

Lishuang Liu, Fulai Liu, Matthew J. Kohn, and Jinghui Guo, 2022, Compositional and metamorphic controls on tectonic erosion along a continental subduction-collision zone: Implications from mafic granulites in the northern Sulu orogen: GSA Bulletin, <https://doi.org/10.1130/B36287.1>.

Supplemental Material

Figure S1. Major element compositions of pyroxene (A–C) and amphibole (D–F).

Figure S2. Chondrite-normalized rare earth element patterns of pyroxene (A–C) and amphibole (D–F). Chondritic values from Sun and McDonough (1989) in all figures. High heavy rare earth elements in clinopyroxene might be produced by mineral inclusions.

Figure S3. Pressure-temperature (*P-T*) conditions calculated by geothermobarometries for the M₁ metamorphism of Opx-bearing mafic granulite sample G28 (A), Opx-absent mafic granulite sample G24 (B), and for the peak high-pressure granulite-facies (C) and a later amphibolite-facies (D) M₂ metamorphism of Cpx-bearing garnet amphibolite sample G25. Grt—garnet; Cpx—clinopyroxene; Opx—orthopyroxene; Pl—plagioclase; Qtz—quartz; Hbl—hornblende.

Table S1. Major element compositions (wt%) of garnet in mafic granulites from the Haiyangsuo complex.

Table S2. Major element compositions (wt%) of plagioclase in mafic granulites from the Haiyangsuo complex.

Table S3. Major element compositions (wt%) of pyroxene in mafic granulites from the Haiyangsuo complex.

Table S4. Major element compositions (wt%) of amphibole in mafic granulites from the Haiyangsuo complex.

Table S5. Trace element compositions (ppm) of garnet in mafic granulites from the Haiyangsuo complex.

Table S6. Trace element compositions (ppm) of pyroxene in mafic granulites from the Haiyangsuo complex.

Table S7. Trace element compositions (ppm) of amphibole in mafic granulites from the Haiyangsuo complex.

Table S8. Mineral volumes (vol%) of whole section and microdomains 1 and 2 of the Opx-bearing mafic granulite sample G28.

Table S9. Calculated bulk-rock compositions (mol%) used for pseudosection modeling of mafic granulites from the Haiyangsuo complex.

Table S10. Comparison of mineral assemblages and *P-T* conditions of granulites from the Haiyangsuo complex and from the Jiaobei Terrane.

SUPPLEMENTARY ANALYTICAL METHODS

Composition maps and mineral modal proportions of sample G28 were determined with a Tescan Integrated Mineral Analyzer (TIMA) with an acceleration voltage of 25 kV, a beam current of 9 nA, and a working distance of 15 mm at Nanjing Hongchuang Geological Exploration Technology Service Co., Ltd. The measurements were performed in high-resolution liberation analysis modes, including collection of backscattered electron (BSE) images and energy dispersive (EDS) data simultaneously on a regular grid. The pixel spacing and dot spacing were set to 3 μm and 6 μm , respectively. The current and BSE signal intensity were calibrated on a platinum Faraday cup using the automated procedure, and the EDS performance was checked using a manganese standard. The volume and mass ratios of all mineral phases were automatically calculated, and the results were plotted in the form of a map showing the distribution of minerals within the sample.

Whole-rock major element analyses of samples G24 and G25 were performed using a PW4400 X-ray fluorescence (XRF) spectrometer at the National Research Center of Geoanalysis, Chinese Academy of Geological Sciences (CAGS). Analytical uncertainties are \pm 3%–5% for major oxides. FeO contents were determined by Fe^{2+} titration, and Fe_2O_3 contents were calculated by the difference method. Structural H_2O contents were analyzed based on the national GB/T14506.2-2010 standard of China.

Mineral major element compositions were determined on a JEOL JXA-8100 electron microprobe (EMP) with an acceleration voltage of 15 kV, a probe current of 10 nA and a beam size of 5 or 2 μm at the State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences (IGGCAS). Counting times were 20 s on the peaks and 10 s on the background. Natural and synthetic phases were used as standards. Minerals were routinely analyzed for Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K, Cr and Ni, and these data were processed with an online atomic number, X-ray absorption and fluorescence (ZAF)-type correction. The accuracy is within 5% (relative). Representative major element compositions of minerals are presented in Tables S1–S4.

Trace element compositions of garnet were analyzed by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) employing an Agilent 7500a quadrupole-ICP-MS instrument (Agilent Technologies, USA) coupled to a 193 nm ArF excimer laser (Geolas HD, Lambda Phvsik, Göttingen, Germany) at the State Key Laboratory of Lithospheric Evolution, IGGCAS. The approaches were similar to those outlined in Wu et al. (2018). The isotopes were measured using peak-hopping mode with a laser diameter of 50–65 μm and a 5 Hz repetition rate. Helium was employed as the ablation gas to improve the transport efficiency of ablated aerosols. External calibration used the NIST SRM 610 reference glass, and quality control monitoring employed the USGS BCR-2G glass. The duration for each analysis was 88 s. The international standard was calcium (^{43}Ca). The resulting data were reduced using the GLITTER program (Griffin et al., 2008). The accuracy and precision were within 5%–10% (relative) for most trace elements with concentrations of more than 0.5 ppm. Representative trace element compositions of minerals are presented in Tables S5–S7.

Garnets for oxygen isotope analysis were separated, after the host rocks fragmented, by magnetic and heavy liquid techniques and handpicked under a binocular microscope. Coarse-grained ($>400 \mu\text{m}$) garnet crystals always show dark brown in color and those fine-grained crystals ($<200 \mu\text{m}$) exhibit distinctive light pink in color. Two different generations were separated and analyzed based on color, particle size (coarse vs. fine) and inclusion abundance.

This process was performed at the Rock-Mineral Preparation and Analysis Lab, IGGCAS. Then, these separated garnets were powdered in an agate mill to less than 200 mesh. Oxygen isotope analysis was performed using laser fluorination (the traditional BrF₅ method described as Clayton and Mayeda, 1963) at Beijing GeoAnalysis Co., Ltd. Approximately 15–20 mg milligrams of garnet powder were weighed, purified using HCl and deionized water, and toasted for 12 h at 105 °C. Oxygen gas was extracted utilizing the reaction between BrF₅ and garnet powder under high temperature (630 °C) and vacuum condition for ~14 h, separated from other by-products (SiF₄ and BrF₃) after being frozen with liquid nitrogen, purified by a metal cold trap, and then collected by a 5 Å molecular sieve tube. O₂ was converted to CO₂ in a graphite reactor at 700 °C with presence of Pt catalyst. The CO₂ collected was transport to a MAT-253 Plus mass spectrometer for analyzing the oxygen isotope ratios ($\delta^{18}\text{O}$), which were converted to values relative to Vienna standard mean ocean water (V-SMOW). Two Chinese national quartz standards (GBW04409 and GBW04410) were adopted to monitor the accuracy. The analytical reproducibility is better than ± 0.2‰.

REFERENCES CITED

- Clayton, R.N., and Mayeda, T.K., 1963, The use of bromine pentafluoride in the extraction of oxygen from oxides and silicates for isotopic analysis: *Geochemica et Cosmochimica Acta*, v. 27, no. 1, p. 43–52, [https://doi.org/10.1016/0016-7037\(63\)90071-1](https://doi.org/10.1016/0016-7037(63)90071-1).
- Ellis, D.J., and Green, D.H., 1979, An experimental study of the effect of Ca upon garnet-clinopyroxene Fe-Mg exchange equilibria. *Contributions to Mineralogy and Petrology*, v. 71, no. 1, p. 13–22, <https://doi.org/10.1007/BF00371878>.
- Griffin, W.L., Powell, W., Pearson, N.J., and O'Reilly, S.Y., 2008, GLITTER: data reduction software for laser ablation ICP-MS: *Laser Ablation ICP-MS in the Earth Sciences: Current practices and outstanding issues*, v. 40, p. 308–311.
- Holland, T., and Blundy, J., 1994, Non-ideal interactions in calcic amphiboles and their bearing on amphibole-plagioclase thermometry: *Contributions to Mineralogy and Petrology*, v. 116, no. 4, p. 433–447, <https://doi.org/10.1007/BF00310910>.
- Liu, P.H., Liu, F.L., Liu, C.H., Wang, F., Liu, J.H., Yang, H., Cai, J., and Shi, J.R., 2013c, Petrogenesis, $P-T-t$ path, and tectonic significance of high-pressure mafic granulites from the Jiaobei terrane, North China Craton: *Precambrian Research*, v. 233, p. 237–258, <https://doi.org/10.1016/j.precamres.2013.05.003>.
- Liu, P.H., Liu, F.L., Cai, J., Wang, F., Liu, C.H., Liu, J.H., Yang, H., Shi, J.R., and Liu, L.S., 2017d, Discovery and geological significance of high-pressure mafic granulites in the Pingdu–Anqiu area of the Jiaobei Terrane, the Jiao–Liao–Ji Belt, the North China Craton: *Precambrian Research*, v. 303, p. 445–469, <https://doi.org/10.1016/j.precamres.2017.05.022>.
- Newton, R., and Perkins, D., 1982, Thermodynamic calibration of geobarometers based on the assemblages garnet-plagioclase-orthopyroxene (clinopyroxene)-quartz: *American Mineralogist*, v. 67, no. 3–4, p. 203–222, <https://doi.org/10.1007/BF01081377>.
- Powell, R., 1985, Regression diagnostics and robust regression in geothermometer/geobarometer calibration: the garnet - clinopyroxene geothermometer revisited: *Journal of metamorphic Geology*, v. 3, no. 3, p. 231–243, <https://doi.org/10.1111/j.1525-1314.1985.tb00319.x>.
- Sun, S.S., and McDonough, W.F., 1989, Chemical and isotopic systematics of oceanic basalts: implications for mantle composition and processes: *Geological Society of London, Special Publications*, v. 42, no. 1, p. 313–345, <https://doi.org/10.1144/GSL.SP.1989.042.01.19>.
- Tam, P.Y., Zhao, G.C., Sun, M., Li, S.Z., Iizuka, Y., Ma, G.S.K., Yin, C.Q., He, Y.H., and Wu, M.L., 2012a, Metamorphic $P-T$ path and tectonic implications of medium-pressure pelitic granulites from the Jiaobei massif in the Jiao-Liao-Ji Belt, North China Craton: *Precambrian Research*, v. 220–221, no. 1, p. 177–191, <https://doi.org/10.1016/j.precamres.2012.08.008>.
- Tam, P.Y., Zhao, G.C., Sun, M., Li, S.Z., Wu, M.L., and Yin, C.Q., 2012b, Petrology and metamorphic $P-T$ path of high-pressure mafic granulites from the Jiaobei massif in the Jiao-Liao-Ji Belt, North China Craton: *Lithos*, v. 155, no. 1, p. 94–109, <https://doi.org/10.1016/j.lithos.2012.08.018>.
- Tam, P.Y., Zhao, G.C., Zhou, X.W., Sun, M., Guo, J.H., Li, S.Z., Yin, C.Q., Wu, M.L., and He, Y.H., 2012c, Metamorphic $P-T$ path and implications of high-pressure pelitic granulites from the Jiaobei massif in the Jiao-Liao-Ji Belt, North China Craton: *Gondwana Research*, v. 22, no. 1, p. 104–117, <https://doi.org/10.1016/j.gr.2011.09.006>.
- Taylor, W.R., 1998, An experimental test of some geothermometer and geobarometer formulations for upper mantle peridotites with application to the thermobarometry of fertile

- Iherzolite and garnet websterite: Neues Jahrbuch für Mineralogie-Abhandlungen, v. 172, no. 2–3, p. 381–408, <https://doi.org/10.1127/njma/172/1998/381>.
- Wu, S.T., Karius, V., Schmidt, B.C., Simon, K., and Wörner, G., 2018, Comparison of Ultrafine Powder Pellet and Flux-free Fusion Glass for Bulk Analysis of Granitoids by Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry: Geostandards and Geoanalytical Research, v. 42, no. 4, p. 575–591, <https://doi.org/10.1111/ggr.12230>.
- Zou, Y., Zhai, M.G., Zhou, L.G., Zhao, L., Lu, J.S., Wang, Y.Q., and Shan, H.X., 2019, Relics of a Paleoproterozoic orogen: New petrological, phase equilibria and geochronological studies on high-pressure pelitic granulites from the Pingdu-Laiyang areas, southwest of the Jiaobei terrane, North China Craton: Precambrian Research, v. 322, p. 136–159, <https://doi.org/10.1016/j.precamres.2018.12.011>.
- Zou, Y., Zhai, M.G., Mitchell, R.N., Zhao, L., Zhou, L.G., Liu, B., Wang, Y.Q., and Chen, M.D., 2020, Discovery of kyanite in typically cordierite/sillimanite-bearing low- to medium-pressure pelitic granulites from the Jiaobei terrain, North China Craton: Precambrian Research, v. 342, p. 105677, <https://doi.org/10.1016/j.precamres.2020.105677>.

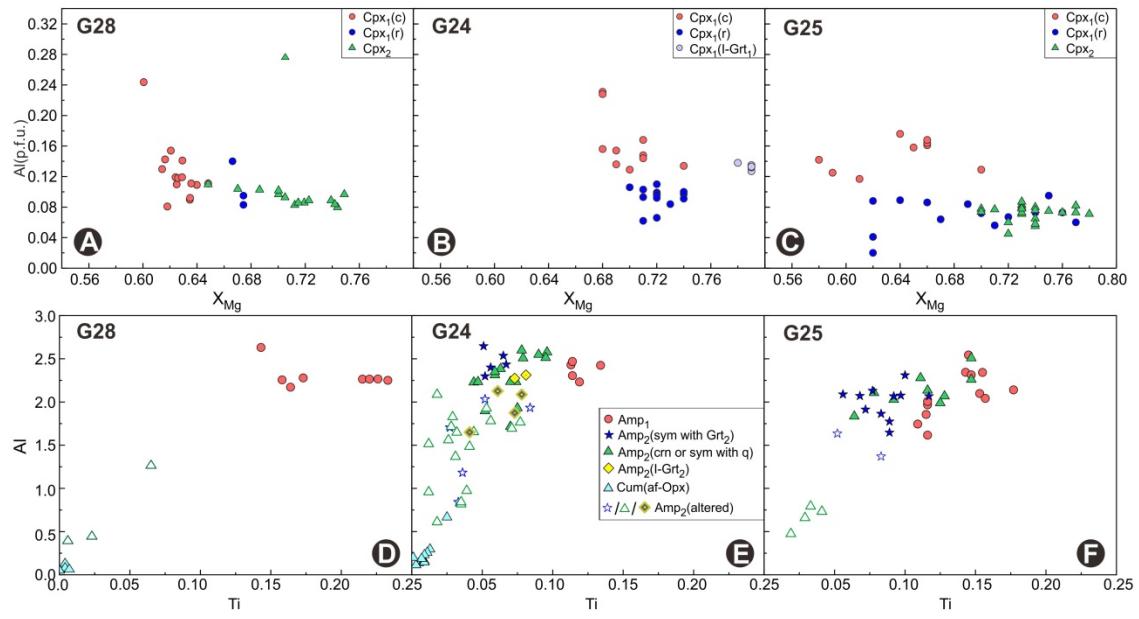


Figure S1. Major element compositions of pyroxene (A–C) and amphibole (D–F).

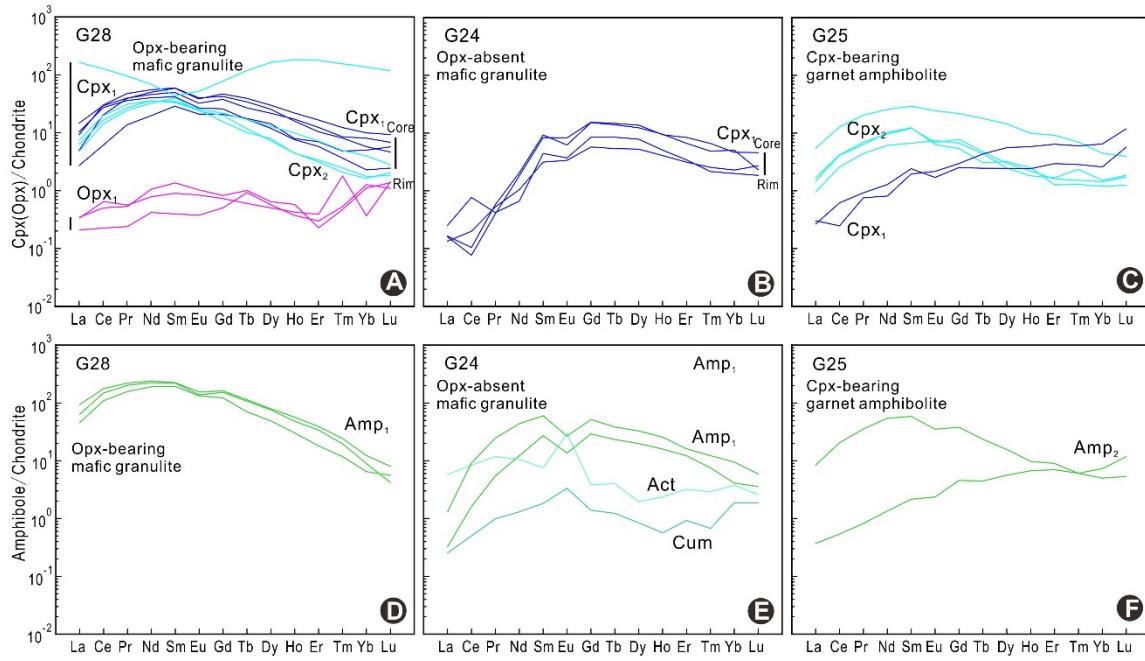


Figure S2. Chondrite-normalized rare earth element patterns of pyroxene (A–C) and amphibole (D–F). Chondritic values from Sun and McDonough (1989) in all figures. High heavy rare earth elements in clinopyroxene might be produced by mineral inclusions.

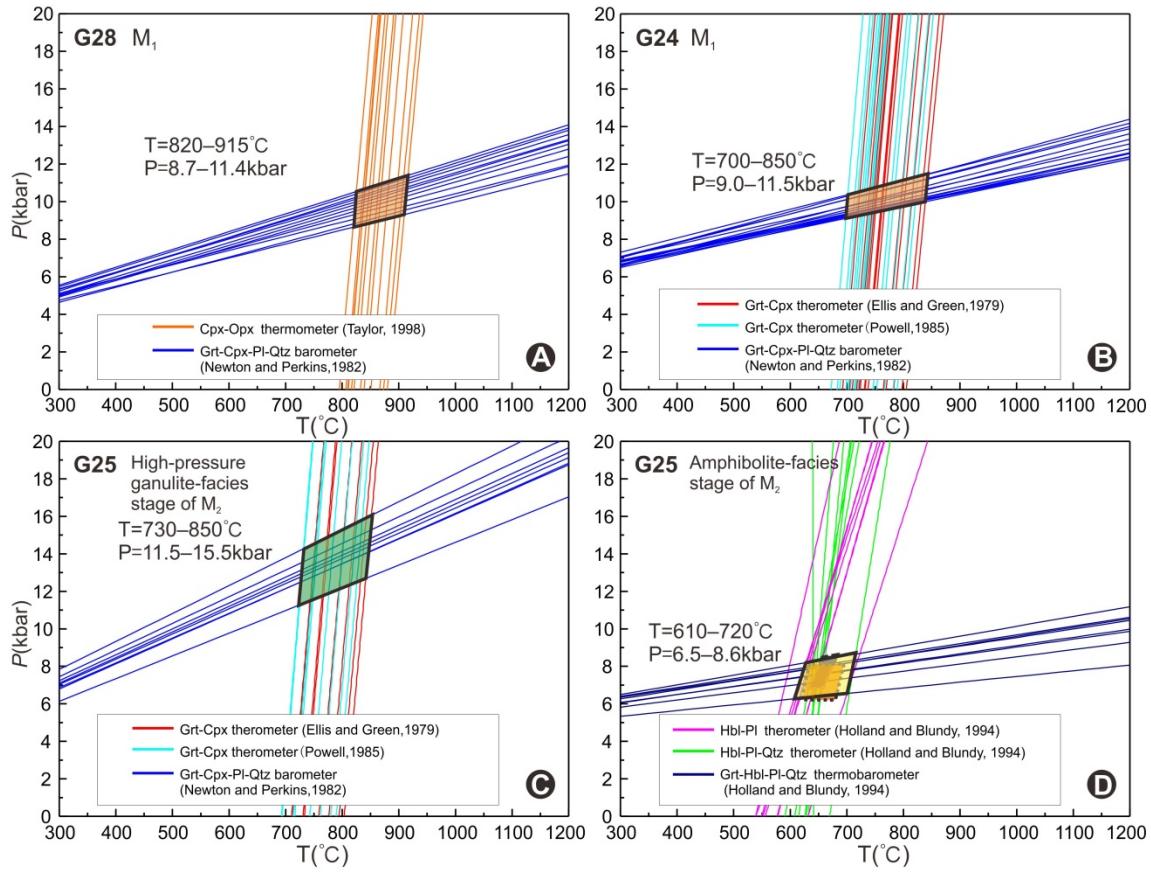


Figure S3. Pressure-temperature (P - T) conditions calculated by geothermobarometry for M_1 metamorphism of Opx-bearing mafic granulite sample G28 (A), Opx-absent mafic granulite sample G24 (B), and for the peak high-pressure granulite-facies (C) and a later amphibolite-facies (D) stages of M_2 metamorphism of Cpx-bearing garnet amphibolite sample G25. Grt—garnet; Cpx—clinopyroxene; Opx—orthopyroxene; Pl—plagioclase; Qtz—quartz; Hbl—hornblende.

