corresponds to the calculation path in supplementary Figure 7. The numbers in Figure. S1A represent: 1. g o law, 2. g o ky, 3. g o gl law di H_2O , 4. g o gl law di -q, 5. g o gl law di, 6. g o gl law ta di, 7. g o gl law ta di -q. The numbers in Figure. S1B represent: 1. g o law ta, 2. g o gl law ep ky, 3. g o gl ep, 4. g o gl ky, 5. g o ky, 6. g o gl ep pa ky, 7. g o gl hb ky, 8. g o hb ky, 9. g o hb ky pl, 10. g o hb pa ky, 11. g o gl ep hb pa, 12. g o ep hb pl, 13. g o ep hb pl pa, 14. g o ep hb pl H_2O , 15. g ep hb pl di H_2O .



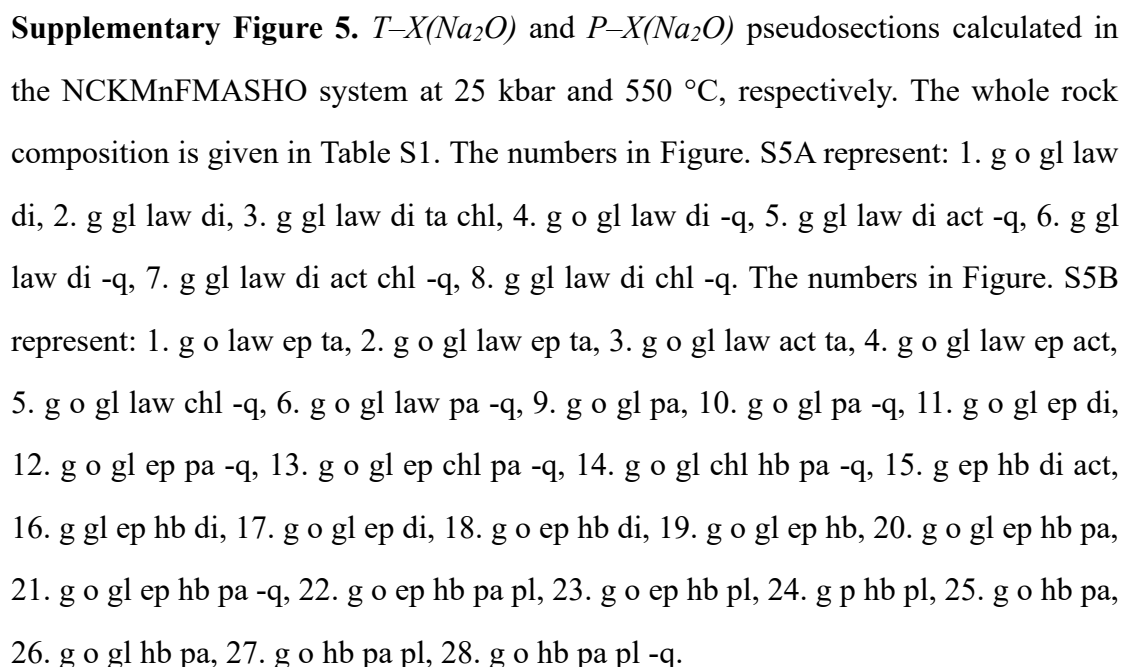
Supplementary Figure 2. *T*-*O* and *P*-*O* pseudosections calculated in the NCKMnFMASHO system at 25 kbar and 550 °C, respectively. The whole rock composition is given in Table S1. The numbers in Figure. S2B represent: 1. g o gl law pa, 2. g o gl law ep pa, 3. g o gl hb pa, 4. g o hb pa pl, 5. g p hb pl, 6. g o ep hb pl di, 7. g o ep hb pa pl