Table S1. Major element compositions (wt%) of garnet in mafic granulites from the Haiyangsuo complex.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G28-grt01	Grt _i (c)	38.99	0.1	19.86	0	27.86	1.15	4.84	6.92	0.02	0	99.73	12	3.075	0.006	1.847	0	0	1.837	0.077	0.569	0.584	0.003	0	0.24	19	19	60	3
G28-grt02	Grt _i (c)	38.69	0.08	19.76	0.05	27.73	1.21	5.01	6.69	0.02	0.01	99.29	12	3.065	0.005	1.845	0.003	0.016	1.822	0.081	0.591	0.568	0.002	0.001	0.24	19	19	60	3
G28-grt03	Grt _i (c)	38.75	0.02	19.64	0	28.08	1.29	4.8	6.93	0.02	0.01	99.61	12	3.065	0.001	1.831	0	0.039	1.819	0.086	0.566	0.588	0.002	0.001	0.24	19	19	59	3
G28-grt04	Grt _i (c)	38.72	0.03	19.43	0.03	28.26	1.29	4.9	6.84	0	0	99.58	12	3.066	0.002	1.814	0.002	0.05	1.822	0.087	0.578	0.58	0	0	0.24	19	19	59	3
G28-grt05	Grt _i (c)	38.93	0.09	19.79	0.01	27.95	1.26	4.97	6.73	0.04	0	99.79	12	3.07	0.006	1.839	0.001	0.016	1.828	0.084	0.584	0.568	0.006	0	0.24	19	19	60	3
G28-grt06	Grt _i (c)	38.3	0.11	19.93	0	28.28	1.21	4.91	6.85	0	0.01	99.72	12	3.027	0.006	1.857	0	0.078	1.791	0.081	0.578	0.58	0	0.001	0.24	19	19	59	3
G28-grt07	Grt _i (c)	38.48	0.05	19.72	0	28.07	1.3	4.83	6.84	0.02	0	99.4	12	3.051	0.003	1.843	0	0.053	1.808	0.087	0.571	0.581	0.003	0	0.24	19	19	59	3
G28-grt08	Grt _i (c)	38.55	0.01	19.97	0.01	28.38	1.28	4.76	7.07	0	0	100.15	12	3.036	0.001	1.854	0.001	0.072	1.797	0.085	0.558	0.596	0	0	0.24	20	18	59	3
G28-grt09	Grt _i (c)	39.05	0.09	20.04	0.02	28.36	1.28	4.67	6.97	0.03	0	100.51	12	3.062	0.005	1.852	0.001	0.016	1.844	0.085	0.545	0.585	0.004	0	0.23	19	18	60	3
G28-grt10	Grt _i (c)	38.61	0.01	19.62	0.04	27.51	1.29	4.75	7.32	0.05	0.01	99.29	12	3.061	0.001	1.834	0.002	0.049	1.775	0.087	0.561	0.622	0.008	0.001	0.24	20	18	58	3
G28-grt11	Grt _i (c)	35.6	0.06	20.54	0	27.37	1.31	4.75	7.82	0.02	0	98	12	2.866	0.004	1.95	0	0.314	1.529	0.089	0.57	0.674	0.004	0	0.27	24	20	53	3
G28-grt12	Grt _i (c)	38.89	0.05	20.07	0	27.41	0.95	4.94	7.47	0	0.01	99.81	12	3.06	0.003	1.861	0	0.015	1.789	0.063	0.579	0.63	0	0.001	0.24	21	19	58	2
G28-grt13	Grt _i (c)	38.75	0.05	20.07	0.06	28.04	1.16	5.23	6.8	0.01	0	100.26	12	3.039	0.003	1.856	0.004	0.057	1.782	0.077	0.611	0.571	0.001	0	0.26	19	20	59	3
G28-grt14	Grt _i (c)	38.69	0.06	20.04	0.02	28.04	1.18	5.11	6.93	0.03	0	100.2	12	3.037	0.004	1.855	0.001	0.066	1.774	0.079	0.597	0.583	0.004	0	0.25	19	20	58	3
G28-grt15	Grt _i (c)	38.48	0.03	19.97	0	27.67	1.28	4.88	7.13	0.02	0	99.54	12	3.042	0.002	1.861	0	0.055	1.774	0.085	0.574	0.604	0.003	0	0.24	20	19	58	3
G28-grt16	Grt _i (c)	38.62	0.08	20.03	0.02	27.61	1.15	4.91	7.3	0.04	0.01	99.87	12	3.041	0.005	1.859	0.001	0.055	1.763	0.077	0.576	0.616	0.005	0.001	0.25	20	19	58	3
G28-grt17	Grt _i (c)	39.24	0.08	20.02	0.01	28.14	1.23	4.8	7.05	0.01	0	100.59	12	3.071	0.005	1.847	0	0.001	1.841	0.082	0.56	0.591	0.001	0	0.23	19	18	60	3
G28-grt18	Grt _i (c)	38.67	0	20.34	0	27.22	1.12	4.82	7.24	0.02	0.02	99.45	12	3.052	0	1.893	0	0.007	1.789	0.075	0.567	0.612	0.003	0.002	0.24	20	19	59	2
G28-grt19	Grt _i (c)	38.92	0	20.12	0.02	26.75	1.11	4.82	7.95	0.05	0	99.76	12	3.06	0	1.865	0.001	0.022	1.736	0.074	0.565	0.669	0.008	0	0.25	22	19	57	2
G28-grt20	Grt _i (c)	39.18	0.04	20.1	0.02	27.27	1.14	5.04	7.09	0	0	99.88	12	3.076	0.002	1.86	0.001	0	1.791	0.076	0.59	0.596	0	0	0.25	20	19	59	2
G28-grt21	Grt _i (c)	38.46	0.03	20.21	0.08	27.75	1.19	4.68	7.11	0.05	0.01	99.67	12	3.037	0.002	1.881	0.005	0.044	1.789	0.08	0.55	0.602	0.008	0.001	0.24	20	18	59	3
G28-grt22	Grt _i (c)	38.9	0.02	20.79	0.03	27.64	1.19	5	7.04	0.01	0	100.65	12	3.034	0.001	1.912	0.002	0.018	1.785	0.079	0.582	0.588	0.001	0	0.25	19	19	59	3
G28-grt23	Grt _i (c)	38.66	0.04	20.06	0	27.88	1.33	5.09	6.92	0.03	0.02	100.13	12	3.037	0.002	1.858	0	0.071	1.761	0.089	0.595	0.582	0.004	0.002	0.25	19	20	58	3
G28-grt24	Grt _i (c)	38.64	0.01	19.98	0.05	27.72	1.34	5.02	6.82	0.02	0	99.67	12	3.049	0.001	1.859	0.003	0.042	1.787	0.089	0.59	0.577	0.003	0	0.25	19	19	59	3
G28-grt25	Grt _i (c)	38.88	0.03	20.37	0.06	27.48	1.17	4.98	7.06	0	0	100.05	12	3.052	0.002	1.885	0.003	0.005	1.799	0.078	0.582	0.594	0	0	0.24	19	19	59	3
G28-grt26	Grt _i (c)	37.59	0.04	20.4	0.02	27.39	1.05	4.86	7.83	0.04	0	99.5	12	2.971	0.003	1.901	0.001	0.156	1.655	0.071	0.573	0.663	0.006	0	0.26	22	19	56	2
G28-grt27	Grt _i (r)	38.71	0	20.32	0.01	26.71	0.87	4.62	8.32	0.05	0	99.65	12	3.047	0	1.886	0	0.027	1.731	0.058	0.542	0.702	0.008	0	0.24	23	18	57	2
G28-grt28	Grt _i (r)	38.84	0.03	20.34	0	26.12	0.89	4.43	9.21	0.11	0	100.06	12	3.043	0.002	1.879	0	0.049	1.662	0.059	0.518	0.773	0.016	0	0.24	26	17	55	2
G28-grt29	Grt _i (r)	38.85	0.02	19.55	0.02	27.31	1.26	4.4	7.78	0.01	0	99.19	12	3.085	0.001	1.83	0.001	0	1.814	0.085	0.521	0.662	0.002	0	0.22	21	17	59	3
G28-grt30	Grt _i (r)	38.59	0.18	19.97	0.07	27.11	0.94	3.75	8.56	0	0.07	99.25	12	3.064	0.011	1.87	0.004	0	1.8	0.063	0.444	0.728	0	0.007	0.20	24	15	59	2

Continued the Table S1.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G28-grt31	Grt ₁ (r)	39.23	0	20.92	0	25.87	0.88	4.74	8.48	0.01	0.02	100.15	12	3.056	0	1.922	0	0	1.686	0.058	0.55	0.708	0.002	0.002	0.25	24	18	56	2
G28-grt32	Grt ₁ (r)	38.89	0.02	20.38	0.03	26.58	0.94	3.88	9.25	0.01	0	99.98	12	3.058	0.001	1.889	0.002	0	1.748	0.063	0.455	0.78	0.001	0	0.21	26	15	57	2
G28-grt33	Grt ₂ (c)	37.42	0.01	20.54	0.02	26.47	1.24	4.53	8.65	0.01	0	99.15	12	2.967	0	1.92	0.001	0.144	1.612	0.084	0.536	0.735	0.001	0	0.25	25	18	54	3
G28-grt34	Grt ₂ (c)	38.23	0.01	20.06	0	27.37	0.9	2.93	9.67	0	0.02	99.21	12	3.05	0.001	1.887	0	0.013	1.813	0.061	0.348	0.827	0	0.002	0.16	27	11	59	2
G28-grt35	Grt ₂ (c)	38.3	0.03	20.54	0	27.05	1	3.86	8.54	0.04	0	99.37	12	3.034	0.001	1.918	0	0.016	1.777	0.067	0.455	0.725	0.006	0	0.20	24	15	59	2
G28-grt36	Grt ₂ (c)	38.69	0	20.19	0	27.31	0.82	4.69	7.5	0	0	99.21	12	3.061	0	1.884	0	0	1.807	0.055	0.554	0.636	0	0	0.23	21	18	59	2
G28-grt37	Grt ₂ (c)	38.58	0.02	20.25	0	28.99	1.07	3.5	7.75	0	0	100.16	12	3.052	0.001	1.888	0	0.007	1.911	0.072	0.413	0.657	0	0	0.18	22	14	63	2
G28-grt38	Grt ₂ (c)	38.37	0.03	19.9	0	27.20	1.15	3.09	9.26	0.01	0.02	99.02	12	3.065	0.002	1.874	0	0	1.817	0.078	0.368	0.792	0.001	0.002	0.17	26	12	59	3
G28-grt39	Grt ₂ (c)	38.63	0.05	19.59	0.02	27.61	0.93	4.1	8.34	0.01	0.01	99.34	12	3.067	0.003	1.834	0.001	0.028	1.806	0.063	0.485	0.709	0.002	0.001	0.21	23	16	59	2
G28-grt40	Grt ₂ (c)	38.42	0.09	20.23	0.01	28.77	0.28	1.94	10.16	0	0.01	99.91	12	3.056	0.005	1.897	0	0	1.914	0.019	0.23	0.866	0	0.001	0.11	29	8	63	1
G28-grt41	Grt ₂ (c)	37.2	0.06	20.35	0.02	29.26	1.04	3.25	7.84	0.08	0	99.32	12	2.976	0.003	1.92	0.001	0.131	1.827	0.07	0.388	0.672	0.012	0	0.18	23	13	62	2
G28-grt42	Grt ₂ (c)	38.67	0.01	20.48	0.03	27.50	0.87	3.67	8.59	0.02	0.01	99.85	12	3.052	0.001	1.906	0.002	0	1.815	0.058	0.432	0.726	0.003	0.001	0.19	24	14	60	2
G28-grt43	Grt ₂ (c)	38.99	0.02	20.32	0	27.31	0.88	3.32	8.82	0.2	0.01	99.88	12	3.075	0.001	1.889	0	0	1.802	0.059	0.39	0.746	0.03	0.001	0.18	25	13	60	2
G28-grt44	Grt ₂ (c)	37.79	0.03	20.37	0.07	27.65	0.83	3.54	8.89	0.09	0.01	99.43	12	3.002	0.002	1.908	0.005	0.094	1.743	0.056	0.419	0.757	0.014	0.001	0.19	25	14	59	2
G28-grt45	Grt ₂ (c)	37.49	0.09	20.61	0.04	28.20	0.85	3.72	8.48	0	0	99.66	12	2.975	0.005	1.928	0.002	0.109	1.763	0.057	0.439	0.721	0	0	0.20	24	15	59	2
G28-grt46	Grt ₂ (c)	39.21	0.02	19.68	0	27.13	1.36	4.76	7.59	0.09	0.02	99.9	12	3.085	0.001	1.825	0	0.019	1.766	0.091	0.558	0.64	0.014	0.002	0.24	21	18	58	3
G28-grt47	Grt ₂ (n-Pl)	38.95	0.04	20.62	0.01	27.75	0.81	4.57	7.4	0.05	0	100.19	12	3.053	0.003	1.905	0	0	1.819	0.053	0.534	0.621	0.008	0	0.23	21	18	60	2
G28-grt48	Grt ₂ (n-Pl)	39.19	0.01	20.44	0.04	28.34	0.81	4.05	7.33	0.01	0	100.21	12	3.076	0.001	1.892	0.002	0	1.86	0.054	0.474	0.616	0.001	0	0.20	21	16	62	2
G28-grt49	Grt ₂ (n-Pl)	38.79	0.06	20.55	0	27.64	0.94	3.15	8.82	0.04	0.01	100	12	3.06	0.003	1.911	0	0	1.824	0.063	0.37	0.746	0.007	0.001	0.17	25	12	61	2
G28-grt50	Grt ₂ (n-Pl)	39.21	0	20.84	0.02	26.51	0.83	4.39	8.86	0	0	100.66	12	3.052	0	1.912	0.001	0	1.725	0.054	0.509	0.739	0	0	0.23	24	17	57	2
G28-grt51	Grt ₂ (n-Pl)	38.85	0.01	20.23	0.1	28.23	0.99	3.37	8.88	0	0	100.67	12	3.054	0	1.875	0.006	0.01	1.846	0.066	0.394	0.748	0	0	0.18	24	13	60	2
G28-grt52	Grt ₂ (n-Pl)	38.02	0	20.92	0	28.11	0.79	3.9	8.2	0.03	0.01	100.11	12	2.996	0	1.943	0	0.072	1.781	0.053	0.458	0.692	0.005	0.001	0.20	23	15	60	2
G28-grt53	Grt ₂ (n-Ampl)	38.1	0.02	19.6	0	29.70	1.11	2.57	8.1	0.03	0	99.26	12	3.062	0.001	1.857	0	0.023	1.973	0.076	0.308	0.697	0.004	0	0.14	23	10	65	2
G28-grt54	Grt ₂ (n-Ampl)	38.3	0.04	19.89	0.06	29.71	0.86	3.05	7.71	0.02	0.01	99.66	12	3.056	0.003	1.871	0.004	0.011	1.971	0.058	0.363	0.659	0.002	0.001	0.16	22	12	65	2
G28-grt55	Grt ₂ (sym)	38.91	0.01	20.45	0	26.35	0.74	4.08	9.19	0.04	0	99.76	12	3.06	0.001	1.895	0	0	1.733	0.049	0.478	0.774	0.006	0	0.22	26	16	57	2
G28-grt56	Grt ₂ (sym)	38.78	0.04	20.45	0.01	26.53	0.95	4.58	8.14	0.02	0	99.49	12	3.055	0.002	1.899	0	0	1.748	0.064	0.538	0.687	0.003	0	0.24	23	18	58	2
G28-grt57	Grt ₂ (sym)	38.74	0.04	19.94	0.03	28.26	1	3.52	7.65	0.16	0	99.33	12	3.08	0.002	1.87	0.002	0	1.879	0.067	0.418	0.652	0.024	0	0.18	22	14	62	2
G28-grt58	Grt ₂ (sym)	38.56	0.06	20.28	0	26.87	0.86	4.45	8.3	0.07	0	99.51	12	3.042	0.004	1.887	0	0.033	1.741	0.058	0.523	0.702	0.011	0	0.23	23	17	58	2
G28-grt59	Grt ₂ (sym)	39.64	0.05	20.6	0	26.45	0.74	4.19	8.59	0.02	0	100.28	12	3.089	0.003	1.893	0	0	1.724	0.049	0.487	0.717	0.002	0	0.22	24	16	58	2
G28-grt60	Grt ₂ (sym)	39.11	0.06	20.39	0	25.06	0.54	3.11	11.05	0.2	0.01	99.53	12	3.078	0.003	1.892	0	0	1.65	0.036	0.365	0.932	0.03	0.001	0.18	31	12	55	1
G28-grt61	Grt ₂ (sym)	39.08	0.02	20.78	0	25.68	1	4.39	9.06	0.04	0	100.04	12	3.054	0.001	1.914	0	0	1.679	0.066	0.511	0.759	0.007	0	0.23	25	17	56	2
G28-grt62	Grt ₂ (I-Cpx)	37.32	0.05	19.63	0	30.51	1.21	2.7	7.67	0.02	0.02	99.35	12	3.005	0.003	1.864	0	0.125	1.93	0.083	0.324	0.662	0.003	0.002	0.14	22	11	64	3

Continued the Table S1.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G28-grt63	Grt ₂ (I-Cpx)	38.64	0.08	19.71	0.03	29.99	1.22	3.02	7.27	0.08	0	100.03	12	3.075	0.005	1.85	0.002	0.002	1.994	0.082	0.358	0.62	0.013	0	0.15	20	12	65	3
G28-grt64	Grt ₂ (I-Cpx)	38.66	0.02	19.19	0.01	30.39	0.98	2.9	7.38	0.06	0	99.59	12	3.096	0.001	1.812	0.001	0.002	2.033	0.067	0.347	0.633	0.009	0	0.15	21	11	66	2
G28-grt65	Grt ₂ (I-Cpx)	38.38	0.03	19.25	0.03	30.31	1	2.72	7.59	0.01	0.02	99.33	12	3.084	0.002	1.824	0.002	0.006	2.031	0.068	0.326	0.654	0.002	0.002	0.14	21	11	66	2
G24-grt01	Grt _i (c)	38.94	0.03	20.91	0.04	25.66	1.22	6.51	6.71	0.06	0.00	100.08	12	3.022	0.002	1.913	0.002	0.046	1.615	0.080	0.753	0.558	0.009	0.000	0.32	19	25	54	3
G24-grt02	Grt _i (c)	39.08	0.01	21.62	0.06	25.90	1.15	6.46	6.77	0.02	0.00	101.07	12	3.002	0.001	1.958	0.004	0.035	1.625	0.075	0.740	0.557	0.003	0.000	0.31	19	25	54	3
G24-grt03	Grt _i (c)	38.63	0.03	20.58	0.02	24.99	1.23	6.62	6.50	0.17	0.10	98.87	12	3.028	0.002	1.902	0.001	0.073	1.557	0.082	0.773	0.546	0.026	0.010	0.33	18	26	53	3
G24-grt04	Grt _i (c)	38.85	0.00	21.23	0.05	25.92	1.34	6.37	6.67	0.01	0.00	100.45	12	3.008	0.000	1.938	0.003	0.045	1.629	0.088	0.735	0.553	0.002	0.000	0.31	18	24	54	3
G24-grt05	Grt _i (c)	38.52	0.02	20.58	0.04	26.90	1.32	5.58	6.71	0.00	0.00	99.68	12	3.024	0.001	1.905	0.002	0.041	1.720	0.088	0.653	0.565	0.000	0.000	0.28	19	22	57	3
G24-grt06	Grt _i (c)	38.87	0.01	21.31	0.04	25.96	1.32	6.47	6.59	0.00	0.00	100.57	12	3.004	0.001	1.942	0.002	0.045	1.627	0.086	0.745	0.546	0.000	0.000	0.31	18	25	54	3
G24-grt07	Grt _i (c)	39.39	0.02	21.44	0.01	25.93	1.15	6.60	6.61	0.03	0.01	101.19	12	3.021	0.001	1.939	0.001	0.022	1.639	0.075	0.754	0.543	0.004	0.001	0.32	18	25	54	2
G24-grt08	Grt _i (c)	38.84	0.01	21.11	0.03	27.02	0.98	5.86	6.83	0.02	0.02	100.72	12	3.010	0.001	1.929	0.002	0.053	1.692	0.064	0.677	0.567	0.003	0.002	0.29	19	23	56	2
G24-grt09	Grt _i (c)	39.15	0.02	21.08	0.00	24.94	0.83	7.21	6.58	0.05	0.00	99.86	12	3.028	0.001	1.922	0.000	0.027	1.583	0.054	0.831	0.545	0.008	0.000	0.34	18	28	53	2
G24-grt10	Grt _i (c)	38.84	0.02	21.20	0.01	26.94	1.30	5.75	6.79	0.01	0.00	100.86	12	3.008	0.001	1.936	0.001	0.046	1.694	0.085	0.664	0.564	0.002	0.000	0.28	19	22	56	3
G24-grt11	Grt _i (c)	38.88	0.02	21.33	0.06	26.35	1.04	6.03	6.98	0.00	0.00	100.70	12	3.007	0.001	1.945	0.004	0.034	1.667	0.068	0.695	0.579	0.000	0.000	0.29	19	23	55	2
G24-grt12	Grt _i (c)	39.13	0.00	21.75	0.05	26.12	1.14	6.52	6.66	0.00	0.00	101.38	12	2.998	0.000	1.964	0.003	0.037	1.633	0.074	0.744	0.547	0.000	0.000	0.31	18	25	54	2
G24-grt13	Grt _i (c)	39.26	0.06	21.30	0.03	26.02	1.14	6.62	6.72	0.01	0.00	101.16	12	3.014	0.003	1.928	0.002	0.037	1.630	0.074	0.757	0.553	0.001	0.000	0.32	18	25	54	2
G24-grt14	Grt _i (c)	39.08	0.03	21.52	0.04	25.88	1.17	6.67	6.60	0.01	0.00	101.00	12	3.003	0.002	1.949	0.002	0.040	1.618	0.076	0.764	0.543	0.001	0.000	0.32	18	25	54	3
G24-grt15	Grt _i (c)	38.87	0.03	21.13	0.05	27.28	0.96	5.49	7.13	0.00	0.00	100.95	12	3.012	0.002	1.930	0.003	0.039	1.725	0.063	0.634	0.593	0.000	0.000	0.27	20	21	57	2
G24-grt16	Grt _i (c)	38.54	0.01	20.85	0.03	26.65	0.96	4.77	8.37	0.00	0.00	100.18	12	3.015	0.001	1.923	0.002	0.044	1.694	0.064	0.556	0.702	0.000	0.000	0.25	23	18	56	2
G24-grt17	Grt _i (c)	38.59	0.04	20.86	0.04	26.69	1.03	4.63	8.26	0.02	0.00	100.16	12	3.021	0.002	1.925	0.002	0.028	1.716	0.068	0.540	0.693	0.003	0.000	0.24	23	18	57	2
G24-grt18	Grt _i (c)	38.62	0.02	20.73	0.09	27.68	1.05	4.43	7.51	0.00	0.00	100.13	12	3.034	0.001	1.920	0.006	0.004	1.815	0.070	0.519	0.633	0.000	0.000	0.22	21	17	60	2
G24-grt19	Grt _i (c)	39.07	0.00	20.72	0.03	27.02	0.81	5.80	7.12	0.01	0.00	100.58	12	3.033	0.000	1.896	0.002	0.037	1.714	0.053	0.671	0.592	0.002	0.000	0.28	20	22	57	2
G24-grt20	Grt ₂ (af-Cum)	38.54	0.00	21.22	0.00	27.79	0.85	4.91	7.15	0.01	0.00	100.46	12	3.009	0.000	1.953	0.000	0.030	1.780	0.056	0.571	0.598	0.002	0.000	0.24	20	19	59	2
G24-grt21	Grt ₂ (af-Cum)	38.65	0.02	21.23	0.00	27.23	0.90	4.91	7.31	0.02	0.00	100.27	12	3.019	0.001	1.955	0.000	0.007	1.771	0.060	0.572	0.612	0.003	0.000	0.24	20	19	59	2
G24-grt22	Grt ₂ (af-Cum)	38.53	0.01	21.06	0.00	28.52	0.86	4.57	6.82	0.01	0.01	100.39	12	3.020	0.001	1.946	0.000	0.016	1.852	0.057	0.534	0.573	0.002	0.001	0.22	19	18	61	2
G24-grt23	Grt ₃ (af-Cum)	38.44	0.03	21.10	0.00	27.96	0.82	4.86	7.06	0.00	0.01	100.28	12	3.009	0.002	1.947	0.000	0.032	1.795	0.054	0.567	0.592	0.000	0.001	0.24	20	19	60	2
G24-grt24	Grt ₃ (af-Cum)	38.03	0.05	19.84	0.00	29.22	1.10	4.73	5.30	0.04	0.02	98.33	12	3.054	0.003	1.878	0.000	0.017	1.943	0.075	0.566	0.456	0.006	0.002	0.23	15	19	64	2
G24-grt25	Grt ₃ (af-Cum)	37.81	0.07	19.73	0.00	29.62	1.19	4.46	5.98	0.01	0.00	98.87	12	3.029	0.004	1.863	0.000	0.073	1.903	0.081	0.532	0.513	0.002	0.000	0.22	17	18	63	3
G24-grt26	Grt ₃ (af-Cum)	38.69	0.06	20.71	0.05	27.55	0.78	4.72	7.44	0.02	0.01	100.03	12	3.036	0.004	1.916	0.003	0.005	1.802	0.052	0.552	0.626	0.003	0.001	0.23	21	18	59	2
G24-grt27	Grt ₃ (af-Cum)	38.26	0.02	20.24	0.03	27.53	0.79	4.95	6.91	0.01	0.00	98.74	12	3.042	0.001	1.897	0.002	0.017	1.811	0.053	0.586	0.589	0.002	0.000	0.24	19	19	60	2
G24-grt28	Grt ₃ (af-Cum)	38.32	0.01	19.94	0.02	27.69	0.80	5.07	6.69	0.01	0.00	98.54	12	3.053	0.001	1.873	0.001	0.019	1.824	0.054	0.602	0.571	0.002	0.000	0.25	19	20	60	2
G24-grt29	Grt ₃ (af-Cum)	38.70	0.02	21.04	0.01	27.23	0.82	4.78	7.31	0.03	0.01	99.95	12	3.033	0.001	1.944	0.001	0.000	1.785	0.054	0.558	0.614	0.005	0.001	0.24	20	19	59	2

Continued the Table S1.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G24-grt30	Grt ₂ (af-Cum)	38.54	0.01	21.28	0.00	29.12	0.91	4.72	5.74	0.02	0.01	100.35	12	3.022	0.001	1.967	0.000	0.000	1.909	0.060	0.551	0.482	0.003	0.001	0.22	16	18	64	2
G24-grt31	Grt ₂ (af-Cum)	38.33	0.00	21.46	0.00	28.25	0.94	4.28	7.04	0.01	0.00	100.31	12	3.007	0.000	1.985	0.000	0.004	1.849	0.062	0.500	0.592	0.002	0.000	0.21	20	17	62	2
G24-grt32	Grt ₂ (af-Cum)	38.59	0.04	21.41	0.00	28.25	0.82	4.76	7.02	0.01	0.00	100.89	12	3.004	0.002	1.965	0.000	0.024	1.811	0.054	0.552	0.586	0.002	0.000	0.23	20	18	60	2
G24-grt33	Grt ₂ (af-Cpx)	38.47	0.01	20.81	0.01	25.28	1.32	2.74	11.70	0.01	0.00	100.35	12	3.021	0.001	1.927	0.001	0.031	1.626	0.088	0.321	0.984	0.002	0.000	0.16	33	11	54	3
G24-grt34	Grt ₂ (af-Cpx)	38.31	0.00	21.55	0.01	27.72	1.00	4.17	7.71	0.01	0.00	100.48	12	2.998	0.000	1.988	0.001	0.016	1.796	0.066	0.486	0.647	0.002	0.000	0.21	22	16	60	2
G24-grt35	Grt ₂ (af-Cpx)	38.49	0.06	20.70	0.00	24.95	1.09	3.33	11.26	0.07	0.03	99.98	12	3.023	0.004	1.917	0.000	0.044	1.589	0.073	0.390	0.948	0.011	0.003	0.20	32	13	53	2
G24-grt36	Grt ₂ (af-Cpx)	38.14	0.02	21.11	0.02	27.59	1.53	3.30	8.76	0.03	0.01	100.51	12	2.999	0.001	1.957	0.001	0.047	1.762	0.102	0.387	0.738	0.005	0.001	0.18	25	13	59	3
G24-grt37	Grt ₂ (af-Cpx)	38.61	0.01	20.68	0.04	26.92	1.08	4.03	8.89	0.00	0.00	100.27	12	3.029	0.001	1.913	0.002	0.024	1.740	0.072	0.471	0.748	0.000	0.000	0.21	25	16	57	2
G24-grt38	Grt ₂ (af-Cpx)	38.45	0.01	21.51	0.02	27.09	1.47	3.16	9.25	0.00	0.01	100.97	12	3.005	0.001	1.982	0.001	0.006	1.764	0.097	0.368	0.775	0.000	0.001	0.17	26	12	59	3
G24-grt39	Grt ₂ (af-Cpx)	38.60	0.01	21.51	0.00	27.53	1.31	3.70	8.34	0.01	0.00	101.01	12	3.011	0.001	1.978	0.000	0.001	1.795	0.087	0.430	0.697	0.002	0.000	0.19	23	14	60	3
G24-grt40	Grt ₂ (af-Cpx)	38.43	0.02	20.77	0.01	26.45	1.92	3.07	9.55	0.01	0.01	100.24	12	3.029	0.001	1.930	0.001	0.012	1.730	0.128	0.361	0.806	0.002	0.001	0.17	27	12	57	4
G24-grt41	Grt ₂ (af-Cpx)	38.60	0.02	21.12	0.01	27.56	1.13	3.92	8.02	0.01	0.01	100.40	12	3.026	0.001	1.952	0.001	0.000	1.807	0.075	0.458	0.674	0.002	0.001	0.20	22	15	60	2
G24-grt42	Grt ₂ (af-Cpx)	38.40	0.04	21.28	0.03	25.63	1.56	2.65	11.08	0.00	0.01	100.68	12	3.008	0.002	1.965	0.002	0.012	1.666	0.104	0.309	0.930	0.000	0.001	0.16	31	10	55	3
G24-grt43	Grt ₂ (af-Cpx)	38.48	0.01	20.64	0.06	25.91	1.31	3.08	10.70	0.01	0.01	100.21	12	3.027	0.001	1.914	0.004	0.029	1.672	0.087	0.361	0.902	0.002	0.001	0.18	30	12	55	3
G24-grt44	Grt ₂ (af-Cpx)	38.43	0.00	20.83	0.01	25.89	1.45	3.00	10.80	0.01	0.00	100.42	12	3.017	0.000	1.928	0.001	0.038	1.658	0.096	0.351	0.909	0.002	0.000	0.17	30	12	55	3
G24-grt45	Grt ₂ (af-Cpx)	38.59	0.01	21.31	0.02	24.84	1.40	2.69	11.85	0.01	0.00	100.72	12	3.014	0.001	1.962	0.001	0.008	1.614	0.093	0.313	0.992	0.002	0.000	0.16	33	10	54	3
G24-grt46	Grt ₂ (sym)	38.83	0.06	21.05	0.02	27.44	1.22	3.77	8.46	0.03	0.01	100.89	12	3.032	0.004	1.938	0.001	0.000	1.792	0.081	0.439	0.708	0.005	0.001	0.20	23	15	59	3
G24-grt47	Grt ₂ (sym)	38.42	0.02	21.03	0.00	27.07	1.21	3.63	8.43	0.08	0.01	99.90	12	3.028	0.001	1.954	0.000	0.001	1.784	0.081	0.426	0.712	0.012	0.001	0.19	24	14	59	3
G24-grt48	Grt ₂ (sym)	38.70	0.00	20.90	0.00	26.79	1.07	3.67	9.54	0.00	0.01	100.68	12	3.026	0.000	1.926	0.000	0.023	1.726	0.071	0.428	0.799	0.000	0.001	0.20	26	14	57	2
G24-grt49	Grt ₂ (sym)	38.31	0.04	20.62	0.04	27.09	1.22	3.64	8.99	0.04	0.00	99.99	12	3.021	0.002	1.917	0.002	0.040	1.742	0.081	0.428	0.760	0.006	0.000	0.20	25	14	58	3
G24-grt50	Grt ₂ (sym)	38.59	0.05	20.91	0.02	26.03	1.26	3.33	9.94	0.01	0.01	100.15	12	3.032	0.003	1.937	0.001	0.000	1.711	0.084	0.390	0.837	0.002	0.001	0.19	28	13	57	3
G24-grt51	Grt ₂ (sym)	38.27	0.04	20.67	0.05	26.68	1.26	3.38	9.61	0.04	0.01	100.01	12	3.018	0.002	1.922	0.003	0.042	1.713	0.084	0.397	0.812	0.006	0.001	0.19	27	13	57	3
G24-grt52	Grt ₂ (sym)	38.60	0.01	20.68	0.06	27.32	1.32	3.48	8.84	0.00	0.00	100.32	12	3.037	0.001	1.918	0.004	0.001	1.797	0.088	0.408	0.746	0.000	0.000	0.19	25	13	59	3
G24-grt53	Grt ₂ (sym)	38.46	0.02	21.10	0.07	26.86	1.16	3.84	8.73	0.01	0.00	100.25	12	3.018	0.001	1.952	0.004	0.006	1.756	0.077	0.449	0.734	0.002	0.000	0.20	24	15	58	3
G24-grt54	Grt ₂ (sym)	38.55	0.04	21.08	0.04	26.55	1.11	3.79	9.36	0.02	0.00	100.54	12	3.015	0.002	1.944	0.002	0.022	1.712	0.074	0.442	0.784	0.003	0.000	0.21	26	15	57	2
G24-grt55	Grt ₂ (I-Cpx)	38.06	0.04	20.18	0.01	28.88	1.75	3.31	8.07	0.05	0.00	100.35	12	3.013	0.002	1.883	0.001	0.094	1.807	0.117	0.390	0.684	0.008	0.000	0.18	23	13	60	4
G24-grt56	Grt ₂ (I-Cpx)	38.11	0.10	20.18	0.02	28.88	1.86	3.31	7.64	0.00	0.00	100.11	12	3.025	0.006	1.889	0.001	0.047	1.865	0.125	0.392	0.650	0.000	0.000	0.17	21	13	62	4
G24-grt57	Grt ₂ (I-Cpx)	38.36	0.03	20.23	0.07	27.66	1.86	2.92	9.31	0.00	0.00	100.45	12	3.031	0.002	1.884	0.004	0.046	1.776	0.124	0.344	0.789	0.000	0.000	0.16	26	11	59	4
G24-grt58	Grt ₂ (I-Cpx)	38.44	0.05	20.28	0.02	28.46	1.85	3.13	8.32	0.01	0.00	100.56	12	3.035	0.003	1.888	0.001	0.036	1.839	0.124	0.368	0.704	0.002	0.000	0.17	23	12	61	4
G24-grt59	Grt ₂ (I-Cpx)	37.80	0.07	20.61	0.05	28.70	2.08	3.08	7.56	0.05	0.01	100.01	12	3.004	0.004	1.931	0.003	0.059	1.842	0.140	0.365	0.644	0.008	0.001	0.17	22	12	62	5
G24-grt60	Grt ₂ (I-Cpx)	37.76	0.06	20.08	0.00	27.55	1.56	3.04	8.81	0.16	0.04	99.06	12	3.019	0.004	1.893	0.000	0.090	1.742	0.106	0.362	0.755	0.025	0.004	0.17	25	12	59	4
G24-grt61	Grt ₂ (I-Cpx)	39.95	0.03	17.19	0.03	24.46	1.38	4.38	11.98	0.10	0.01	99.51	12	3.154	0.002	1.600	0.002	0.102	1.502	0.092	0.515	1.014	0.015	0.001	0.26	32	16	48	3

Continued the Table S1.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G24-grt62	Grt ₂ (I-Cpx)	38.19	0.04	20.19	0.04	28.23	2.07	2.97	8.27	0.00	0.00	100.00	12	3.035	0.002	1.892	0.003	0.030	1.842	0.139	0.352	0.705	0.000	0.000	0.16	23	12	61	5
G24-grt63	Grt ₂ (I-Cpx)	38.27	0.04	20.66	0.04	25.68	1.78	2.26	11.23	0.00	0.00	99.97	12	3.029	0.002	1.928	0.003	0.006	1.693	0.119	0.267	0.953	0.000	0.000	0.14	31	9	56	4
G24-grt64	Grt ₂ (af-IIm)	38.32	0.21	21.21	0.11	30.33	1.09	5.10	4.02	0.01	0.00	100.40	12	3.009	0.012	1.964	0.007	0.000	1.992	0.073	0.597	0.338	0.002	0.000	0.23	11	20	66	2
G24-grt65	Grt ₂ (af-IIm)	38.22	0.12	21.07	0.06	30.18	1.05	5.17	4.84	0.04	0.01	100.77	12	2.991	0.007	1.944	0.004	0.063	1.906	0.070	0.603	0.406	0.006	0.001	0.24	14	20	64	2
G24-grt66	Grt ₂ (af-IIm)	38.20	0.16	20.62	0.12	29.97	1.10	4.76	4.62	0.01	0.00	99.56	12	3.030	0.010	1.928	0.008	0.000	1.988	0.074	0.563	0.393	0.002	0.000	0.22	13	19	66	2
G24-grt67	Grt ₂ (af-IIm)	37.95	0.31	20.63	0.11	30.73	1.14	5.00	3.95	0.02	0.02	99.85	12	3.007	0.018	1.927	0.007	0.021	2.013	0.077	0.590	0.335	0.003	0.002	0.23	11	20	67	3
G24-grt68	Grt ₂ (af-IIm)	37.81	0.13	19.87	0.03	29.16	1.03	4.93	5.43	0.10	0.05	98.54	12	3.027	0.008	1.875	0.002	0.075	1.869	0.070	0.588	0.466	0.016	0.005	0.24	16	20	62	2
G24-grt69	Grt ₂ (af-IIm)	38.37	0.08	21.09	0.01	26.35	0.95	3.82	9.85	0.00	0.00	100.53	12	3.000	0.005	1.944	0.001	0.046	1.671	0.063	0.445	0.826	0.000	0.000	0.21	27	15	56	2
G24-grt70	Grt ₂ (af-IIm)	38.34	0.04	21.36	0.00	27.31	1.33	3.56	8.26	0.06	0.00	100.26	12	3.013	0.002	1.979	0.000	0.001	1.794	0.089	0.417	0.696	0.009	0.000	0.19	23	14	60	3
G24-grt71	Grt ₂ (af-IIm)	38.60	0.01	21.42	0.00	26.76	1.35	3.32	9.33	0.01	0.00	100.80	12	3.016	0.001	1.973	0.000	0.000	1.749	0.089	0.387	0.781	0.002	0.000	0.18	26	13	58	3
G24-grt72	Grt ₂ (af-IIm)	38.48	0.00	20.89	0.02	27.01	1.39	3.40	8.99	0.00	0.00	100.19	12	3.030	0.000	1.939	0.001	0.001	1.778	0.093	0.399	0.759	0.000	0.000	0.18	25	13	59	3
G24-grt73	Grt ₂ (af-IIm)	38.30	0.02	21.15	0.00	26.94	1.26	3.37	8.97	0.02	0.00	100.03	12	3.018	0.001	1.965	0.000	0.001	1.774	0.084	0.396	0.757	0.003	0.000	0.18	25	13	59	3
G25-grt01	Grt ₂ (c)	38.19	0.00	21.80	0.01	26.75	0.81	5.35	7.43	0.00	0.00	100.45	12	2.969	0.000	1.998	0.001	0.062	1.677	0.053	0.620	0.620	0.000	0.000	0.27	21	21	56	2
G25-grt02	Grt ₂ (c)	38.40	0.03	21.53	0.06	25.75	0.76	5.16	8.50	0.00	0.00	100.27	12	2.987	0.002	1.975	0.004	0.043	1.632	0.050	0.598	0.709	0.000	0.000	0.27	24	20	55	2
G25-grt03	Grt ₂ (c)	37.88	0.06	21.36	0.00	27.19	0.87	4.84	7.37	0.00	0.00	99.67	12	2.980	0.004	1.981	0.000	0.052	1.737	0.058	0.567	0.622	0.000	0.000	0.25	21	19	58	2
G25-grt04	Grt ₂ (c)	38.40	0.00	21.55	0.02	27.38	0.85	4.67	7.55	0.00	0.00	100.46	12	2.997	0.000	1.983	0.001	0.021	1.766	0.056	0.543	0.632	0.000	0.000	0.24	21	18	59	2
G25-grt05	Grt ₂ (c)	38.58	0.03	21.82	0.01	25.34	0.77	5.73	8.13	0.01	0.01	100.52	12	2.983	0.002	1.989	0.001	0.044	1.595	0.050	0.660	0.674	0.001	0.001	0.29	23	22	54	2
G25-grt06	Grt ₂ (c)	38.27	0.03	21.52	0.01	26.77	0.72	4.89	8.07	0.00	0.01	100.38	12	2.984	0.002	1.978	0.001	0.052	1.693	0.048	0.568	0.674	0.000	0.001	0.25	23	19	57	2
G25-grt07	Grt ₂ (c)	38.71	0.02	21.69	0.00	26.64	0.58	5.07	7.69	0.02	0.01	100.43	12	3.009	0.001	1.987	0.000	0.000	1.732	0.038	0.587	0.640	0.003	0.001	0.25	21	20	58	1
G25-grt08	Grt ₂ (c)	38.21	0.01	21.61	0.01	25.50	0.69	5.10	8.88	0.01	0.00	100.13	12	2.975	0.001	1.984	0.001	0.066	1.594	0.046	0.592	0.741	0.002	0.000	0.27	25	20	54	2
G25-grt09	Grt ₂ (c)	38.69	0.04	21.83	0.01	26.56	0.95	4.68	8.42	0.00	0.00	101.23	12	2.991	0.002	1.990	0.001	0.023	1.694	0.062	0.539	0.698	0.000	0.000	0.24	23	18	57	2
G25-grt10	Grt ₂ (c)	38.73	0.01	21.85	0.02	25.45	0.88	5.17	8.70	0.00	0.00	100.86	12	2.991	0.001	1.990	0.001	0.025	1.619	0.058	0.595	0.721	0.000	0.000	0.27	24	20	54	2
G25-grt11	Grt ₂ (c)	38.77	0	20.52	0.02	25.20	0.87	4.97	8.91	0.02	0.01	99.3	12	3.047	0	1.901	0.001	0.008	1.648	0.058	0.582	0.75	0.003	0.001	0.26	25	19	54	2
G25-grt12	Grt ₂ (c)	38.38	0.03	20.42	0.06	26.29	0.78	5.57	8.37	0.02	0	100.14	12	2.996	0.002	1.879	0.004	0.125	1.592	0.051	0.648	0.7	0.003	0	0.29	23	22	53	2
G25-grt13	Grt ₂ (c)	38.63	0	20.26	0	24.91	0.82	5.47	9.18	0	0.01	99.4	12	3.028	0	1.873	0	0.072	1.562	0.055	0.639	0.771	0	0.001	0.29	25	21	52	2
G25-grt14	Grt ₂ (c)	39.38	0.01	21.19	0.01	23.04	0.68	5.45	10	0	0	99.77	12	3.05	0.001	1.935	0.001	0	1.492	0.044	0.629	0.831	0	0	0.30	28	21	50	1
G25-grt15	Grt ₂ (c)	38.53	0.09	20.63	0	24.56	0.74	5.7	9.06	0.02	0	99.45	12	3.012	0.005	1.901	0	0.067	1.539	0.049	0.664	0.759	0.003	0	0.30	25	22	51	2
G25-grt16	Grt ₂ (c)	38.16	0.02	20.78	0	27.88	0.91	5.15	7.07	0.01	0	100.14	12	2.992	0.001	1.921	0	0.094	1.734	0.06	0.602	0.594	0.002	0	0.26	20	20	58	2
G25-grt17	Grt ₂ (c)	38.58	0.04	20.44	0.04	26.16	0.86	5.19	8.01	0.01	0.01	99.39	12	3.035	0.002	1.896	0.002	0.03	1.692	0.057	0.608	0.675	0.002	0.001	0.26	22	20	56	2
G25-grt18	Grt ₂ (c)	38.94	0.02	20.9	0.02	23.53	0.82	5.63	9.64	0.02	0.02	99.58	12	3.031	0.001	1.918	0.001	0.021	1.511	0.054	0.653	0.804	0.003	0.002	0.30	27	22	50	2
G25-grt19	Grt ₂ (c)	38.53	0.01	20.35	0	25.79	0.97	4.88	8.37	0.02	0.03	98.99	12	3.045	0.001	1.896	0	0.02	1.685	0.065	0.575	0.709	0.003	0.003	0.25	23	19	56	2
G25-grt20	Grt ₂ (c)	38.61	0	21.6	0	25.90	0.71	5.27	7.12	0.01	0.01	99.23	12	3.025	0	1.995	0	0	1.697	0.047	0.615	0.598	0.002	0.001	0.27	20	21	57	2