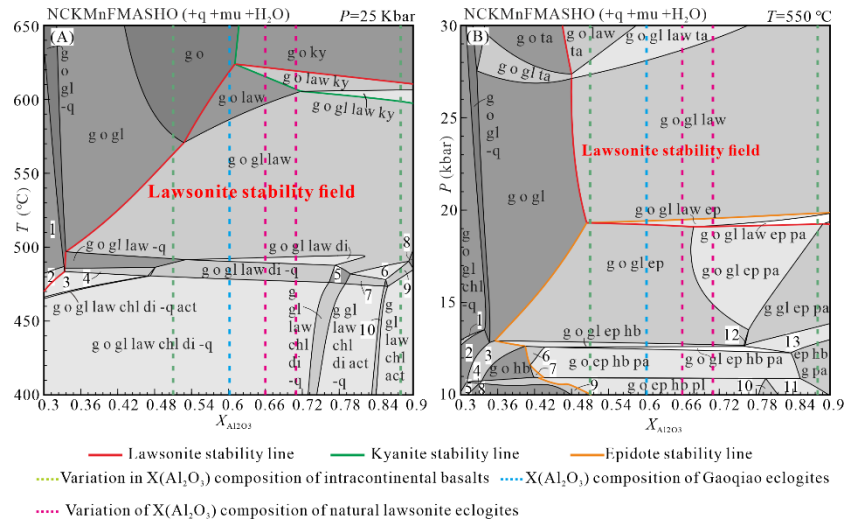
Supplementary Figure 3. T - $X(\text{MgO})$ and P - $X(\text{MgO})$ pseudosections calculated in the NCKMnFMASHO system at 25 kbar and 550 °C, respectively. The whole rock composition is given in Table S1. The numbers in Figure. S3A represent: 1. g o gl ky, 2. g o gl ky ta, 3. g o gl law ky ta, 4. g o ky ta -q, 5. g o gl ky ta -q, 6. g o gl law di ta -q, 7. g o gl law chl di ta -q. The numbers in Figure. S3B represent: 1. g o gl law ta act -q, 2. go gl law pa, 3. g o gl law ep pa, 4. g o gl law -q, 5. g o gl law ep act, 6. g o gl law ep act -q, 7. g o gl ep hb act, 8. g o gl hb pa, 9. g o hb pa, 10. g o gl ep hb pa act.



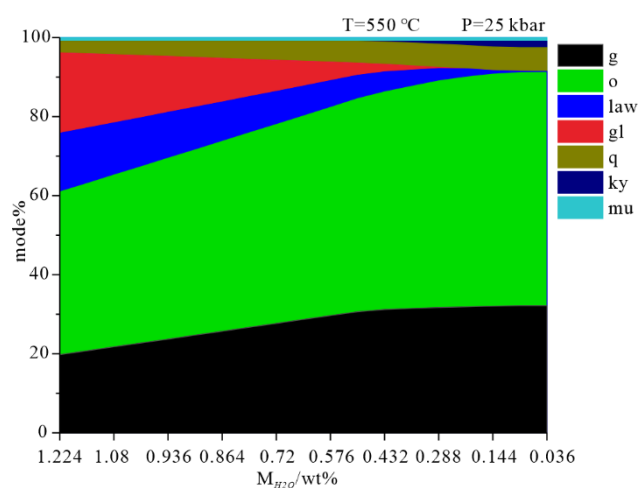
Supplementary Figure 4. T – $X(CaO)$ and P – $X(CaO)$ pseudosections calculated in the NCKMnFMASHO system at 25 kbar and 550 °C, respectively. The whole rock composition is given in Table S1. The numbers in Figure. S4B represent: 1. g o gl law pa -q, 2. g o gl pa, 3. g o gl pa -q, 4. g gl hb pa -q, 5. g o gl hb pa -q, 6. g o gl ep hb pa -q, 7. g gl ep hb pa -q, 8. g gl hb pa, 9. g gl ep hb pa, 10. g o gl hb pa, 11. g gl hb pa pl, 12. g hb pa pl, 13. g hb pl, 14. g o hb pa, 15. g o hb pa pl, 16. g o ep act, 17. g o ep hb act.



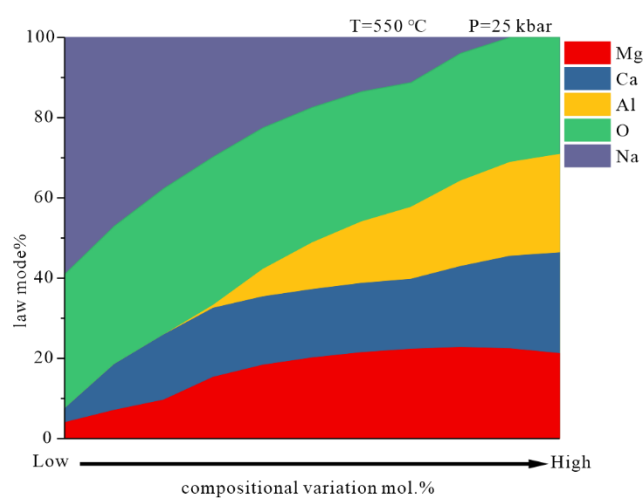
Supplementary Figure 5. T - $X(\text{Na}_2\text{O})$ and P - $X(\text{Na}_2\text{O})$ pseudosections calculated in the NCKMnFMASHO system at 25 kbar and 550 °C, respectively. The whole rock composition is given in Table S1. The numbers in Figure. S5A represent: 1. g o gl law di, 2. g gl law di, 3. g gl law di ta chl, 4. g o gl law di -q, 5. g gl law di act -q, 6. g gl law di -q, 7. g gl law di act chl -q, 8. g gl law di chl -q. The numbers in Figure. S5B represent: 1. g o law ep ta, 2. g o gl law ep ta, 3. g o gl law act ta, 4. g o gl law ep act, 5. g o gl law chl -q, 6. g o gl law pa -q, 9. g o gl pa, 10. g o gl pa -q, 11. g o gl ep di, 12. g o gl ep pa -q, 13. g o gl ep chl pa -q, 14. g o gl chl hb pa -q, 15. g ep hb di act, 16. g gl ep hb di, 17. g o gl ep di, 18. g o ep hb di, 19. g o gl ep hb, 20. g o gl ep hb pa, 21. g o gl ep hb pa -q, 22. g o ep hb pa pl, 23. g o ep hb pl, 24. g p hb pl, 25. g o hb pa, 26. g o gl hb pa, 27. g o hb pa pl, 28. g o hb pa pl -q.



Supplementary Figure 6. T- $X(Al_2O_3)$ and P- $X(Al_2O_3)$ pseudosections calculated in the NCKMnFMASHO system at 25 kbar and 550 °C. The whole rock composition is given in Table S1. The numbers in Figure. S6A represent: 1. g o gl chl -q, 2. g o gl chl act -q, 3. g o gl law chl act -q, 4. g o gl law act -q, 5. g gl law di -q, 6. g gl law di act, 8. g gl law. 9. g gl law act, 10. g gl law chl act -q. The numbers in Figure. S6B represent: 1. g o gl chl hb -q, 2. g o gl hb -q, 3. g o gl hb, 4. g o gl hb pl, 5. g o gl hb pl -q, 6. g o ep hb, 7. g o ep hb pa, 8. g o hb pl -q, 9. g o hb pl, 10. g ep hb pl, 11. g ep hb pa pl, 12. g gl ep, 13. g gl ep hb pa.



Supplementary Figure 7. Calculated lawsonite modal variations with decreasing water content in whole rock composition at 25 kbar, 550 °C. The calculated path corresponds to Figure. S1.



Supplementary Figure 8. Calculated lawsonite modal variations with increasing O, X_{MgO} , X_{CaO} , $X_{\text{Na}_2\text{O}}$ and $X_{\text{Al}_2\text{O}_3}$ in whole rock composition at 25 kbar, 550 °C.

Supplementary Table 1. Whole rock compositions (wt%) together with modified bulk rock compositions for eclogite at Gaoqiao, western Dabie