Continued the Table S1.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G25-grt21	Grt ₂ (c)	39	0.02	21.56	0	25.54	0.75	4.18	8.32	0	0	99.38	12	3.053	0.001	1.99	0	0	1.672	0.05	0.488	0.699	0	0	0.23	24	17	57	2
G25-grt22	Grt ₂ (c)	38.76	0.03	21.82	0	23.78	0.65	4.84	9.64	0	0	99.53	12	3.017	0.002	2.003	0	0	1.548	0.043	0.562	0.805	0	0	0.27	27	19	52	1
G25-grt23	Grt ₂ (c)	38.18	0.01	20.42	0.03	28.05	0.92	4.32	8.18	0.01	0	100.28	12	3.002	0.001	1.893	0.002	0.101	1.743	0.061	0.506	0.689	0.002	0	0.22	23	17	58	2
G25-grt24	Grt ₂ (c)	38.74	0.03	20.61	0	25.13	0.64	6.2	7.95	0	0	99.38	12	3.027	0.002	1.899	0	0.043	1.599	0.042	0.722	0.666	0	0	0.31	22	24	53	1
G25-grt25	Grt ₂ (c)	38.5	0.01	20.21	0.02	26.59	0.8	6.07	7.85	0	0	100.31	12	2.998	0.001	1.855	0.001	0.146	1.587	0.052	0.704	0.656	0	0	0.31	22	23	53	2
G25-grt26	Grt ₂ (n-Pl)	38.09	0.06	20.49	0.02	23.64	0.45	4.52	11.71	0.02	0	99.19	12	2.994	0.004	1.899	0.001	0.109	1.446	0.03	0.529	0.986	0.003	0	0.27	33	18	48	1
G25-grt27	Grt ₂ (n-Pl)	38.71	0	21.17	0.04	25.09	0.95	3.95	10	0	0.01	99.92	12	3.03	0	1.954	0.002	0	1.643	0.063	0.461	0.839	0	0.001	0.22	28	15	55	2
G25-grt28	Grt ₂ (n-Pl)	38.36	0.06	20.87	0.01	23.11	0.66	4.1	11.72	0.02	0	98.94	12	3.02	0.004	1.937	0.001	0.018	1.504	0.044	0.481	0.989	0.003	0	0.24	33	16	50	1
G25-grt29	Grt ₂ (n-Pl)	38.22	0.03	20.56	0.01	24.69	0.63	4.13	11.56	0.01	0	100.05	12	2.991	0.002	1.897	0.001	0.119	1.497	0.042	0.482	0.969	0.002	0	0.24	32	16	50	1
G25-grt30	Grt ₂ (n-Pl)	38.44	0	20.66	0.01	25.25	1.18	3.77	9.65	0.01	0.03	99	12	3.044	0	1.929	0.001	0	1.672	0.079	0.445	0.819	0.002	0.003	0.21	27	15	55	3
G25-grt31	Grt ₂ (n-Pl)	38.89	0.02	20.79	0.01	23.45	0.77	4.51	11.07	0	0	99.52	12	3.041	0.001	1.917	0.001	0	1.534	0.051	0.526	0.929	0	0	0.26	31	17	50	2
G25-grt32	Grt ₂ (n-Pl)	39.22	0.01	20.74	0.05	22.05	0.43	4.92	11.97	0.01	0	99.4	12	3.053	0.001	1.903	0.003	0	1.435	0.029	0.571	0.998	0.002	0	0.28	33	19	47	1
G25-grt33	Grt ₂ (n-Pl)	38.41	0	21.64	0	25.53	0.94	4.1	8.91	0.01	0	99.55	12	3.014	0	2.002	0	0	1.676	0.063	0.48	0.749	0.002	0	0.22	25	16	56	2
G25-grt34	Grt ₂ (n-Pl)	38.84	0.01	20.57	0	23.89	0.47	4.5	10.94	0.01	0.01	99.24	12	3.048	0.001	1.903	0	0.002	1.566	0.032	0.526	0.92	0.002	0.001	0.25	30	17	51	1
G25-grt35	Grt ₂ (n-Pl)	38.61	0	20.71	0.02	25.15	0.69	4.54	10.11	0.02	0	99.94	12	3.02	0	1.909	0.001	0.053	1.592	0.046	0.529	0.847	0.003	0	0.25	28	18	53	2
G25-grt36	Grt ₂ (n-Pl)	38.62	0.05	20.39	0	24.74	0.64	4.32	11.15	0	0	100.06	12	3.019	0.003	1.879	0	0.076	1.543	0.042	0.503	0.935	0	0	0.25	31	17	51	1
G25-grt37	Grt ₂ (n-Amp ₂)	38.77	0.03	21.14	0.02	26.39	0.96	4.67	7.98	0.01	0	99.97	12	3.033	0.002	1.95	0.001	0	1.727	0.064	0.544	0.669	0.002	0	0.24	22	18	57	2
G25-grt38	Grt ₂ (n-Amp ₂)	38.09	0.03	21.35	0.00	27.61	0.94	4.67	7.23	0.01	0.00	100.00	12	2.990	0.002	1.976	0.000	0.041	1.772	0.063	0.546	0.608	0.002	0.000	0.23	20	18	59	2
G25-grt39	Grt ₂ (n-Amp ₂)	38.04	0	21.55	0.01	26.76	1.35	3.29	8.45	0.02	0.01	99.48	12	3.009	0	2.01	0.001	0	1.77	0.09	0.388	0.716	0.003	0.001	0.18	24	13	60	3
G25-grt40	Grt ₂ (n-Amp ₂)	38.36	0.01	20.44	0.02	26.44	0.92	4.66	8.17	0.02	0	99.08	12	3.035	0.001	1.907	0.001	0.024	1.726	0.062	0.549	0.693	0.003	0	0.24	23	18	57	2
G25-grt41	Grt ₂ (n-Amp ₂)	38.3	0	21.49	0.03	26.81	1.05	4.13	7.33	0.01	0	99.15	12	3.024	0	2.001	0.002	0	1.771	0.07	0.486	0.62	0.002	0	0.22	21	16	60	2
G25-grt42	Grt ₂ (n-Amp ₂)	38.11	0.04	20.8	0.02	26.03	1.1	3.45	10.31	0	0.01	99.98	12	3.001	0.002	1.931	0.001	0.061	1.653	0.074	0.405	0.87	0	0.001	0.20	29	13	55	2
G25-grt43	Grt ₂ (n-Amp ₂)	38.56	0.01	20.25	0.03	28.11	1.18	4.11	7.54	0	0	99.82	12	3.049	0.001	1.887	0.002	0.012	1.847	0.079	0.484	0.639	0	0	0.21	21	16	61	3
G25-grt44	Grt ₂ (n-Amp ₂)	38.23	0.05	20.16	0.05	28.94	1.51	4.09	7.16	0.01	0	100.34	12	3.018	0.003	1.876	0.003	0.081	1.83	0.101	0.481	0.606	0.002	0	0.21	20	16	61	3
G25-grt45	Grt ₂ (n-Amp ₂)	37.85	0	20.27	0	27.48	1.23	3.45	9.33	0.03	0.02	99.86	12	2.998	0	1.893	0	0.117	1.703	0.083	0.407	0.792	0.005	0.002	0.19	27	14	57	3
G25-grt46	Grt ₂ (n-Amp ₂)	38.34	0.06	19.8	0.06	28.02	1.38	3.67	8.39	0.02	0.01	99.86	12	3.04	0.004	1.851	0.004	0.062	1.797	0.092	0.434	0.713	0.003	0.001	0.19	23	14	59	3
G25-grt47	Grt ₂ (n-Amp ₂)	38.75	0.07	20.14	0.05	26.23	1.08	3.31	9.84	0.02	0.01	99.5	12	3.067	0.004	1.879	0.003	0	1.736	0.072	0.39	0.834	0.003	0.001	0.18	28	13	57	2
G25-grt48	Grt ₂ (n-Amp ₂)	38.32	0.06	21.37	0.04	26.34	0.78	3.64	8.81	0.02	0	99.38	12	3.022	0.004	1.987	0.002	0	1.737	0.052	0.428	0.745	0.003	0	0.20	25	14	59	2
G25-grt49	Grt ₂ (n-Amp ₂)	38.68	0.05	20.26	0.03	25.67	0.94	4.04	10.05	0	0.01	99.78	12	3.043	0.003	1.879	0.002	0.029	1.66	0.063	0.474	0.847	0	0.001	0.22	28	16	55	2
G25-grt50	Grt ₂ (n-Amp ₂)	38.68	0.05	21.58	0	25.10	0.73	3.62	10.1	0.03	0.01	99.9	12	3.025	0.003	1.989	0	0	1.641	0.048	0.422	0.846	0.005	0.001	0.20	29	14	55	2
G25-grt51	Grt ₂ (n-Amp ₂)	38.07	0.02	20.45	0	28.29	0.82	4.7	7.62	0.03	0	100.21	12	2.992	0.001	1.895	0	0.122	1.738	0.055	0.551	0.642	0.005	0	0.24	22	18	58	2
G25-grt52	Grt ₂ (n-Amp ₂)	38.06	0	20.23	0.02	27.69	0.93	3.74	8.69	0.01	0	99.48	12	3.021	0	1.893	0.001	0.064	1.774	0.063	0.442	0.739	0.002	0	0.20	24	15	59	2

Continued the **Table S1**.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Total	Oxygen	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}	Grs	Prp	Alm	Sps
G25-grt53	Grt ₂ (n-Amp ₂)	38.34	0.01	20.25	0.11	28.34	0.91	4.81	7.2	0.02	0	100.14	12	3.016	0.001	1.878	0.007	0.086	1.779	0.061	0.564	0.607	0.003	0	0.24	20	19	59	2
G25-grt54	Grt ₂ (n-Amp ₂)	38.35	0.03	20.46	0	27.60	0.83	5.59	7.02	0	0.01	100.07	12	3.003	0.002	1.889	0	0.102	1.707	0.055	0.652	0.589	0	0.001	0.28	20	22	57	2
G25-grt55	Grt ₂ (n-Amp ₂)	38.13	0.05	20.18	0.03	27.68	0.98	4.3	8.39	0.02	0.03	99.97	12	3.007	0.003	1.876	0.002	0.107	1.718	0.065	0.505	0.709	0.003	0.003	0.23	24	17	57	2

Notes: X_{Mg} = Mg/(Mg+Fe²⁺).

Table S2. Major element compositions (wt%) of plagioclase in mafic granulites from the Haiyangsuo complex.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	An	Ab	Or
G28-Pl01	Pl ₁ (c)	54.42	0	27.91	0.03	0.26	0.01	0.02	11.07	5.14	0.11	99	8	2.481	0	1.5	0.001	0.01	0	0.001	0.001	0.541	0.454	0.006	54	45	1
G28-Pl02	Pl ₁ (c)	56	0.03	27.32	0.03	0.07	0	0	10.12	5.49	0.1	99.16	8	2.535	0.001	1.458	0.001	0.003	0	0	0	0.491	0.482	0.005	50	49	1
G28-Pl03	Pl ₁ (c)	53	0.01	29.41	0.04	0.38	0	0	12.41	4.37	0.06	99.73	8	2.407	0	1.575	0.002	0.014	0	0	0	0.604	0.385	0.003	61	39	0
G28-Pl04	Pl ₁ (c)	55.08	0.01	27.73	0.02	0.13	0.05	0.01	10.87	5.32	0.07	99.28	8	2.5	0	1.484	0.001	0.005	0	0.002	0.001	0.528	0.468	0.004	53	47	0
G28-Pl05	Pl ₁ (c)	55.53	0.01	27.7	0.01	0.14	0.01	0.01	10.63	5.36	0.05	99.45	8	2.512	0	1.477	0	0.005	0	0	0.001	0.515	0.47	0.003	52	48	0
G28-Pl06	Pl ₁ (c)	55.37	0.03	27.54	0.02	0.08	0.06	0	10.53	5.5	0.1	99.24	8	2.512	0.001	1.473	0.001	0.003	0	0.002	0	0.512	0.484	0.006	51	48	1
G28-Pl07	Pl ₁ (c)	55.43	0.04	27.35	0	0.02	0	0	10.53	5.42	0.05	98.84	8	2.521	0.001	1.466	0	0.001	0	0	0	0.513	0.478	0.003	52	48	0
G28-Pl08	Pl ₁ (c)	55.37	0	27.07	0.06	0.02	0.02	0.02	10.64	5.27	0.09	98.55	8	2.527	0	1.457	0.002	0.001	0	0.001	0.002	0.52	0.466	0.005	52	47	1
G28-Pl09	Pl ₁ (c)	56.54	0.03	26.49	0.03	0.04	0	0	9.85	5.87	0.07	98.93	8	2.565	0.001	1.417	0.001	0.002	0	0	0	0.479	0.517	0.004	48	52	0
G28-Pl10	Pl ₁ (c)	54.64	0.02	27.89	0.03	0.03	0	0.01	11.36	5.15	0.04	99.16	8	2.485	0.001	1.496	0.001	0.001	0	0	0	0.553	0.454	0.002	55	45	0
G28-Pl11	Pl ₁ (c)	54.98	0.1	28.22	0	0.03	0	0	11.31	4.99	0.07	99.7	8	2.484	0.004	1.503	0	0.001	0	0	0	0.547	0.437	0.004	55	44	0
G28-Pl12	Pl ₁ (c)	54.8	0.01	28.35	0	0.03	0.01	0.02	11.15	5.23	0.06	99.65	8	2.479	0	1.512	0	0.001	0	0	0.001	0.54	0.459	0.003	54	46	0
G28-Pl13	Pl ₁ (c)	54.75	0.03	27.79	0	0.06	0	0	11.22	5.14	0.07	99.06	8	2.491	0.001	1.491	0	0.002	0	0	0	0.547	0.453	0.004	54	45	0
G28-Pl14	Pl ₁ (c)	54.34	0	28.48	0	0.09	0	0	11.62	5.01	0.03	99.57	8	2.463	0	1.522	0	0.004	0	0	0	0.564	0.44	0.002	56	44	0
G28-Pl15	Pl ₁ (c)	55.13	0	28.06	0.04	0.10	0	0	10.85	5.08	0.04	99.31	8	2.497	0	1.498	0.002	0.004	0	0	0	0.527	0.446	0.003	54	46	0
G28-Pl16	Pl ₁ (c)	55.35	0	28.39	0.03	0.04	0.01	0.02	11.03	5.19	0.05	100.12	8	2.489	0	1.505	0.001	0.002	0	0.001	0.001	0.531	0.452	0.003	54	46	0
G28-Pl17	Pl ₁ (c)	54.92	0	28.42	0	0.05	0.02	0	11.22	5.25	0.07	99.95	8	2.478	0	1.511	0	0.002	0	0.001	0	0.542	0.459	0.004	54	46	0
G28-Pl18	Pl ₁ (c)	56.14	0	27.42	0.02	0.13	0	0	10.25	5.76	0.06	99.79	8	2.529	0	1.457	0.001	0.005	0	0	0	0.495	0.503	0.003	49	50	0
G28-Pl19	Pl ₁ (c)	55.8	0	27.76	0.02	0.05	0.06	0.03	10.69	5.57	0.04	100.01	8	2.511	0	1.473	0.001	0.002	0	0.002	0.002	0.515	0.486	0.002	51	48	0
G28-Pl20	Pl ₁ (c)	55.9	0.01	27.71	0	0.02	0	0.01	10.72	5.32	0.06	99.73	8	2.519	0	1.472	0	0.001	0	0	0.001	0.517	0.465	0.003	52	47	0
G28-Pl21	Pl ₁ (r)	56.75	0	26.53	0	0.01	0	0.02	9.4	5.84	0.12	98.67	8	2.576	0	1.419	0	0	0	0	0.001	0.457	0.514	0.007	47	53	1
G28-Pl22	Pl ₁ (r)	57.19	0	26.5	0	0.05	0	0	9.24	6.23	0.13	99.34	8	2.58	0	1.409	0	0.002	0	0	0	0.447	0.545	0.007	45	55	1
G28-Pl23	Pl ₁ (r)	60.28	0.04	24.17	0	0.48	0.04	0.02	6.69	7.58	0.07	99.42	8	2.7	0.001	1.277	0	0.018	0	0.002	0.001	0.321	0.658	0.004	33	67	0
G28-Pl24	Pl ₁ (r)	57.12	0.01	26.34	0.02	0.02	0.01	0	9.43	6.23	0.05	99.23	8	2.581	0	1.403	0.001	0.001	0	0	0	0.457	0.546	0.003	45	54	0
G28-Pl25	Pl ₁ (r)	58.98	0	24.43	0	0.20	0.03	0.02	7.41	7.13	0.09	98.31	8	2.675	0	1.306	0	0.007	0	0.001	0.001	0.36	0.627	0.005	36	63	1
G28-Pl26	Pl ₂ (I-Grt ₂)	62.04	0.03	22.87	0	0.46	0.02	0.01	5.37	8.8	0.06	99.71	8	2.765	0.001	1.202	0	0.017	0	0.001	0.001	0.256	0.761	0.003	25	75	0
G28-Pl27	Pl ₂ (I-Grt ₂)	60.88	0	24.58	0.02	0.30	0.01	0.01	6.69	7.84	0.03	100.39	8	2.699	0	1.285	0.001	0.011	0	0	0.001	0.318	0.674	0.002	32	68	0
G28-Pl28	Pl ₂ (I-Grt ₂)	61.71	0.02	22.98	0.01	0.28	0	0	5.83	8.65	0.06	99.58	8	2.756	0.001	1.21	0	0.01	0	0	0	0.279	0.749	0.004	27	73	0
G28-Pl29	Pl ₂ (I-Grt ₂)	62.47	0.02	22.84	0.02	0.45	0.02	0.03	4.96	8.84	0.07	99.76	8	2.777	0.001	1.197	0.001	0.017	0	0.001	0.002	0.236	0.762	0.004	24	76	0
G28-Pl30	Pl ₂ (n-Grt ₂)	61.7	0.02	23.45	0.01	0.41	0.02	0.04	5.69	8.25	0.06	99.69	8	2.748	0.001	1.231	0	0.015	0	0.001	0.003	0.272	0.712	0.003	28	72	0

Continued the Table S2.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	An	Ab	Or	
G28-Pl31	Pl ₂ (n-Grt ₂)	60.82	0.01	23.47	0.03	0.48	0.03	0.05	5.93	8.04	0.05	98.97	8	2.732	0	1.243	0.001	0.018	0	0.001	0.003	0.286	0.7	0.003	29	71	0	
G28-Pl32	Pl ₂ (n-Grt ₂)	63.64	0.03	22.48	0	0.31	0	0.06	4.56	8.9	0.06	100.07	8	2.811	0.001	1.171	0	0.012	0	0	0.004	0.216	0.762	0.003	22	78	0	
G28-Pl33	Pl ₂ (n-Grt ₂)	61.89	0	22.58	0.01	0.94	0.03	0.16	5.21	8.6	0.08	99.62	8	2.764	0	1.189	0	0.035	0	0.001	0.011	0.249	0.744	0.005	25	75	1	
G28-Pl34	Pl ₂ (n-Grt ₂)	61.64	0	23.07	0.01	0.32	0.05	0.01	5.85	7.97	0.05	99.01	8	2.761	0	1.219	0	0.012	0	0.002	0.001	0.281	0.692	0.003	29	71	0	
G28-Pl35	Pl ₂ (n-Grt ₂)	60.82	0	24.2	0	0.18	0	0.03	6.47	7.86	0.08	99.68	8	2.713	0	1.273	0	0.007	0	0	0.002	0.309	0.68	0.004	31	68	0	
G28-Pl36	Pl ₂ (n-Grt ₂)	59.51	0	25.25	0.03	0.30	0	0.01	7.29	7.63	0.07	100.11	8	2.655	0	1.328	0.001	0.011	0	0	0	0.349	0.66	0.004	34	65	0	
G28-Pl37	Pl ₂ (n-Grt ₂)	62.32	0.02	23.48	0.05	0.31	0.01	0.03	5.8	8.34	0.11	100.51	8	2.754	0.001	1.223	0.002	0.011	0	0	0.002	0.275	0.714	0.006	28	72	1	
G28-Pl38	Pl ₂ (n-Grt ₂)	59.2	0.02	25.56	0.01	0.06	0	0.04	8.15	6.95	0.06	100.05	8	2.642	0.001	1.345	0	0.002	0	0	0.003	0.39	0.602	0.003	39	61	0	
G28-Pl39	Pl ₂ (n-Grt ₂)	61.78	0	24.26	0.01	0.26	0.03	0.01	6.09	8.04	0.07	100.59	8	2.727	0	1.263	0	0.01	0	0.001	0.001	0.288	0.688	0.004	29	70	0	
G28-Pl40	Pl ₂ (sym)	61.25	0	24.03	0.04	0.58	0	0.09	6.26	8.03	0.08	100.43	8	2.715	0	1.256	0.001	0.022	0	0	0.006	0.297	0.69	0.005	30	70	1	
G28-Pl41	Pl ₂ (sym)	57.52	0	26.31	0	0.40	0	0	8.48	6.55	0.04	99.36	8	2.592	0	1.398	0	0.015	0	0	0	0.41	0.572	0.003	42	58	0	
G28-Pl42	Pl ₂ (sym)	59.13	0.03	25.25	0.01	0.40	0	0.01	7.45	7.17	0.04	99.53	8	2.651	0.001	1.334	0	0.015	0	0	0	0.358	0.623	0.002	36	63	0	
G28-Pl43	Pl ₂ (sym)	59.11	0	25.44	0	0.14	0	0	7.72	6.93	0.04	99.4	8	2.651	0	1.345	0	0.005	0	0	0	0.371	0.603	0.002	38	62	0	
G28-Pl44	Pl ₂ (sym)	56.42	0	26.52	0.02	0.13	0.01	0	9.56	5.94	0.09	98.71	8	2.565	0	1.421	0.001	0.005	0	0	0	0.466	0.523	0.005	47	53	1	
G28-Pl45	Pl ₂ (sym)	56.41	0.04	26.95	0.01	0.01	0.06	0.01	9.85	5.9	0.08	99.32	8	2.55	0.001	1.436	0	0	0	0.002	0	0.477	0.518	0.004	48	52	0	
G28-Pl46	Pl ₂ (sym)	61.42	0.02	23.89	0	0.29	0.03	0.05	6.5	8.15	0.04	100.4	8	2.723	0.001	1.249	0	0.011	0	0.001	0.003	0.309	0.7	0.002	31	69	0	
G24-Pl01	Pl ₁ (c)	51.63	0.04	30.52	0	0.1	0	0	13.29	3.64	0.03	99.25	8	2.358	0.001	1.643	0	0.003	0	0	0	0.65	0.322	0.002	67	33	0	
G24-Pl02	Pl ₁ (c)	50.43	0	30.87	0.01	0.1	0	0	13.98	3.24	0.02	98.65	8	2.323	0	1.676	0	0.003	0	0	0	0.69	0.289	0.001	70	29	0	
G24-Pl03	Pl ₁ (c)	53.19	0	30.06	0	0.09	0.02	0.01	12.41	4.05	0.05	99.88	8	2.405	0	1.602	0	0.003	0	0.001	0.001	0.601	0.355	0.003	63	37	0	
G24-Pl04	Pl ₁ (c)	51.4	0	30.81	0.04	0.23	0.01	0	13.76	3.37	0.01	99.63	8	2.341	0	1.655	0.001	0.008	0	0	0	0	0.672	0.298	0.001	69	31	0
G24-Pl05	Pl ₁ (c)	54.22	0.07	29.01	0	0.02	0.01	0.03	11.37	4.73	0.05	99.51	8	2.454	0.002	1.548	0	0.001	0	0	0.002	0.552	0.415	0.003	57	43	0	
G24-Pl06	Pl ₁ (c)	53.17	0.03	29.57	0	0	0	0.01	11.96	4.35	0.06	99.15	8	2.42	0.001	1.587	0	0	0	0	0.001	0.583	0.384	0.003	60	40	0	
G24-Pl07	Pl ₁ (c)	52.49	0.1	30.27	0.04	0	0.02	0.01	12.93	3.97	0.03	99.86	8	2.38	0.003	1.618	0.001	0	0	0.001	0.001	0.628	0.349	0.002	64	36	0	
G24-Pl08	Pl ₁ (c)	53.81	0	29.59	0	0	0	0	12.3	4.32	0.03	100.05	8	2.428	0	1.574	0	0	0	0	0	0.595	0.378	0.002	61	39	0	
G24-Pl09	Pl ₁ (c)	52.87	0.08	29.94	0	0.11	0	0	12.55	4.11	0.03	99.69	8	2.398	0.003	1.601	0	0.004	0	0	0	0	0.61	0.361	0.002	63	37	0
G24-Pl10	Pl ₁ (c)	51.68	0	30.7	0	0.04	0	0	13.18	3.75	0.02	99.37	8	2.356	0	1.65	0	0.002	0	0	0	0	0.644	0.332	0.001	66	34	0
G24-Pl11	Pl ₁ (c)	51.81	0	30.58	0	0.06	0	0.01	13.13	3.59	0.02	99.2	8	2.364	0	1.645	0	0.002	0	0	0.001	0.642	0.318	0.001	67	33	0	
G24-Pl12	Pl ₁ (c)	50.99	0	30.72	0.03	0.01	0	0	13.66	3.45	0.04	98.9	8	2.34	0	1.662	0.001	0	0	0	0	0	0.672	0.307	0.002	69	31	0
G24-Pl13	Pl ₁ (c)	53.97	0	28.81	0.01	0.04	0	0	11.55	4.65	0.05	99.08	8	2.455	0	1.545	0	0.002	0	0	0	0	0.563	0.41	0.003	58	42	0
G24-Pl14	Pl ₁ (c)	54.71	0.08	28.99	0	0.04	0	0	11.37	4.91	0.04	100.14	8	2.461	0.003	1.538	0	0.002	0	0	0	0	0.548	0.428	0.002	56	44	0
G24-Pl15	Pl ₁ (c)	50.32	0.06	31.28	0	0.13	0.01	0	13.83	3.49	0.03	99.15	8	2.308	0.002	1.691	0	0.005	0	0	0	0	0.68	0.31	0.002	69	31	0
G24-Pl16	Pl ₁ (r)	53.34	0	29.35	0.04	0.12	0.01	0.01	12.16	4.45	0.06	99.54	8	2.422	0	1.571	0.001	0.004	0	0	0.001	0.592	0.392	0.003	60	40	0	