Samples	Figures	H ₂ O	SiO ₂	Al ₂ O ₃	CaO	MgO	FeO(FeO ^T)	K ₂ O	Na ₂ O	MnO	O(Fe ₂ O ₃)	P ₂ O ₅
Analyzed whole rock composition (wt%)												
GQ-1d		*	50.059	14.452	9.212	5.562	13.082	0.103	4.434	0.167	*	0.068
Corrected bulk rock composition for modeling garnet (mol.%)												
GQ-1	Fig. S1A, B	0	46.944	7.986	9.165	7.776	9.231	0.061	4.031	0.133	0.868	
		20	46.944	7.986	9.165	7.776	9.231	0.061	4.031	0.133	0.868	
GQ-1	Fig. S2A, B	excess	55.016	9.359	10.741	9.113	10.819	0.072	4.724	0.155	0	
		excess	53.366	9.078	10.418	8.840	10.495	0.070	4.582	0.151	3	
GQ-1	Fig. S3A, B	excess	54.462	9.265	10.633	3.946	15.785	0.071	4.676	0.154	1.007	
		excess	54.462	9.265	10.633	15.785	3.946	0.071	4.676	0.154	1.007	
GQ-1	Fig. S4A, B	excess	54.462	9.265	3.519	11.634	13.812	0.071	6.030	0.198	1.007	
		excess	54.462	9.265	17.597	6.463	7.673	0.071	3.350	0.110	1.007	
GQ-1	Fig. S5A, B	excess	54.462	9.265	13.778	9.021	10.710	0.071	1.531	0.154	1.007	
		excess	54.462	9.265	7.654	9.021	10.710	0.071	7.654	0.154	1.007	
GQ-1	Fig. S6A, B	excess	54.462	5.687	13.106	9.021	10.710	0.088	5.764	0.154	1.007	
		excess	54.462	11.674	8.967	9.021	10.710	0.060	3.944	0.154	1.007	

Supplementary Table 2. Whole rock compositions of intracontinental plate basalts screened from the GEOROC database (refer to Wang et al., 2016)

Samples	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	K ₂ O	X _{Mg}	X _{Ca}	X _{Na}	X _{Al}
Average	55.78	10.12	0.47	8.39	0.15	10.90	9.56	3.64	1.00	0.57	0.29	0.28	0.71
Median	55.67	10.07	0.47	8.43	0.15	10.89	9.81	3.61	0.90	0.56	0.30	0.27	0.70
Mode	55.24	9.49	0.51	9.25	0.17	10.98	10.16	3.46	0.73	0.54	0.30	0.25	0.66
MDR	75.59	10.24	0.25	4.53	0.10	0.28	7.19	1.82	0.00	0.06	0.52	0.20	1.14
	46.55	9.97	0.57	10.31	0.19	16.20	9.41	4.58	2.21	0.61	0.23	0.33	0.62

MDR, main distribution range.

Supplementary Table 3. Whole rock composition of the representative natural lawsonite eclogite in the world (refer to Wei and Clarke, 2011)

Samples	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	K ₂ O	X _{Mg}	X _{Ca}	X _{Na}	X _{Al}
BLR3	56.28	9.39	0.44	6.46	0.11	13.12	9.66	3.67	0.88	0.67	0.29	0.28	0.66
BLR6	53.82	11.15	0.42	8.32	0.00	12.34	10.69	2.81	0.45	0.60	0.31	0.21	0.80
16C	51.75	8.36	0.46	9.23	0.17	13.57	11.52	4.87	0.06	0.60	0.29	0.30	0.51
3-132	51.59	9.28	0.00	14.21	0.40	8.83	11.40	3.66	0.63	0.38	0.30	0.24	0.59
1-79B	51.95	10.51	0.00	8.72	0.56	8.30	15.44	4.36	0.16	0.49	0.41	0.22	0.53
1-79D	52.72	10.23	0.00	14.22	0.25	10.91	7.68	3.59	0.40	0.43	0.21	0.32	0.88
1-ECL	54.96	11.54	0.00	10.94	0.51	7.16	9.69	2.50	2.71	0.40	0.31	0.21	0.77
9341	51.20	9.40	0.00	10.50	0.00	14.41	11.00	3.30	0.20	0.58	0.28	0.23	0.65
9408	63.33	9.06	0.00	10.69	0.00	5.81	7.64	3.36	0.10	0.35	0.28	0.31	0.82
Q5-1	52.49	10.19	0.41	7.36	0.14	13.19	11.53	4.37	0.32	0.64	0.32	0.27	0.63
Q7-61	48.19	9.91	0.65	11.75	0.23	10.79	14.98	2.90	0.60	0.48	0.37	0.16	0.54
Q7-60	54.68	10.06	0.48	8.64	0.16	13.22	7.64	3.81	1.31	0.60	0.23	0.33	0.79
MR19	56.34	10.55	0.40	7.21	0.15	8.72	8.39	8.17	0.07	0.55	0.26	0.49	0.63
D334	54.32	11.50	0.48	8.59	0.18	11.50	8.95	4.41	0.07	0.57	0.27	0.33	0.86