Continued the Table S2.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	An	Ab	Or
G24-Pl17	Pl ₁ (r)	52.79	0	29.46	0	0.04	0.01	0.03	12.25	4.27	0.05	98.9	8	2.412	0	1.587	0	0.002	0	0	0.002	0.6	0.378	0.003	61	39	0
G24-Pl18	Pl ₁ (r)	53.46	0.03	29.33	0	0.26	0.01	0	12.1	4.43	0.05	99.67	8	2.424	0.001	1.568	0	0.009	0	0	0	0.588	0.39	0.003	60	40	0
G24-Pl19	Pl ₁ (r)	53.41	0.01	29.38	0.01	0.19	0	0.01	11.91	4.42	0.05	99.39	8	2.426	0	1.573	0	0.006	0	0	0.001	0.58	0.389	0.003	60	40	0
G24-Pl20	Pl ₁ (r)	53.6	0	29.07	0	0.06	0.01	0	11.61	4.38	0.02	98.75	8	2.445	0	1.563	0	0.002	0	0	0	0.567	0.387	0.001	59	41	0
G24-Pl21	Pl ₁ (r)	53.47	0	28.93	0	0.18	0	0	11.63	4.75	0.03	98.99	8	2.439	0	1.556	0	0.006	0	0	0	0.568	0.42	0.002	57	42	0
G24-Pl22	Pl ₁ (r)	53.54	0	29.03	0.01	0.04	0.02	0.03	11.59	4.52	0.06	98.84	8	2.442	0	1.561	0	0.002	0	0.001	0.002	0.566	0.4	0.003	58	41	0
G24-Pl23	Pl ₁ (r)	53.13	0	29.69	0.03	0.12	0	0.02	12.3	4.35	0.04	99.68	8	2.41	0	1.588	0.001	0.004	0	0	0.001	0.598	0.383	0.002	61	39	0
G24-Pl24	Pl ₁ (r)	52.66	0	29.96	0.01	0.28	0	0	12.48	3.99	0.03	99.41	8	2.395	0	1.607	0	0.01	0	0	0	0.608	0.352	0.002	63	37	0
G24-Pl25	Pl ₁ (r)	52.52	0.16	29.9	0	0.1	0.01	0	12.48	4.19	0.04	99.4	8	2.391	0.005	1.605	0	0.003	0	0	0	0.609	0.37	0.002	62	38	0
G24-Pl26	Pl ₁ (r)	53.2	0	29.65	0	0.13	0	0	12.1	4.24	0.02	99.34	8	2.417	0	1.588	0	0.005	0	0	0	0.589	0.374	0.001	61	39	0
G24-Pl27	Pl ₁ (r)	53.11	0.04	30.06	0	0.03	0.01	0	12.41	4.14	0.04	99.84	8	2.403	0.001	1.603	0	0.001	0	0	0	0.602	0.363	0.002	62	38	0
G24-Pl28	Pl ₁ (r)	52.9	0.03	30.01	0	0.17	0	0	12.6	4.07	0.07	99.85	8	2.396	0.001	1.603	0	0.006	0	0	0	0.612	0.358	0.004	63	37	0
G24-Pl29	Pl ₁ (r)	52.41	0	29.69	0.03	0.89	0.03	0.01	12.52	3.96	0.01	99.55	8	2.387	0	1.594	0.001	0.03	0	0.001	0.001	0.611	0.35	0.001	64	36	0
G24-Pl30	Pl ₁ (r)	53.01	0.11	30.42	0.01	0.66	0	0	12.59	4.11	0.02	100.93	8	2.38	0.004	1.61	0	0.022	0	0	0	0.606	0.358	0.001	63	37	0
G24-Pl31	Pl ₁ (r)	53.36	0.06	29.7	0	0.5	0	0	12.06	4.28	0.01	99.97	8	2.412	0.002	1.583	0	0.017	0	0	0	0.584	0.375	0.001	61	39	0
G24-Pl32	Pl ₁ (r)	53.68	0	29.04	0	0.29	0	0.04	11.53	4.63	0.05	99.26	8	2.44	0	1.556	0	0.01	0	0	0.003	0.562	0.408	0.003	58	42	0
G24-Pl33	Pl ₂ (sym)	50.68	0.04	31.43	0.02	0.16	0.04	0.01	14.14	3.31	0.04	99.87	8	2.308	0.001	1.688	0.001	0.005	0	0.002	0.001	0.69	0.292	0.002	70	30	0
G24-Pl34	Pl ₂ (sym)	52.91	0.11	29.74	0.02	0.42	0.01	0.01	12.2	4.13	0.06	99.61	8	2.402	0.004	1.592	0.001	0.014	0	0	0.001	0.593	0.364	0.003	62	38	0
G24-Pl35	Pl ₂ (sym)	51.37	0	31.03	0.02	0.36	0	0.03	13.76	3.52	0.02	100.11	8	2.332	0	1.66	0.001	0.012	0	0	0.002	0.669	0.31	0.001	68	32	0
G24-Pl36	Pl ₂ (sym)	49.02	0	32.08	0.01	0.76	0.03	0.01	15.27	2.69	0	99.87	8	2.245	0	1.732	0	0.026	0	0.001	0.001	0.749	0.239	0	76	24	0
G24-Pl37	Pl ₂ (sym)	54.87	0.01	27.9	0	0.48	0.03	0.01	10.7	5.28	0.04	99.32	8	2.49	0	1.493	0	0.016	0	0.001	0.001	0.52	0.465	0.002	53	47	0
G24-Pl38	Pl ₂ (n-Grt ₂)	58.31	0	25.51	0	0.8	0	0.02	7.55	6.54	0.03	98.76	8	2.634	0	1.358	0	0.027	0	0	0.001	0.365	0.573	0.002	39	61	0
G24-Pl39	Pl ₂ (n-Grt ₂)	59.37	0.03	25.84	0.03	0.29	0	0.02	7.41	7	0.06	100.05	8	2.644	0.001	1.357	0.001	0.01	0	0	0.001	0.354	0.604	0.003	37	63	0
G24-Pl40	Pl ₂ (n-Grt ₂)	56.96	0	26.91	0	0.19	0.01	0.03	9.15	5.95	0.04	99.24	8	2.569	0	1.431	0	0.006	0	0	0.002	0.442	0.52	0.002	46	54	0
G24-Pl41	Pl ₂ (n-Grt ₂)	56.91	0.01	27.3	0.01	0.4	0	0	9.23	5.93	0.06	99.85	8	2.554	0	1.444	0	0.014	0	0	0	0.444	0.516	0.003	46	54	0
G24-Pl42	Pl ₂ (n-Grt ₂)	55.34	0.03	27.56	0	0.08	0.02	0.04	9.86	5.34	0.1	98.37	8	2.524	0.001	1.482	0	0.003	0	0.001	0.003	0.482	0.472	0.006	50	49	1
G24-Pl43	Pl ₂ (n-Grt ₂)	57.54	0	26.29	0	0.42	0	0.03	8.49	6.02	0.07	98.86	8	2.6	0	1.4	0	0.014	0	0	0.002	0.411	0.527	0.004	44	56	0
G24-Pl44	Pl ₂ (n-Grt ₂)	58.42	0.14	26.58	0.03	0.34	0.02	0.01	8.08	6.5	0.08	100.2	8	2.603	0.005	1.396	0.001	0.012	0	0.001	0.001	0.386	0.562	0.005	41	59	1
G24-Pl45	Pl ₂ (n-Grt ₂)	56.26	0.03	27.04	0.02	0.33	0.03	0.03	9.4	5.66	0.07	98.87	8	2.551	0.001	1.445	0.001	0.011	0	0.001	0.002	0.457	0.498	0.004	48	52	0
G24-Pl46	Pl ₂ (n-Grt ₂)	56.83	0	27.28	0	0.26	0	0	9.41	5.68	0.08	99.54	8	2.557	0	1.447	0	0.009	0	0	0	0.454	0.495	0.005	48	52	1
G24-Pl47	Pl ₂ (n-Grt ₂)	56.59	0	27.42	0.04	0.1	0.01	0	9.96	5.6	0.07	99.79	8	2.544	0	1.453	0.001	0.003	0	0	0	0.48	0.488	0.004	49	50	0
G24-Pl48	Pl ₂ (n-Grt ₂)	55.61	0.01	27.71	0.03	0.16	0	0.01	9.96	5.32	0.06	98.87	8	2.523	0	1.482	0.001	0.005	0	0	0.001	0.484	0.468	0.003	51	49	0

Continued the Table S2.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	An	Ab	Or	
G24-Pl49	Pl ₂ (n-Grt ₂)	57.06	0.01	27.01	0	0.1	0.02	0	9.05	5.75	0.08	99.08	8	2.574	0	1.436	0	0.003	0	0.001	0	0.437	0.503	0.005	46	53	1	
G24-Pl50	Pl ₂ (n-Grt ₂)	58.49	0	26.29	0.02	0.63	0.05	0.05	7.92	6.57	0.05	100.07	8	2.611	0	1.384	0.001	0.021	0	0.002	0.003	0.379	0.569	0.003	40	60	0	
G25-Pl01	Pl ₁ (c-r)	54.16	0.1	28.42	0.02	0.19	0.05	0	10.76	5.01	0.08	98.79	8	2.47	0.003	1.528	0.001	0.006	0	0.002	0	0.526	0.443	0.005	54	45	1	
G25-Pl02	Pl ₁ (c-r)	53.88	0.02	28.49	0	0.27	0	0.01	11.68	4.68	0.04	99.07	8	2.455	0.001	1.53	0	0.009	0	0	0.001	0.57	0.414	0.002	58	42		
G25-Pl03	Pl ₁ (c-r)	57.97	0	25.55	0	0.48	0	0.02	9.48	5.89	0.17	99.56	8	2.61	0	1.356	0	0.016	0	0	0.001	0.457	0.514	0.01	47	52		
G25-Pl04	Pl ₁ (c-r)	55.19	0	27.79	0.01	0.26	0	0	10.71	5.01	0.08	99.05	8	2.506	0	1.487	0	0.009	0	0	0	0.521	0.441	0.005	54	46		
G25-Pl05	Pl ₂ (c)	62.54	0	23.09	0.02	0.03	0	0	4.38	8.3	0.15	98.51	8	2.798	0	1.218	0.001	0.001	0	0	0	0.21	0.72	0.009	22	77	1	
G25-Pl06	Pl ₂ (c)	61.26	0.04	23.5	0	0	0.03	0.02	5.33	7.89	0.13	98.2	8	2.759	0.001	1.248	0	0	0	0.001	0.001	0.257	0.689	0.007	27	72	1	
G25-Pl07	Pl ₂ (c)	62.57	0.07	22.64	0	0.12	0.01	0.01	4.29	8.48	0.15	98.34	8	2.807	0.002	1.197	0	0.004	0	0	0.001	0.206	0.738	0.009	22	77	1	
G25-Pl08	Pl ₂ (c)	63.15	0	22.77	0	0.12	0	0.01	4.22	8.5	0.17	98.94	8	2.813	0	1.196	0	0.004	0	0	0.001	0.201	0.734	0.01	21	78	1	
G25-Pl09	Pl ₂ (c)	63.17	0.13	22.46	0.02	0.03	0	0.01	4	8.68	0.17	98.67	8	2.821	0.004	1.182	0.001	0.001	0	0	0.001	0.191	0.752	0.01	20	79	1	
G25-Pl10	Pl ₂ (c)	63.3	0	22.53	0.02	0.13	0	0	3.94	8.72	0.16	98.8	8	2.823	0	1.184	0.001	0.004	0	0	0	0.188	0.754	0.009	20	79	1	
G25-Pl11	Pl ₂ (c)	62.43	0	23.15	0	0.01	0.03	0.01	5.35	8.57	0.15	99.7	8	2.775	0	1.213	0	0	0	0.001	0.001	0.255	0.739	0.009	25	74		
G25-Pl12	Pl ₂ (c)	63.22	0	22.67	0	0.04	0	0	4.75	8.74	0.15	99.57	8	2.806	0	1.186	0	0.001	0	0	0	0.226	0.752	0.009	23	76		
G25-Pl13	Pl ₂ (c)	63.48	0	23.23	0	0.07	0	0.01	4.44	8.58	0.12	99.93	8	2.801	0	1.209	0	0.002	0	0	0.001	0.21	0.734	0.007	22	77		
G25-Pl14	Pl ₂ (c)	63.96	0	22.2	0	0	0.01	0	4.38	9.15	0.14	99.84	8	2.829	0	1.158	0	0	0	0	0	0.208	0.785	0.008	21	78		
G25-Pl15	Pl ₂ (c)	63.68	0	22.01	0.02	0.16	0.01	0	4.57	8.49	0.14	99.08	8	2.835	0	1.155	0.001	0.005	0	0	0	0.218	0.733	0.008	23	76		
G25-Pl16	Pl ₂ (c)	64.71	0	21.31	0	0.09	0.02	0	3.78	9.22	0.15	99.28	8	2.871	0	1.115	0	0.003	0	0.001	0	0.18	0.793	0.008	18	81		
G25-Pl17	Pl ₂ (c)	62.4	0.01	23.33	0	0.02	0	0.01	4.76	8.39	0.13	99.05	8	2.782	0	1.226	0	0.001	0	0	0.001	0.227	0.725	0.007	24	76		
G25-Pl18	Pl ₂ (r)	59.38	0	25.29	0	0.02	0	0	7.08	7.17	0.1	99.04	8	2.667	0	1.339	0	0.001	0	0	0	0	0.341	0.624	0.006	35	64	1
G25-Pl19	Pl ₂ (r)	59.4	0.08	25.13	0	0.21	0.02	0.01	6.91	6.98	0.14	98.88	8	2.671	0.003	1.332	0	0.007	0	0.001	0.001	0.333	0.609	0.008	35	64	1	
G25-Pl20	Pl ₂ (r)	58.69	0.01	25.43	0.02	0.1	0	0	7.49	6.68	0.08	98.5	8	2.652	0	1.355	0.001	0.003	0	0	0	0	0.363	0.585	0.005	38	61	1
G25-Pl21	Pl ₂ (r)	58.28	0	25.56	0	0.07	0	0.01	7.48	6.59	0.12	98.11	8	2.644	0	1.367	0	0.002	0	0	0.001	0.364	0.58	0.007	38	61	1	
G25-Pl22	Pl ₂ (r)	59.47	0.02	25.18	0	0.09	0.01	0	7.68	7.14	0.08	99.67	8	2.661	0.001	1.328	0	0.003	0	0	0	0	0.368	0.619	0.005	37	62	
G25-Pl23	Pl ₂ (r)	58.21	0	25.93	0	0.01	0	0	8.85	6.77	0.08	99.85	8	2.611	0	1.371	0	0	0	0	0	0.425	0.589	0.005	42	58		
G25-Pl24	Pl ₂ (r)	59.72	0.04	25.84	0.03	0	0.02	0	7.09	6.79	0.1	99.63	8	2.662	0.001	1.358	0.001	0	0	0.001	0	0.339	0.587	0.006	36	63		
G25-Pl25	Pl ₂ (r)	59.49	0	25.35	0	0.09	0	0.01	8.01	6.99	0.06	100	8	2.654	0	1.333	0	0.003	0	0	0.001	0.383	0.605	0.003	39	61		
G25-Pl26	Pl ₂ (r)	59.32	0	25.57	0.02	0.03	0	0	7.82	6.98	0.12	99.86	8	2.649	0	1.346	0.001	0.001	0	0	0	0	0.374	0.604	0.007	38	61	
G25-Pl27	Pl ₂ (r)	59.25	0	26.17	0	0.14	0.02	0.01	7.9	6.75	0.1	100.35	8	2.633	0	1.371	0	0.005	0	0.001	0.001	0.376	0.582	0.006	39	60		
G25-Pl28	Pl ₂ (r)	57.57	0	27.12	0	0.03	0	0.01	9.19	5.85	0.13	99.9	8	2.577	0	1.431	0	0.001	0	0	0.001	0.441	0.508	0.007	46	53		
G25-Pl29	Pl ₂ (r)	56.87	0	27.32	0.01	0.03	0.03	0	9.03	6.07	0.12	99.48	8	2.559	0	1.45	0	0.001	0	0.001	0	0.435	0.53	0.007	45	55		
G25-Pl30	Pl ₂ (n-Grt ₂)	60.86	0	24.17	0	0.52	0	0.01	6.27	7.79	0.03	99.65	8	2.715	0	1.271	0	0.018	0	0	0.001	0.3	0.674	0.002	31	69		

Continued the Table S2.

Sample	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	An	Ab	Or
G25-Pl31	Pl ₂ (n-Grt ₂)	59.05	0	25.45	0	0.34	0	0	7.87	6.97	0.07	99.75	8	2.643	0	1.343	0	0.012	0	0	0	0.377	0.605	0.004	38	61	
G25-Pl32	Pl ₂ (n-Grt ₂)	61.18	0.02	23.93	0.03	0.31	0.03	0	6.23	7.96	0.11	99.8	8	2.725	0.001	1.257	0.001	0.01	0	0.001	0	0.297	0.688	0.006	30	69	
G25-Pl33	Pl ₂ (n-Grt ₂)	61.32	0	24.25	0.01	0.17	0	0.01	6.46	7.93	0.14	100.29	8	2.719	0	1.268	0	0.006	0	0	0.001	0.307	0.682	0.008	31	68	
G25-Pl34	Pl ₂ (n-Grt ₂)	58.95	0	25.9	0.02	0.27	0.02	0	7.55	6.87	0.11	99.69	8	2.637	0	1.366	0.001	0.009	0	0.001	0	0.362	0.596	0.006	38	62	
G25-Pl35	Pl ₂ (n-Grt ₂)	58.42	0	26.23	0.01	0.33	0	0	7.78	6.81	0.12	99.7	8	2.616	0	1.385	0	0.011	0	0	0	0.373	0.591	0.007	38	61	
G25-Pl36	Pl ₂ (n-Grt ₂)	57.78	0	26.26	0	0.39	0	0	8.16	6.54	0.1	99.23	8	2.603	0	1.395	0	0.013	0	0	0	0.394	0.571	0.006	41	59	
G25-Pl37	Pl ₂ (n-Grt ₂)	61.57	0	23.1	0.01	0.41	0.02	0	6.39	7.44	0.09	99.03	8	2.758	0	1.22	0	0.014	0	0.001	0	0.307	0.646	0.005	32	67	
G25-Pl38	Pl ₂ (n-Grt ₂)	62.13	0.08	23.51	0.01	0.48	0.01	0	5.35	8.57	0.16	100.29	8	2.751	0.003	1.227	0	0.016	0	0	0	0.254	0.736	0.009	25	74	
G25-Pl39	Pl ₂ (n-Grt ₂)	61.67	0.02	23.61	0	0.56	0.04	0	5.1	8.32	0.12	99.43	8	2.75	0.001	1.241	0	0.019	0	0.001	0	0.244	0.719	0.007	25	74	
G25-Pl40	Pl ₂ (n-Grt ₂)	63.08	0	22.16	0.05	0.28	0	0.01	4.48	8.93	0.15	99.14	8	2.815	0	1.166	0.002	0.009	0	0	0.001	0.214	0.773	0.009	21	78	
G25-Pl41	Pl ₂ (n-Grt ₂)	60.19	0	24.92	0.03	0.39	0	0	6.8	7.51	0.1	99.94	8	2.682	0	1.309	0.001	0.013	0	0	0	0.325	0.649	0.006	33	66	
G25-Pl42	Pl ₂ (n-Grt ₂)	62.22	0.04	23.74	0	0.51	0.01	0.01	5.22	8.15	0.14	100.04	8	2.755	0.001	1.239	0	0.017	0	0	0.001	0.248	0.7	0.008	26	73	
G25-Pl43	Pl ₂ (n-Grt ₂)	60.13	0.06	24.37	0	0.83	0.04	0.01	6.08	7.58	0.2	99.3	8	2.696	0.002	1.288	0	0.028	0	0.001	0.001	0.292	0.659	0.011	30	69	
G25-Pl44	Pl ₂ (n-Grt ₂)	61.49	0.01	23.49	0	0.54	0.03	0	6.76	7.27	0.14	99.73	8	2.74	0	1.234	0	0.018	0	0.001	0	0.323	0.628	0.008	34	65	
G25-Pl45	Pl ₂ (n-Grt ₂)	61.1	0.02	24.2	0	0.41	0.03	0	7.11	7.77	0.1	100.74	8	2.705	0.001	1.263	0	0.014	0	0.001	0	0.337	0.667	0.006	33	66	
G25-Pl46	Pl ₂ (n-Grt ₂)	58.38	0	25.63	0.01	0.62	0.01	0	7.34	7	0.12	99.11	8	2.631	0	1.362	0	0.021	0	0	0	0.354	0.612	0.007	36	63	
G25-Pl47	Pl ₂ (n-Grt ₂)	60.43	0.02	23.92	0.06	0.56	0.03	0.01	6.33	7.73	0.13	99.21	8	2.712	0.001	1.265	0.002	0.019	0	0.001	0.001	0.304	0.673	0.007	31	68	
G25-Pl48	Pl ₂ (n-Amp ₂)	59.55	0	24.54	0.03	0.33	0.01	0.01	7.33	7.32	0.1	99.22	8	2.677	0	1.301	0.001	0.011	0	0	0.001	0.353	0.638	0.006	35	64	
G25-Pl49	Pl ₂ (n-Amp ₂)	60.3	0	24.84	0.01	0.5	0.03	0.01	6.55	7.47	0.07	99.78	8	2.688	0	1.306	0	0.017	0	0.001	0.001	0.313	0.646	0.004	33	67	
G25-Pl50	Pl ₂ (n-Amp ₂)	59.47	0	24.87	0	0.52	0	0	7.57	7.34	0.09	99.86	8	2.661	0	1.312	0	0.018	0	0	0	0.363	0.637	0.005	36	63	
G25-Pl51	Pl ₂ (n-Amp ₂)	57.98	0.03	26.82	0.02	0.53	0	0.01	7.81	6.69	0.08	99.97	8	2.592	0.001	1.413	0.001	0.018	0	0	0.001	0.374	0.58	0.005	39	60	
G25-Pl52	Pl ₂ (n-Amp ₂)	59.14	0	25.31	0	0.43	0.03	0.01	7.88	7.22	0.09	100.11	8	2.642	0	1.333	0	0.015	0	0.001	0.001	0.377	0.625	0.005	37	62	
G25-Pl53	Pl ₂ (n-Amp ₂)	59.18	0.02	25.73	0	0.39	0.03	0	6.93	7.19	0.07	99.54	8	2.648	0.001	1.357	0	0.013	0	0.001	0	0.332	0.624	0.004	35	65	
G25-Pl54	Pl ₂ (n-Amp ₂)	58.23	0	26.17	0.03	0.42	0	0	8.2	6.48	0.11	99.64	8	2.611	0	1.384	0.001	0.014	0	0	0	0.394	0.563	0.006	41	58	
G25-Pl55	Pl ₂ (n-Amp ₂)	59.34	0	25.36	0.02	0.5	0	0	7.01	7.24	0.09	99.56	8	2.656	0	1.338	0.001	0.017	0	0	0	0.336	0.628	0.005	35	65	
G25-Pl56	Pl ₂ (n-Amp ₂)	60.42	0.02	24.17	0.04	0.47	0	0	5.97	7.89	0.09	99.07	8	2.711	0.001	1.279	0.001	0.016	0	0	0	0.287	0.686	0.005	29	70	

Table S3. Major element compositions (wt%) of pyroxene in mafic granulites from the Haiyangsuo complex.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^F	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G28-cpx01	Cpx _i (c)	50.92	0.31	3.47	0.02	13.72	0.18	10.57	19.88	1.11	0	100.43	6	1.92	0.009	0.154	0.001	0.069	0.363	0.006	0.594	0.803	0.081	0	0.62
G28-cpx03	Cpx _i (c)	51.04	0.23	3.18	0.02	13.43	0.23	10.67	20.38	1.01	0.01	100.44	6	1.924	0.007	0.141	0.001	0.07	0.353	0.007	0.599	0.823	0.074	0	0.63
G28-cpx04	Cpx _i (c)	52.14	0.23	2.46	0.05	12.35	0.21	10.99	21.3	0.96	0	100.84	6	1.952	0.007	0.109	0.002	0.042	0.345	0.007	0.613	0.855	0.07	0	0.64
G28-cpx05	Cpx _i (c)	51.12	0.29	3.22	0.05	13.52	0.17	10.4	20.22	1.12	0.02	100.34	6	1.929	0.008	0.143	0.001	0.062	0.364	0.005	0.585	0.818	0.082	0.001	0.62
G28-cpx06	Cpx _i (c)	52.44	0.14	1.82	0.05	12.78	0.27	10.98	21.63	0.67	0.02	100.87	6	1.969	0.004	0.081	0.001	0.021	0.38	0.009	0.615	0.871	0.049	0.001	0.62
G28-cpx07	Cpx _i (c)	52.23	0.11	2.51	0.08	12.37	0.22	11.16	21.11	0.85	0.02	100.77	6	1.956	0.003	0.111	0.002	0.031	0.357	0.007	0.623	0.847	0.061	0.001	0.64
G28-cpx08	Cpx _i (c)	52.25	0.12	2.04	0.05	12.77	0.18	11.16	21.7	0.69	0.03	101.13	6	1.956	0.003	0.09	0.002	0.042	0.358	0.006	0.622	0.87	0.05	0.001	0.63
G28-cpx09	Cpx _i (c)	52.38	0.14	2.51	0.02	12.49	0.15	11.08	20.65	0.98	0	100.47	6	1.966	0.004	0.111	0.001	0.02	0.372	0.005	0.62	0.831	0.071	0	0.63
G28-cpx10	Cpx _i (c)	49.53	0.64	5.48	0.05	14.89	0.19	10.33	17.17	1.5	0	100.09	6	1.872	0.018	0.244	0.001	0.084	0.387	0.006	0.582	0.695	0.11	0	0.60
G28-cpx11	Cpx _i (c)	51.97	0.23	2.95	0.04	12.83	0.17	10.82	20.66	0.93	0.01	100.67	6	1.95	0.006	0.13	0.001	0.023	0.38	0.005	0.605	0.831	0.067	0	0.61
G28-cpx12	Cpx _i (c)	51.92	0.17	2.69	0.02	12.97	0.2	10.76	21.01	0.95	0	100.85	6	1.948	0.005	0.119	0.001	0.045	0.362	0.006	0.601	0.845	0.069	0	0.62
G28-cpx13	Cpx _i (c)	51.85	0.19	2.65	0.03	12.68	0.2	10.98	20.68	0.91	0.01	100.27	6	1.953	0.005	0.118	0.001	0.031	0.368	0.006	0.616	0.834	0.066	0	0.63
G28-cpx14	Cpx _i (c)	51.32	0.19	2.5	0.02	12.71	0.15	10.87	21.06	0.98	0	100.03	6	1.94	0.005	0.111	0	0.07	0.332	0.005	0.612	0.853	0.071	0	0.65
G28-cpx15	Cpx _i (c)	52.08	0.19	2.68	0.02	12.70	0.17	10.94	20.6	1.06	0	100.57	6	1.954	0.005	0.119	0.001	0.038	0.361	0.005	0.612	0.828	0.077	0	0.63
G28-cpx16	Cpx _i (c)	52.6	0.17	2.08	0.01	11.69	0.12	11.31	21.51	0.78	0	100.28	6	1.976	0.005	0.092	0	0.003	0.364	0.004	0.633	0.866	0.057	0	0.63
G28-cpx17	Cpx _i (r)	53.02	0.19	2.16	0	10.84	0.1	12.11	21.46	0.85	0.02	100.8	6	1.972	0.005	0.095	0	0.013	0.324	0.003	0.671	0.855	0.061	0.001	0.67
G28-cpx18	Cpx _i (r)	50.74	0.25	3.15	0.01	12.80	0.24	10.93	21.03	0.96	0.01	100.46	6	1.91	0.007	0.14	0	0.096	0.307	0.008	0.613	0.848	0.07	0.001	0.67
G28-cpx19	Cpx _i (r)	52.68	0.13	1.88	0.02	11.27	0.16	12.03	21.1	0.87	0.03	100.26	6	1.973	0.004	0.083	0.001	0.029	0.324	0.005	0.671	0.847	0.063	0.001	0.67
G28-cpx20	Cpx _x	51.87	0.27	2.45	0.03	11.23	0.16	12.05	20.77	1.02	0.03	100.11	6	1.944	0.007	0.108	0.001	0.065	0.288	0.005	0.673	0.834	0.074	0.001	0.70
G28-cpx21	Cpx _x	53.1	0.18	2.13	0.02	9.97	0.09	12.49	21.6	0.94	0	100.58	6	1.972	0.005	0.093	0	0.021	0.289	0.003	0.691	0.859	0.067	0	0.71
G28-cpx22	Cpx _x	53.24	0.13	2.04	0.01	9.14	0.06	12.65	21.54	1.21	0	100.15	6	1.977	0.004	0.089	0	0.037	0.247	0.002	0.7	0.857	0.087	0	0.74
G28-cpx23	Cpx _x	53.87	0.03	1.82	0.03	8.18	0.08	13.33	21.85	0.96	0.01	100.14	6	1.993	0.001	0.08	0.001	0	0.253	0.002	0.735	0.866	0.069	0	0.74
G28-cpx24	Cpx _x	53.38	0.18	2.24	0.01	8.94	0.06	12.81	21.81	1.18	0.02	100.75	6	1.969	0.005	0.097	0	0.039	0.236	0.002	0.704	0.862	0.084	0.001	0.75
G28-cpx25	Cpx _x	53.71	0.11	1.93	0	8.56	0.03	12.98	22.47	0.93	0	100.78	6	1.981	0.003	0.084	0	0.016	0.248	0.001	0.713	0.888	0.067	0	0.74
G28-cpx26	Cpx _x	52.56	0.14	2.19	0	10.01	0.07	12.19	21.79	0.85	0	99.89	6	1.967	0.004	0.097	0	0.022	0.291	0.002	0.68	0.874	0.062	0	0.70
G28-cpx27	Cpx _x	52.82	0.17	2.03	0.02	9.72	0.02	12.54	21.92	0.92	0	100.28	6	1.966	0.005	0.089	0.001	0.036	0.267	0.001	0.696	0.874	0.066	0	0.72
G28-cpx28	Cpx _x	52.88	0.19	2.34	0.02	10.10	0.08	12.17	21.56	0.89	0	100.24	6	1.972	0.005	0.103	0.001	0.006	0.309	0.003	0.676	0.862	0.064	0	0.69
G28-cpx29	Cpx _x	53.13	0.15	1.89	0.04	10.10	0.09	12.71	21.49	0.9	0.03	100.63	6	1.972	0.004	0.083	0.001	0.03	0.284	0.003	0.703	0.855	0.065	0.001	0.71
G28-cpx30	Cpx _x	53.73	0.14	1.96	0.02	8.85	0.06	12.7	21.83	0.9	0	100.19	6	1.992	0.004	0.086	0.001	0	0.274	0.002	0.702	0.868	0.065	0	0.72
G28-cpx31	Cpx _x	53.27	0.12	1.98	0.05	10.08	0.02	12.12	21.48	1.05	0.01	100.23	6	1.986	0.003	0.087	0.002	0.01	0.305	0.001	0.673	0.858	0.076	0.001	0.69

Continued the Table S3.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G28-cpx32	Cpx ₂	52.12	0.16	2.32	0.02	10.99	0.07	11.56	21.64	1.13	0	100.26	6	1.951	0.005	0.102	0.001	0.068	0.276	0.002	0.645	0.868	0.082	0	0.70
G28-cpx33	Cpx ₂	52.69	0.23	2.35	0.02	10.73	0.04	11.54	21.36	1.08	0.03	100.14	6	1.972	0.006	0.104	0.001	0.019	0.317	0.001	0.644	0.857	0.078	0.001	0.67
G28-cpx34	Cpx ₂	53.43	0.15	1.96	0.06	9.47	0.18	12.72	21.82	0.89	0.01	100.72	6	1.978	0.004	0.086	0.002	0.013	0.28	0.005	0.702	0.866	0.064	0.001	0.71
G28-cpx35	Cpx ₂	53.03	0.14	1.98	0.02	8.46	0.12	13.08	21.73	1.19	0.02	99.98	6	1.968	0.004	0.087	0.001	0.055	0.207	0.004	0.723	0.864	0.086	0.001	0.78
G28-cpx36	Cpx ₂	51.78	0.17	2.46	0.02	11.96	0.16	11.24	21.24	0.82	0	99.97	6	1.953	0.005	0.11	0.001	0.034	0.343	0.005	0.632	0.859	0.06	0	0.65
G28-opx01	Opx	51.94	0.06	0.78	0.01	30.57	0.39	17.14	0.34	0.06	0	101.29	6	1.982	0.002	0.035	0	0.002	0.974	0.012	0.975	0.014	0.005	0	0.50
G28-opx02	Opx	51.21	0.05	0.96	0.02	29.72	0.36	17.94	0.46	0.01	0	100.88	6	1.954	0.001	0.043	0.001	0.045	0.903	0.012	1.021	0.019	0.001	0	0.53
G28-opx03	Opx	51.04	0.01	1.11	0.02	29.33	0.33	17.75	0.38	0.03	0	100.1	6	1.961	0	0.05	0.001	0.029	0.913	0.011	1.016	0.016	0.002	0	0.53
G28-opx04	Opx	50.26	0.03	0.87	0.04	30.70	0.38	16.85	0.37	0.04	0	99.74	6	1.953	0.001	0.04	0.001	0.054	0.944	0.012	0.976	0.016	0.003	0	0.51
G28-opx05	Opx	50.11	0.06	0.89	0.02	30.54	0.32	17.42	0.53	0.03	0	100.25	6	1.934	0.002	0.04	0.001	0.089	0.896	0.011	1.002	0.022	0.002	0	0.53
G28-opx06	Opx	51.02	0	0.81	0	30.84	0.3	16.69	0.36	0.02	0.03	100.12	6	1.975	0	0.037	0	0.016	0.982	0.01	0.963	0.015	0.001	0.001	0.50
G28-opx07	Opx	51.2	0.03	0.73	0	31.01	0.34	16.7	0.34	0.04	0	100.44	6	1.976	0.001	0.033	0	0.016	0.985	0.011	0.961	0.014	0.003	0	0.49
G28-opx08	Opx	49.12	1.22	0.84	0.02	30.46	0.34	17.23	0.55	0.05	0	100.13	6	1.904	0.036	0.038	0	0.085	0.903	0.011	0.995	0.023	0.004	0	0.52
G24-cpx01	Cpx _{i(c)}	50.79	0.32	3.32	0.03	10.31	0.10	12.13	21.65	0.59	0.03	99.27	6	1.917	0.009	0.148	0.001	0.045	0.276	0.003	0.682	0.875	0.043	0.001	0.71
G24-cpx02	Cpx _{i(c)}	50.70	0.30	3.79	0.01	10.07	0.11	11.93	21.89	0.62	0.02	99.44	6	1.909	0.008	0.168	0.000	0.043	0.269	0.004	0.669	0.883	0.045	0.001	0.71
G24-cpx03	Cpx _{i(c)}	49.75	0.38	5.20	0.04	11.96	0.12	11.76	19.51	0.74	0.09	99.55	6	1.875	0.011	0.231	0.001	0.054	0.317	0.004	0.661	0.788	0.054	0.004	0.68
G24-cpx04	Cpx _{i(c)}	50.71	0.27	3.49	0.02	11.10	0.13	11.87	20.90	0.61	0.05	99.16	6	1.920	0.008	0.156	0.001	0.036	0.311	0.004	0.670	0.848	0.045	0.002	0.68
G24-cpx05	Cpx _{i(c)}	50.85	0.29	3.24	0.04	10.09	0.15	11.87	22.15	0.55	0.04	99.27	6	1.921	0.008	0.144	0.001	0.039	0.275	0.005	0.668	0.896	0.040	0.002	0.71
G24-cpx06	Cpx _{i(c)}	50.21	0.37	5.14	0.02	10.86	0.10	11.93	19.72	0.72	0.11	99.18	6	1.893	0.010	0.228	0.001	0.022	0.317	0.003	0.670	0.797	0.053	0.005	0.68
G24-cpx07	Cpx _{i(c)}	50.94	0.21	2.90	0.03	10.82	0.14	12.04	21.72	0.53	0.05	99.39	6	1.925	0.006	0.129	0.001	0.050	0.286	0.004	0.678	0.879	0.039	0.002	0.70
G24-cpx08	Cpx _{i(c)}	50.88	0.24	3.46	0.05	11.07	0.15	11.85	21.42	0.60	0.03	99.75	6	1.916	0.007	0.154	0.001	0.045	0.298	0.005	0.665	0.864	0.044	0.001	0.69
G24-cpx09	Cpx _{i(c)}	51.00	0.25	3.02	0.02	9.57	0.08	12.15	22.83	0.53	0.01	99.45	6	1.919	0.007	0.134	0.001	0.052	0.243	0.003	0.681	0.921	0.039	0.000	0.74
G24-cpx10	Cpx _{i(c)}	51.27	0.29	3.07	0.02	10.16	0.12	11.77	22.32	0.51	0.03	99.55	6	1.932	0.008	0.136	0.001	0.021	0.297	0.004	0.661	0.901	0.037	0.001	0.69
G24-cpx11	Cpx _{i(r)}	51.55	0.18	2.18	0.05	9.61	0.10	12.46	23.06	0.42	0.01	99.62	6	1.938	0.005	0.097	0.001	0.046	0.251	0.003	0.698	0.929	0.031	0.000	0.74
G24-cpx12	Cpx _{i(r)}	51.66	0.21	2.17	0.03	10.06	0.15	12.25	23.02	0.41	0.01	99.97	6	1.939	0.006	0.096	0.001	0.043	0.269	0.005	0.685	0.926	0.030	0.000	0.72
G24-cpx13	Cpx _{i(r)}	51.92	0.26	2.28	0.05	9.35	0.09	12.51	23.29	0.43	0.04	100.22	6	1.939	0.007	0.100	0.001	0.039	0.249	0.003	0.696	0.932	0.031	0.002	0.74
G24-cpx14	Cpx _{i(r)}	51.58	0.22	2.23	0.02	9.52	0.10	12.21	23.01	0.46	0.01	99.35	6	1.945	0.006	0.099	0.001	0.033	0.264	0.003	0.686	0.930	0.034	0.000	0.72
G24-cpx15	Cpx _{i(r)}	51.54	0.19	2.09	0.06	10.11	0.15	12.03	22.85	0.44	0.02	99.48	6	1.946	0.005	0.093	0.002	0.036	0.279	0.005	0.677	0.924	0.032	0.001	0.71
G24-cpx16	Cpx _{i(r)}	51.60	0.26	2.17	0.03	9.22	0.09	12.03	23.51	0.45	0.01	99.37	6	1.946	0.007	0.096	0.001	0.030	0.258	0.003	0.676	0.950	0.033	0.000	0.72
G24-cpx17	Cpx _{i(r)}	52.48	0.14	1.50	0.04	9.60	0.15	12.30	23.59	0.41	0.00	100.21	6	1.964	0.004	0.066	0.001	0.026	0.272	0.005	0.686	0.946	0.030	0.000	0.72
G24-cpx18	Cpx _{i(r)}	51.51	0.18	2.39	0.04	10.16	0.11	12.16	22.36	0.46	0.02	99.39	6	1.944	0.005	0.106	0.001	0.029	0.288	0.004	0.684	0.904	0.034	0.001	0.70
G24-cpx19	Cpx _{i(r)}	51.33	0.26	2.48	0.03	9.90	0.06	12.07	22.72	0.52	0.06	99.43	6	1.935	0.007	0.110	0.001	0.044	0.263	0.002	0.678	0.918	0.038	0.003	0.72

Continued the Table S3.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G24-cpx20	Cpx _i (r)	52.41	0.16	1.90	0.06	9.12	0.10	12.60	23.28	0.44	0.02	100.09	6	1.958	0.004	0.084	0.002	0.022	0.260	0.003	0.702	0.932	0.032	0.001	0.73
G24-cpx21	Cpx _i (r)	51.69	0.23	2.06	0.07	9.25	0.13	12.57	22.90	0.44	0.02	99.36	6	1.946	0.007	0.091	0.002	0.034	0.253	0.004	0.705	0.924	0.032	0.001	0.74
G24-cpx22	Cpx _i (r)	51.57	0.22	2.33	0.04	9.95	0.11	12.05	23.05	0.45	0.02	99.79	6	1.939	0.006	0.103	0.001	0.038	0.270	0.004	0.675	0.929	0.033	0.001	0.71
G24-cpx23	Cpx _i (r)	52.33	0.13	1.39	0.01	9.53	0.15	12.29	23.54	0.37	0.00	99.74	6	1.968	0.004	0.062	0.000	0.022	0.276	0.005	0.689	0.949	0.027	0.000	0.71
G24-cpx24	Cpx _i (r)	51.65	0.20	2.08	0.04	10.08	0.12	12.09	23.10	0.45	0.01	99.82	6	1.943	0.006	0.092	0.001	0.043	0.269	0.004	0.678	0.931	0.033	0.000	0.72
G24-cpx25	Cpx ₂ (I-Grt _i)	52.45	0.25	2.90	0.00	6.83	0.08	13.70	22.97	0.51	0.00	99.69	6	1.945	0.007	0.127	0.000	0.005	0.206	0.003	0.757	0.913	0.037	0.000	0.79
G24-cpx26	Cpx ₂ (I-Grt _i)	52.01	0.29	3.08	0.02	6.94	0.08	13.51	22.86	0.53	0.00	99.32	6	1.938	0.008	0.135	0.001	0.011	0.204	0.003	0.750	0.913	0.038	0.000	0.79
G24-cpx27	Cpx ₂ (I-Grt _i)	52.49	0.29	3.05	0.02	7.55	0.13	13.66	22.90	0.57	0.02	100.67	6	1.932	0.008	0.132	0.001	0.029	0.200	0.004	0.749	0.903	0.041	0.001	0.79
G24-cpx28	Cpx ₂ (I-Grt _i)	52.66	0.31	3.19	0.03	7.29	0.07	13.82	22.55	0.61	0.01	100.54	6	1.937	0.009	0.138	0.001	0.014	0.209	0.002	0.758	0.889	0.044	0.000	0.78
G24-cpx29	Cpx ₂ (I-Grt _i)	52.43	0.31	3.05	0.00	6.89	0.06	13.87	22.69	0.53	0.00	99.83	6	1.941	0.009	0.133	0.000	0.006	0.206	0.002	0.765	0.900	0.038	0.000	0.79
G25-cpx01	Cpx _i (c)	49.48	0.43	3.89	0.02	11.42	0.20	9.92	22.48	0.59	0.00	98.43	6	1.902	0.012	0.176	0.001	0.037	0.326	0.007	0.568	0.926	0.044	0.000	0.64
G25-cpx02	Cpx _i (c)	50.03	0.16	3.58	0.03	11.47	0.22	10.32	22.92	0.56	0.00	99.29	6	1.905	0.005	0.161	0.001	0.060	0.299	0.007	0.586	0.935	0.041	0.000	0.66
G25-cpx03	Cpx _i (c)	50.88	0.21	2.89	0.05	10.01	0.14	11.39	22.92	0.57	0.00	99.06	6	1.929	0.006	0.129	0.001	0.041	0.272	0.004	0.644	0.931	0.042	0.000	0.70
G25-cpx04	Cpx _i (c)	49.49	0.39	3.63	0.01	11.64	0.23	10.19	22.88	0.52	0.00	98.98	6	1.894	0.011	0.164	0.000	0.064	0.301	0.007	0.581	0.938	0.039	0.000	0.66
G25-cpx05	Cpx _i (c)	50.51	0.15	3.52	0.02	10.99	0.15	10.44	22.83	0.58	0.00	99.20	6	1.921	0.004	0.158	0.001	0.033	0.313	0.005	0.592	0.930	0.043	0.000	0.65
G25-cpx06	Cpx _i (c)	49.93	0.36	3.75	0.03	11.83	0.23	10.19	22.99	0.59	0.02	99.93	6	1.893	0.010	0.168	0.001	0.070	0.297	0.007	0.576	0.934	0.043	0.001	0.66
G25-cpx07	Cpx _i (c)	51.88	0.17	2.63	0.00	11.75	0.21	10.49	22.14	0.56	0.00	99.83	6	1.963	0.005	0.117	0.000	0.000	0.372	0.007	0.592	0.898	0.041	0.000	0.61
G25-cpx08	Cpx _i (c)	52.79	0.09	2.82	0.00	10.97	0.22	8.93	23.47	0.55	0.00	99.84	6	1.991	0.003	0.125	0.000	0.000	0.346	0.007	0.502	0.949	0.040	0.000	0.59
G25-cpx09	Cpx _i (c)	51.15	0.23	3.16	0.09	11.29	0.20	8.69	23.73	0.57	0.03	99.14	6	1.956	0.007	0.142	0.003	0.000	0.361	0.006	0.495	0.972	0.042	0.001	0.58
G25-cpx10	Cpx _i (r)	51.17	0.14	1.96	0.06	11.95	0.24	10.30	22.89	0.50	0.00	99.21	6	1.957	0.004	0.088	0.002	0.025	0.354	0.008	0.587	0.938	0.037	0.000	0.62
G25-cpx11	Cpx _i (r)	50.92	0.14	1.99	0.01	12.42	0.27	10.45	22.95	0.47	0.00	99.62	6	1.941	0.004	0.089	0.000	0.054	0.336	0.009	0.594	0.938	0.035	0.000	0.64
G25-cpx12	Cpx _i (r)	50.91	0.12	1.91	0.02	11.90	0.18	10.85	22.98	0.44	0.01	99.33	6	1.942	0.003	0.086	0.001	0.056	0.317	0.006	0.617	0.939	0.033	0.000	0.66
G25-cpx13	Cpx _i (r)	51.91	0.10	1.61	0.02	10.20	0.14	11.95	22.99	0.44	0.00	99.36	6	1.963	0.003	0.072	0.001	0.028	0.292	0.004	0.674	0.932	0.032	0.000	0.70
G25-cpx14	Cpx _i (r)	50.85	0.12	1.86	0.00	10.84	0.22	11.23	23.03	0.44	0.01	98.59	6	1.946	0.003	0.084	0.000	0.050	0.291	0.007	0.641	0.944	0.033	0.000	0.69
G25-cpx15	Cpx _i (r)	52.52	0.07	2.14	0.07	7.91	0.10	12.76	22.29	0.82	0.00	98.69	6	1.976	0.002	0.095	0.002	0.007	0.241	0.003	0.715	0.899	0.060	0.000	0.75
G25-cpx16	Cpx _i (r)	52.65	0.09	1.64	0.10	8.26	0.11	12.98	22.40	0.62	0.01	98.86	6	1.981	0.003	0.073	0.003	0.002	0.258	0.004	0.728	0.903	0.045	0.000	0.74
G25-cpx17	Cpx _i (r)	52.79	0.05	1.36	0.05	8.16	0.10	13.30	23.16	0.54	0.01	99.52	6	1.974	0.001	0.060	0.001	0.028	0.224	0.003	0.741	0.928	0.039	0.000	0.77
G25-cpx18	Cpx _i (r)	52.15	0.09	1.64	0.25	8.20	0.07	12.81	22.60	0.69	0.00	98.50	6	1.971	0.003	0.073	0.007	0.023	0.233	0.002	0.721	0.915	0.051	0.000	0.76
G25-cpx19	Cpx _i (r)	52.38	0.08	1.43	0.00	10.53	0.19	12.06	22.33	0.44	0.00	99.44	6	1.980	0.002	0.064	0.000	0.005	0.328	0.006	0.679	0.904	0.032	0.000	0.67
G25-cpx20	Cpx _i (r)	51.49	0.09	1.51	0.02	10.97	0.18	12.02	23.35	0.39	0.00	100.02	6	1.940	0.003	0.067	0.001	0.075	0.262	0.006	0.675	0.943	0.029	0.000	0.72
G25-cpx21	Cpx _i (r)	50.72	0.11	1.91	0.00	12.43	0.23	10.46	23.44	0.49	0.02	99.81	6	1.931	0.003	0.086	0.000	0.084	0.303	0.007	0.593	0.956	0.036	0.001	0.66
G25-cpx22	Cpx _i (r)	51.79	0.04	1.25	0.03	9.96	0.23	12.00	23.30	0.42	0.00	99.01	6	1.966	0.001	0.056	0.001	0.040	0.271	0.007	0.679	0.948	0.031	0.000	0.71

Continued the Table S3.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G25-cpx23	Cpx ₁ (r)	51.42	0.05	0.45	0.02	12.59	0.29	10.48	23.43	0.22	0.00	98.95	6	1.981	0.001	0.020	0.001	0.031	0.371	0.009	0.602	0.967	0.016	0.000	0.62
G25-cpx24	Cpx ₁ (r)	51.27	0.08	0.90	0.05	12.57	0.25	10.46	23.10	0.31	0.00	98.99	6	1.972	0.002	0.041	0.002	0.032	0.368	0.008	0.600	0.952	0.023	0.000	0.62
G25-cpx25	Cpx ₂	53.21	0.08	1.89	0.06	8.40	0.09	12.63	22.73	0.71	0.00	99.80	6	1.984	0.002	0.083	0.002	0.000	0.262	0.003	0.702	0.908	0.051	0.000	0.73
G25-cpx26	Cpx ₂	53.21	0.05	1.61	0.06	8.38	0.10	12.47	22.68	0.74	0.00	99.31	6	1.994	0.001	0.071	0.002	0.000	0.263	0.003	0.696	0.911	0.054	0.000	0.73
G25-cpx27	Cpx ₂	52.63	0.07	1.65	0.03	8.55	0.11	12.61	23.11	0.75	0.01	99.53	6	1.971	0.002	0.073	0.001	0.036	0.228	0.004	0.704	0.927	0.054	0.000	0.76
G25-cpx28	Cpx ₂	53.47	0.10	1.83	0.00	8.05	0.10	12.30	23.10	0.81	0.00	99.76	6	1.993	0.003	0.080	0.000	0.000	0.251	0.003	0.683	0.922	0.059	0.000	0.73
G25-cpx29	Cpx ₂	53.11	0.06	1.37	0.00	8.89	0.08	12.77	22.81	0.58	0.00	99.66	6	1.988	0.002	0.060	0.000	0.002	0.276	0.002	0.712	0.915	0.042	0.000	0.72
G25-cpx30	Cpx ₂	53.45	0.03	1.03	0.17	8.55	0.10	12.44	23.71	0.48	0.01	99.98	6	1.997	0.001	0.045	0.005	0.000	0.267	0.003	0.693	0.949	0.035	0.000	0.72
G25-cpx31	Cpx ₂	53.27	0.03	1.48	0.11	8.28	0.12	13.48	22.04	0.57	0.00	99.38	6	1.990	0.001	0.065	0.003	0.000	0.259	0.004	0.750	0.882	0.041	0.000	0.74
G25-cpx32	Cpx ₂	53.13	0.06	1.25	0.07	8.44	0.14	13.27	22.26	0.45	0.00	99.07	6	1.994	0.002	0.055	0.002	0.000	0.265	0.005	0.742	0.895	0.033	0.000	0.74
G25-cpx33	Cpx ₂	53.48	0.06	1.74	0.01	8.44	0.13	11.81	22.96	0.70	0.00	99.33	6	2.003	0.002	0.077	0.000	0.000	0.264	0.004	0.659	0.921	0.051	0.000	0.71
G25-cpx34	Cpx ₂	52.46	0.13	1.66	0.08	8.98	0.12	13.34	22.19	0.71	0.00	99.67	6	1.960	0.004	0.073	0.002	0.049	0.226	0.004	0.743	0.888	0.051	0.000	0.77
G25-cpx35	Cpx ₂	52.40	0.06	1.61	0.01	8.79	0.09	13.35	22.45	0.68	0.01	99.45	6	1.961	0.002	0.071	0.000	0.054	0.215	0.003	0.744	0.900	0.049	0.000	0.78
G25-cpx36	Cpx ₂	53.10	0.18	1.82	0.03	8.06	0.07	13.12	22.31	0.58	0.00	99.27	6	1.984	0.005	0.080	0.001	0.000	0.252	0.002	0.731	0.893	0.042	0.000	0.74
G25-cpx37	Cpx ₂	52.34	0.12	1.31	0.02	8.95	0.14	12.47	23.39	0.55	0.00	99.29	6	1.971	0.003	0.058	0.001	0.032	0.246	0.004	0.700	0.944	0.040	0.000	0.74
G25-cpx38	Cpx ₂	52.62	0.15	1.75	0.29	9.29	0.12	12.20	21.83	0.79	0.00	99.04	6	1.984	0.004	0.078	0.009	0.000	0.293	0.004	0.686	0.882	0.058	0.000	0.70
G25-cpx39	Cpx ₂	52.92	0.11	1.66	0.09	8.97	0.11	11.72	22.80	0.78	0.01	99.17	6	1.993	0.003	0.074	0.003	0.000	0.283	0.004	0.658	0.920	0.057	0.000	0.70
G25-cpx40	Cpx ₂	53.43	0.11	1.66	0.05	8.97	0.15	13.61	21.11	0.75	0.00	99.85	6	1.988	0.003	0.073	0.001	0.000	0.279	0.005	0.755	0.841	0.054	0.000	0.73
G25-cpx41	Cpx ₂	53.42	0.07	1.74	0.02	8.40	0.07	13.65	21.39	0.69	0.00	99.45	6	1.990	0.002	0.076	0.001	0.000	0.262	0.002	0.758	0.854	0.050	0.000	0.74
G25-cpx42	Cpx ₂	53.18	0.04	1.76	0.06	8.63	0.10	13.35	21.36	0.78	0.00	99.26	6	1.989	0.001	0.078	0.002	0.000	0.270	0.003	0.744	0.856	0.057	0.000	0.73
G25-cpx43	Cpx ₂	53.17	0.08	1.98	0.03	8.50	0.14	12.75	22.61	0.71	0.00	99.97	6	1.980	0.002	0.087	0.001	0.000	0.265	0.004	0.708	0.902	0.051	0.000	0.73
G25-cpx44	Cpx ₂	53.37	0.11	1.70	0.04	8.36	0.09	13.75	21.29	0.75	0.01	99.47	6	1.988	0.003	0.075	0.001	0.000	0.260	0.003	0.763	0.850	0.054	0.000	0.75
G25-cpx45	Cpx ₂	53.52	0.11	1.88	0.01	7.32	0.07	13.83	21.96	0.83	0.00	99.53	6	1.986	0.003	0.082	0.000	0.000	0.227	0.002	0.765	0.873	0.060	0.000	0.77

Notes: X_{Mg} = Mg/(Mg+Fe²⁺).

Table S4. Major element compositions (wt%) of amphibole in mafic granulites from the Haiyangsuo complex.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G28-amp01	Amp ₁	41.96	1.44	12.21	0.09	19.83	0.07	8.32	11	2.13	1.6	98.84	23	6.332	0.164	2.171	0.01	0.215	2.288	0.008	1.871	1.778	0.623	0.307	0.45
G28-amp02	Amp ₁	39.96	1.85	12.42	0.06	20.41	0.03	7.6	10.89	1.9	2.11	97.4	23	6.181	0.215	2.264	0.007	0.219	2.422	0.004	1.751	1.804	0.569	0.415	0.42
G28-amp03	Amp ₁	40.6	2.03	12.55	0.06	19.75	0.08	8.22	11.11	1.79	2.26	98.63	23	6.179	0.233	2.251	0.007	0.207	2.306	0.01	1.865	1.813	0.528	0.439	0.45
G28-amp04	Amp ₁	40.69	1.92	12.57	0.02	19.53	0.07	8.08	11.08	1.99	1.98	98.07	23	6.216	0.22	2.264	0.003	0.165	2.331	0.009	1.839	1.814	0.589	0.385	0.44
G28-amp05	Amp ₁	40.9	1.26	14.73	0.04	17.80	0.05	7.92	11.11	2.21	1.46	97.56	23	6.197	0.143	2.631	0.004	0.093	2.163	0.007	1.788	1.804	0.649	0.282	0.45
G28-amp06	Amp ₁	41.68	1.52	12.77	0.12	17.40	0.08	9.02	11.27	2.12	1.54	97.61	23	6.312	0.173	2.279	0.015	0.101	2.104	0.01	2.035	1.828	0.623	0.298	0.49
G28-amp07	Amp ₁	40.81	1.37	12.46	0	19.97	0.08	7.79	11.35	1.88	1.88	97.73	23	6.268	0.158	2.256	0	0.146	2.42	0.01	1.784	1.868	0.558	0.368	0.42
G28-amp08	Amp ₁	40.36	1.97	12.55	0.05	20.26	0.1	7.77	10.93	1.71	2.33	98.22	23	6.183	0.226	2.266	0.006	0.228	2.368	0.013	1.775	1.794	0.509	0.454	0.43
G28-amp09	Cum(af-Opx)	55.42	0.05	0.38	0	24.65	0.16	17.15	1.31	0	0	99.13	23	8.001	0.005	0.065	0	0	2.977	0.019	3.691	0.203	0.001	0	0.55
G28-amp10	Cum(af-Opx)	54.43	0.03	0.76	0.03	23.89	0.25	17.43	1.51	0.13	0.04	98.55	23	7.904	0.004	0.13	0.003	0.05	2.851	0.031	3.772	0.234	0.038	0.008	0.57
G28-amp11	Cum(af-Opx)	54.39	0.04	0.46	0	25.74	0.26	16.65	1.13	0.1	0.01	98.82	23	7.933	0.004	0.079	0	0.044	3.096	0.032	3.619	0.177	0.029	0.002	0.54
G28-amp12	Cum(af-Opx)	55	0	0.3	0.03	24.82	0.24	17.69	0.66	0	0	98.75	23	7.976	0	0.051	0.004	0	3.011	0.03	3.823	0.102	0	0	0.56
G28-amp13	Cum(af-Opx)	55.29	0.06	0.36	0	25.54	0.29	17.02	0.75	0.07	0	99.37	23	7.99	0.007	0.062	0	0	3.087	0.035	3.665	0.116	0.019	0	0.54
G28-amp14	Amp _{2(ms)}	55.05	0.05	2.35	0.07	12.87	0.02	16.4	11.5	0.43	0.1	98.9	23	7.782	0.006	0.392	0.007	0.075	1.446	0.003	3.455	1.742	0.116	0.017	0.70
G28-amp15	Amp _{2(ms)}	53.78	0.22	2.64	0.04	15.57	0.09	14.97	11.02	0.49	0.12	99.06	23	7.69	0.023	0.444	0.004	0.144	1.718	0.01	3.19	1.689	0.134	0.021	0.65
G28-amp16	Amp _{2(ms)}	48.82	0.6	7.41	0	17.50	0.12	13.31	8.81	1.37	0.44	98.83	23	7.067	0.065	1.264	0	0.465	1.655	0.015	2.871	1.367	0.386	0.082	0.63
G24-amp01	Amp ₁	42.42	1.00	13.76	0.06	16.36	0.11	9.36	11.75	1.54	0.93	97.29	23	6.355	0.113	2.430	0.007	0.147	1.886	0.014	2.090	1.886	0.447	0.178	0.53
G24-amp02	Amp ₁	42.12	1.19	13.69	0.05	16.53	0.08	9.24	11.89	1.59	0.93	97.31	23	6.326	0.134	2.424	0.006	0.115	1.949	0.010	2.068	1.913	0.463	0.178	0.51
G24-amp03	Amp ₁	43.36	1.02	13.12	0.07	15.90	0.10	9.71	11.91	1.59	0.57	97.35	23	6.462	0.114	2.305	0.008	0.104	1.867	0.013	2.157	1.902	0.459	0.108	0.54
G24-amp04	Amp ₁	42.55	1.02	14.06	0.01	16.17	0.07	9.50	11.95	1.66	0.65	97.64	23	6.337	0.114	2.469	0.001	0.134	1.865	0.009	2.109	1.907	0.479	0.124	0.53
G24-amp05	Amp ₁	43.19	1.06	12.65	0.03	16.15	0.09	9.88	11.82	1.61	0.56	97.04	23	6.465	0.119	2.232	0.004	0.146	1.860	0.011	2.204	1.896	0.467	0.107	0.54
G24-amp06	Amp ₂	46.41	0.63	9.84	0.04	14.03	0.06	12.04	12.17	1.00	0.32	96.54	23	6.862	0.070	1.715	0.005	0.153	1.565	0.008	2.653	1.928	0.287	0.060	0.63
G24-amp07	Amp ₂	46.10	0.47	10.90	0.00	14.72	0.05	11.25	12.12	1.18	0.32	97.11	23	6.800	0.052	1.896	0.000	0.109	1.695	0.006	2.473	1.916	0.338	0.060	0.59
G24-amp08	Amp ₂	43.47	0.71	14.46	0.04	12.23	0.04	11.59	12.09	1.66	0.50	96.79	23	6.396	0.079	2.508	0.005	0.100	1.394	0.005	2.542	1.906	0.474	0.094	0.65
G24-amp09	Amp ₂	42.44	0.70	14.80	0.03	14.10	0.07	10.21	12.01	1.77	0.58	96.71	23	6.322	0.078	2.599	0.004	0.090	1.657	0.009	2.267	1.917	0.511	0.110	0.58
G24-amp10	Amp ₂	43.49	0.81	14.70	0.03	13.91	0.03	10.44	11.84	1.70	0.55	97.50	23	6.396	0.090	2.549	0.003	0.101	1.599	0.004	2.288	1.866	0.485	0.103	0.59
G24-amp11	Amp ₂	44.94	0.54	13.46	0.05	11.58	0.05	12.52	11.77	1.67	0.43	97.01	23	6.548	0.059	2.312	0.006	0.154	1.240	0.006	2.719	1.838	0.472	0.080	0.69
G24-amp12	Amp ₂	44.29	0.39	12.72	0.00	15.52	0.07	10.27	11.74	1.43	0.41	96.84	23	6.584	0.044	2.229	0.000	0.181	1.729	0.009	2.275	1.870	0.412	0.078	0.57
G24-amp13	Amp ₂	45.72	0.68	11.12	0.04	11.34	0.01	13.38	11.54	1.54	0.34	95.71	23	6.733	0.075	1.930	0.005	0.193	1.181	0.001	2.936	1.821	0.440	0.064	0.71
G24-amp14	Amp ₂	43.44	0.56	13.57	0.08	11.64	0.04	12.02	11.59	1.81	0.46	95.22	23	6.474	0.063	2.384	0.009	0.141	1.294	0.005	2.670	1.851	0.523	0.088	0.67

Continued the Table S4.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G24-amp15	Amp ₂	44.30	0.67	12.83	0.00	15.23	0.08	10.60	11.76	1.56	0.42	97.45	23	6.542	0.074	2.234	0.000	0.183	1.677	0.010	2.333	1.861	0.447	0.079	0.58
G24-amp16	Amp ₂	44.09	0.63	12.78	0.04	14.80	0.07	10.71	11.81	1.58	0.42	96.93	23	6.540	0.070	2.235	0.005	0.160	1.659	0.009	2.368	1.877	0.454	0.080	0.59
G24-amp17	Amp ₂	42.08	0.85	14.55	0.01	15.43	0.08	9.35	11.92	1.65	0.65	96.56	23	6.321	0.096	2.577	0.001	0.092	1.835	0.010	2.093	1.919	0.481	0.125	0.53
G24-amp18	Amp ₂	45.01	0.43	12.95	0.00	14.21	0.02	11.24	11.96	1.51	0.42	97.75	23	6.587	0.047	2.234	0.000	0.153	1.569	0.002	2.451	1.875	0.428	0.078	0.61
G24-amp19	Amp ₂	43.40	0.86	14.46	0.01	14.19	0.07	10.37	11.90	1.68	0.57	97.51	23	6.396	0.095	2.512	0.001	0.101	1.637	0.009	2.278	1.879	0.480	0.107	0.58
G24-amp20	Amp ₂	43.54	0.53	13.48	0.11	13.66	0.06	11.31	12.06	1.66	0.50	96.91	23	6.442	0.059	2.351	0.013	0.165	1.506	0.008	2.494	1.912	0.476	0.094	0.62
G24-amp21	Amp ₂ (s)	44.44	0.47	13.21	0.04	12.48	0.06	11.75	11.90	1.55	0.48	96.38	23	6.558	0.052	2.298	0.005	0.115	1.413	0.007	2.584	1.882	0.444	0.090	0.65
G24-amp22	Amp ₂ (s)	43.72	0.59	14.68	0.00	13.04	0.05	11.15	11.95	1.68	0.53	97.39	23	6.407	0.065	2.536	0.000	0.121	1.463	0.006	2.435	1.876	0.477	0.099	0.62
G24-amp23	Amp ₂ (s)	43.60	0.60	13.98	0.05	12.94	0.04	11.35	11.96	1.69	0.53	96.73	23	6.439	0.067	2.434	0.006	0.115	1.469	0.005	2.498	1.893	0.484	0.100	0.63
G24-amp24	Amp ₂ (s)	42.85	0.46	15.20	0.17	13.36	0.05	10.69	11.87	1.75	0.54	96.95	23	6.328	0.051	2.646	0.020	0.138	1.497	0.006	2.353	1.878	0.501	0.102	0.61
G24-amp25	Amp ₂ (s)	44.07	0.51	13.85	0.05	13.13	0.04	11.42	11.90	1.59	0.47	97.04	23	6.477	0.056	2.400	0.006	0.152	1.446	0.005	2.501	1.874	0.453	0.088	0.63
G24-amp26	Amp ₂ (I-Grt ₂)	43.32	0.72	13.19	0.04	14.98	0.10	10.64	11.88	1.52	0.53	96.92	23	6.441	0.081	2.312	0.005	0.229	1.607	0.013	2.358	1.893	0.438	0.101	0.59
G24-amp27	Amp ₂ (I-Grt ₂)	43.98	0.66	13.04	0.11	12.93	0.09	11.66	12.07	1.52	0.52	96.58	23	6.506	0.073	2.274	0.013	0.123	1.463	0.011	2.571	1.913	0.436	0.098	0.64
G24-amp28	Cum(af-Opx)	54.31	0.06	1.02	0.02	21.27	0.25	18.90	0.97	0.09	0.01	96.90	23	7.912	0.007	0.175	0.002	0.015	2.576	0.031	4.103	0.151	0.025	0.002	0.61
G24-amp29	Cum(af-Opx)	54.44	0.05	0.80	0.01	21.08	0.18	19.32	0.98	0.09	0.02	96.97	23	7.914	0.005	0.137	0.001	0.041	2.517	0.022	4.186	0.153	0.025	0.004	0.62
G24-amp30	Cum(af-Opx)	54.33	0.07	0.86	0.01	21.23	0.22	19.15	0.85	0.08	0.00	96.80	23	7.917	0.008	0.148	0.001	0.030	2.554	0.027	4.159	0.133	0.023	0.000	0.62
G24-amp31	Cum(af-Opx)	54.22	0.08	0.92	0.02	21.02	0.19	19.49	1.04	0.12	0.01	97.11	23	7.866	0.009	0.157	0.002	0.113	2.426	0.023	4.214	0.162	0.034	0.002	0.63
G24-amp32	Cum(af-Opx)	53.85	0.08	0.85	0.00	21.21	0.26	19.16	1.09	0.09	0.02	96.61	23	7.866	0.009	0.146	0.000	0.133	2.444	0.032	4.171	0.171	0.025	0.004	0.63
G24-amp33	Cum(af-Opx)	53.47	0.12	1.72	0.01	20.65	0.22	18.46	1.96	0.23	0.04	96.88	23	7.795	0.013	0.296	0.001	0.107	2.398	0.027	4.011	0.306	0.065	0.007	0.63
G24-amp34	Cum(af-Opx)	53.16	0.10	1.49	0.01	20.96	0.22	18.45	1.98	0.17	0.03	96.57	23	7.783	0.011	0.257	0.001	0.176	2.371	0.027	4.026	0.311	0.048	0.006	0.63
G24-amp35	Cum(af-Opx)	53.56	0.03	0.65	0.04	21.54	0.23	19.06	1.13	0.05	0.01	96.30	23	7.884	0.003	0.113	0.005	0.000	2.652	0.029	4.182	0.178	0.014	0.002	0.61
G24-amp36	Cum(af-Opx)	53.86	0.08	1.35	0.02	21.31	0.17	18.58	1.72	0.14	0.03	97.26	23	7.832	0.009	0.231	0.002	0.101	2.480	0.021	4.026	0.268	0.039	0.006	0.62
G24-amp37	Cum(af-Opx)	53.60	0.06	1.09	0.02	21.79	0.22	18.74	1.39	0.16	0.02	97.09	23	7.816	0.007	0.187	0.002	0.184	2.453	0.027	4.073	0.217	0.045	0.004	0.62
G24-amp38	Cum(af-Opx)	51.80	0.23	3.88	0.05	17.32	0.15	17.44	4.89	0.53	0.10	96.39	23	7.551	0.025	0.667	0.006	0.185	1.906	0.019	3.789	0.764	0.150	0.019	0.67
G24-amp39	Cum(af-Opx)	53.80	0.01	1.16	0.00	21.67	0.22	18.20	1.86	0.11	0.00	97.03	23	7.856	0.001	0.200	0.000	0.112	2.522	0.027	3.961	0.291	0.031	0.000	0.61
G24-amp40	Amp ₂ '(s)	49.83	0.33	6.89	0.04	12.92	0.05	13.82	11.97	0.92	0.17	96.94	23	7.253	0.036	1.182	0.005	0.134	1.424	0.006	2.998	1.867	0.260	0.032	0.68
G24-amp41	Amp ₂ '(s)	50.89	0.30	4.91	0.02	12.94	0.10	14.78	12.10	0.60	0.09	96.73	23	7.404	0.033	0.842	0.002	0.229	1.320	0.012	3.205	1.886	0.169	0.017	0.71
G24-amp42	Amp ₂ '(s)	45.52	0.47	11.67	0.05	14.01	0.07	11.33	11.92	1.29	0.37	96.70	23	6.724	0.052	2.032	0.006	0.125	1.593	0.009	2.494	1.887	0.370	0.070	0.61
G24-amp43	Amp ₂ '(s)	47.25	0.25	9.95	0.04	13.51	0.07	13.27	11.35	1.40	0.25	97.34	23	6.869	0.027	1.705	0.005	0.332	1.274	0.009	2.875	1.768	0.395	0.046	0.69
G24-amp44	Amp ₂ '(s)	45.27	0.75	11.06	0.02	15.07	0.04	11.01	12.10	1.39	0.38	97.09	23	6.713	0.084	1.933	0.002	0.099	1.759	0.005	2.433	1.923	0.400	0.072	0.58
G24-amp45	Amp ₂ '	47.42	0.27	10.73	0.00	11.12	0.02	14.13	11.67	1.23	0.28	96.87	23	6.853	0.029	1.828	0.000	0.253	1.064	0.002	3.043	1.807	0.345	0.052	0.74
G24-amp46	Amp ₂ '	48.63	0.24	9.18	0.02	11.57	0.06	14.45	11.59	1.22	0.21	97.17	23	7.009	0.026	1.560	0.002	0.260	1.106	0.007	3.104	1.790	0.341	0.039	0.74

Continued the Table S4.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G24-amp47	Amp ₂ '	49.03	0.29	8.05	0.03	11.90	0.05	14.95	11.67	1.07	0.18	97.22	23	7.068	0.031	1.368	0.003	0.312	1.088	0.006	3.212	1.803	0.299	0.033	0.75
G24-amp48	Amp ₂ '	52.73	0.17	3.60	0.02	14.10	0.11	17.16	8.46	0.51	0.11	96.98	23	7.596	0.018	0.611	0.002	0.168	1.512	0.013	3.684	1.306	0.142	0.020	0.71
G24-amp49	Amp ₂ '	47.94	0.26	10.08	0.04	10.95	0.06	14.34	11.79	1.30	0.26	97.02	23	6.920	0.028	1.715	0.005	0.207	1.092	0.007	3.085	1.824	0.364	0.048	0.74
G24-amp50	Amp ₂ '	48.42	0.11	8.87	0.01	12.59	0.06	14.16	11.41	1.17	0.21	97.00	23	7.015	0.012	1.515	0.001	0.331	1.157	0.007	3.057	1.771	0.329	0.039	0.73
G24-amp51	Amp ₂ '	47.08	0.29	9.55	0.02	14.07	0.07	12.92	11.33	1.26	0.26	96.84	23	6.897	0.032	1.649	0.002	0.335	1.351	0.009	2.821	1.778	0.358	0.049	0.68
G24-amp52	Amp ₂ '	51.14	0.11	5.62	0.02	11.42	0.06	15.41	12.07	0.63	0.10	96.58	23	7.393	0.012	0.958	0.002	0.188	1.173	0.007	3.320	1.870	0.177	0.018	0.74
G24-amp53	Amp ₂ '	45.54	0.66	10.00	0.05	16.37	0.13	10.20	14.11	1.34	0.12	98.52	23	6.542	0.071	1.694	0.006	1.770	0.000	0.016	2.184	2.172	0.373	0.022	1.00
G24-amp54	Amp ₂ '	45.59	0.48	11.07	0.01	14.44	0.09	11.62	11.99	1.37	0.41	97.06	23	6.730	0.053	1.927	0.001	0.157	1.607	0.011	2.556	1.897	0.392	0.077	0.61
G24-amp55	Amp ₂ '	47.18	0.51	10.41	0.00	12.99	0.07	12.95	12.00	1.26	0.26	97.62	23	6.848	0.056	1.781	0.000	0.177	1.380	0.009	2.801	1.866	0.355	0.048	0.67
G24-amp56	Amp ₂ '	45.59	0.16	12.08	0.03	13.39	0.00	12.12	11.96	1.39	0.36	97.08	23	6.680	0.018	2.087	0.003	0.190	1.430	0.000	2.647	1.878	0.395	0.067	0.65
G24-amp57	Amp ₂ '	47.58	0.40	9.63	0.04	13.67	0.07	12.70	12.05	1.11	0.28	97.52	23	6.932	0.044	1.654	0.005	0.166	1.480	0.009	2.758	1.881	0.314	0.052	0.65
G24-amp58	Amp ₂ '	46.88	0.70	10.28	0.02	11.59	0.07	13.82	11.81	1.17	0.28	96.63	23	6.827	0.077	1.765	0.002	0.228	1.159	0.009	2.999	1.843	0.330	0.052	0.72
G24-amp59	Amp ₂ '	52.18	0.37	5.84	0.03	8.27	0.10	17.36	12.53	0.68	0.02	97.38	23	7.382	0.039	0.974	0.003	0.122	0.842	0.012	3.660	1.899	0.187	0.004	0.81
G24-amp60	Amp ₂ '	52.45	0.33	4.87	0.00	8.10	0.06	17.55	12.61	0.50	0.02	96.49	23	7.481	0.035	0.819	0.000	0.098	0.858	0.007	3.730	1.927	0.138	0.004	0.81
G24-amp61	Amp ₂ '	53.09	0.33	5.08	0.02	8.02	0.06	17.93	12.59	0.56	0.06	97.74	23	7.464	0.035	0.842	0.002	0.128	0.801	0.007	3.757	1.897	0.153	0.011	0.82
G24-amp62	Amp ₂ '	48.89	0.38	8.73	0.01	11.59	0.08	14.34	12.08	0.98	0.20	97.29	23	7.052	0.041	1.485	0.001	0.179	1.200	0.010	3.083	1.867	0.274	0.037	0.72
G24-amp63	Amp ₂ '(I-Grt ₂)	48.00	0.38	9.69	0.05	11.66	0.05	14.00	12.32	1.12	0.24	97.51	23	6.932	0.041	1.650	0.006	0.146	1.247	0.006	3.013	1.906	0.314	0.044	0.71
G24-amp64	Amp ₂ '(I-Grt ₂)	45.91	0.66	10.87	0.02	13.85	0.07	12.45	12.01	1.22	0.39	97.45	23	6.715	0.073	1.874	0.002	0.264	1.401	0.009	2.714	1.882	0.346	0.073	0.66
G24-amp65	Amp ₂ '(I-Grt ₂)	45.24	0.71	12.07	0.01	12.89	0.05	12.20	12.06	1.40	0.40	97.04	23	6.635	0.078	2.087	0.001	0.142	1.425	0.006	2.667	1.895	0.398	0.075	0.65
G24-amp66	Amp ₂ '(I-Grt ₂)	45.11	0.55	12.23	0.01	13.85	0.04	11.32	11.93	1.42	0.37	96.83	23	6.656	0.061	2.127	0.001	0.121	1.574	0.005	2.489	1.886	0.406	0.070	0.61
G25-amp01	Amp ₁	41.39	1.27	14.21	0.12	16.14	0.06	8.69	11.63	1.88	0.93	96.32	23	6.286	0.145	2.544	0.014	0.038	2.008	0.008	1.967	1.893	0.554	0.180	0.49
G25-amp02	Amp ₁	43.94	1.36	11.90	0.01	13.71	0.04	11.09	11.73	1.68	0.81	96.27	23	6.570	0.153	2.098	0.001	0.034	1.677	0.005	2.471	1.879	0.487	0.155	0.60
G25-amp03	Amp ₁	42.74	1.37	11.39	0.09	15.19	0.07	10.50	11.62	1.69	1.10	95.76	23	6.501	0.157	2.042	0.011	0.084	1.840	0.009	2.380	1.894	0.498	0.214	0.56
G25-amp04	Amp ₁	42.20	1.26	13.14	0.04	16.18	0.08	9.30	11.52	1.87	0.89	96.49	23	6.386	0.143	2.344	0.005	0.087	1.952	0.010	2.097	1.868	0.549	0.172	0.52
G25-amp05	Amp ₁	42.23	1.36	13.13	0.04	16.19	0.05	9.27	11.54	1.79	0.83	96.43	23	6.389	0.155	2.342	0.005	0.089	1.950	0.006	2.090	1.871	0.525	0.160	0.52
G25-amp06	Amp ₁	46.48	0.98	10.03	0.03	14.92	0.06	10.65	12.55	1.47	0.70	97.87	23	6.856	0.109	1.744	0.003	0.000	1.841	0.007	2.341	1.984	0.420	0.132	0.56
G25-amp07	Amp ₁	44.78	1.03	10.57	0.13	16.13	0.06	10.76	11.55	1.61	0.85	97.47	23	6.670	0.115	1.856	0.015	0.156	1.836	0.007	2.389	1.843	0.465	0.162	0.57
G25-amp08	Amp ₁	42.08	1.29	12.93	0.07	14.78	0.04	10.09	11.63	1.75	1.18	95.85	23	6.387	0.147	2.314	0.008	0.053	1.818	0.005	2.282	1.891	0.515	0.229	0.56
G25-amp09	Amp ₁	44.16	1.03	11.14	0.08	13.97	0.03	11.58	11.81	1.52	0.75	96.08	23	6.615	0.116	1.967	0.009	0.119	1.619	0.004	2.585	1.895	0.441	0.143	0.61
G25-amp10	Amp ₁	42.84	1.56	12.00	0.02	15.52	0.05	9.95	11.57	1.78	1.08	96.37	23	6.481	0.177	2.140	0.002	0.038	1.922	0.006	2.243	1.875	0.522	0.209	0.54
G25-amp11	Amp ₁	44.64	1.04	11.43	0.05	15.74	0.02	10.32	11.63	1.56	0.96	97.39	23	6.647	0.116	2.007	0.006	0.074	1.878	0.003	2.290	1.856	0.450	0.183	0.55
G25-amp12	Amp ₁	46.53	1.04	9.21	0.11	16.04	0.08	10.53	11.56	1.48	0.68	97.27	23	6.924	0.116	1.616	0.013	0.031	1.963	0.010	2.335	1.843	0.427	0.129	0.54

Continued the Table S4.

Samples	Textural setting	SiO ₂	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO ^T	MnO	MgO	CaO	Na ₂ O	K ₂ O	Totals	Oxygens	Si	Ti	Al	Cr	Fe ³⁺	Fe ²⁺	Mn	Mg	Ca	Na	K	X _{Mg}
G25-amp13	Amp ₂ (n-Grt ₂)	43.65	0.69	11.90	0.06	15.72	0.09	10.39	11.72	1.66	0.65	96.54	23	6.556	0.078	2.107	0.007	0.152	1.806	0.011	2.326	1.886	0.483	0.125	0.56
G25-amp14	Amp ₂ (n-Grt ₂)	45.47	0.57	10.49	0.01	14.79	0.07	11.68	11.81	1.42	0.52	96.83	23	6.746	0.064	1.835	0.001	0.181	1.634	0.009	2.582	1.877	0.408	0.099	0.61
G25-amp15	Amp ₂ (n-Grt ₂)	44.30	0.82	11.53	0.06	14.62	0.07	11.16	11.72	1.57	0.69	96.54	23	6.612	0.092	2.029	0.007	0.141	1.668	0.009	2.482	1.874	0.454	0.132	0.60
G25-amp16	Amp ₂ (n-Grt ₂)	43.31	1.32	12.94	0.05	14.81	0.08	10.92	11.30	1.85	0.86	97.44	23	6.415	0.147	2.260	0.006	0.209	1.602	0.010	2.411	1.794	0.531	0.163	0.60
G25-amp17	Amp ₂ (n-Grt ₂)	43.71	1.03	12.08	0.00	15.73	0.07	10.01	11.68	1.72	0.98	97.01	23	6.553	0.116	2.135	0.000	0.055	1.911	0.009	2.237	1.876	0.500	0.188	0.54
G25-amp18	Amp ₂ (n-Grt ₂)	45.16	1.16	11.95	0.04	13.96	0.03	11.56	11.03	1.78	0.71	97.39	23	6.629	0.128	2.068	0.005	0.194	1.499	0.004	2.529	1.735	0.507	0.133	0.63
G25-amp19	Amp ₂ (n-Grt ₂)	42.99	0.98	12.89	0.12	16.22	0.02	9.56	11.56	1.84	1.22	97.40	23	6.448	0.111	2.279	0.014	0.067	1.960	0.003	2.137	1.858	0.535	0.234	0.52
G25-amp20	Amp ₂ (n-Grt ₂)	44.29	1.11	11.27	0.07	13.81	0.01	11.40	11.78	1.61	0.68	96.03	23	6.631	0.125	1.989	0.008	0.072	1.650	0.001	2.544	1.890	0.467	0.130	0.61
G25-amp21	Amp ₂ (n-Grt ₂)	41.83	1.30	14.18	0.01	15.34	0.06	9.72	11.62	1.84	1.01	96.91	23	6.279	0.147	2.509	0.001	0.110	1.804	0.008	2.174	1.869	0.536	0.194	0.55
G25-amp22	Amp ₂ (s)	44.60	0.50	11.79	0.00	15.54	0.08	10.31	11.55	1.53	0.64	96.55	23	6.667	0.056	2.078	0.000	0.133	1.796	0.010	2.297	1.850	0.444	0.122	0.56
G25-amp23	Amp ₂ (s)	43.95	0.60	11.60	0.04	15.71	0.09	10.32	11.68	1.51	0.63	96.13	23	6.619	0.068	2.060	0.005	0.146	1.816	0.011	2.316	1.885	0.441	0.121	0.56
G25-amp24	Amp ₂ (s)	44.82	0.64	10.73	0.02	15.30	0.09	10.72	11.49	1.56	0.54	95.91	23	6.739	0.072	1.902	0.002	0.135	1.774	0.011	2.402	1.851	0.455	0.104	0.58
G25-amp25	Amp ₂ (s)	44.58	0.82	11.72	0.05	14.79	0.08	10.86	11.73	1.54	0.62	96.80	23	6.633	0.092	2.056	0.006	0.118	1.710	0.010	2.408	1.870	0.444	0.118	0.58
G25-amp26	Amp ₂ (s)	44.16	0.68	12.02	0.03	15.08	0.08	10.53	11.62	1.58	0.63	96.41	23	6.607	0.077	2.120	0.004	0.131	1.741	0.010	2.348	1.863	0.458	0.120	0.57
G25-amp27	Amp ₂ (s)	45.35	0.74	10.57	0.04	13.63	0.06	12.03	11.79	1.46	0.61	96.28	23	6.742	0.083	1.853	0.005	0.128	1.553	0.008	2.665	1.878	0.421	0.116	0.63
G25-amp28	Amp ₂ (s)	44.66	1.05	11.82	0.05	14.47	0.05	11.34	11.56	1.70	0.74	97.44	23	6.593	0.117	2.057	0.006	0.150	1.619	0.006	2.495	1.829	0.487	0.140	0.61
G25-amp29	Amp ₂ (s)	44.37	0.87	11.78	0.05	14.19	0.02	11.37	11.84	1.55	0.67	96.70	23	6.596	0.097	2.065	0.006	0.125	1.625	0.003	2.519	1.886	0.447	0.127	0.61
G25-amp30	Amp ₂ (s)	43.65	0.91	13.28	0.06	15.17	0.04	11.15	11.29	1.70	0.82	98.07	23	6.409	0.100	2.299	0.007	0.309	1.520	0.005	2.440	1.776	0.484	0.154	0.62
G25-amp31	Amp ₂ (s)	46.20	0.80	10.10	0.00	14.72	0.05	11.34	11.63	1.50	0.70	97.03	23	6.844	0.089	1.764	0.000	0.074	1.741	0.006	2.503	1.846	0.431	0.132	0.59
G25-amp32	Amp ₂ (s)	46.97	0.81	9.46	0.05	13.61	0.05	12.38	12.30	1.43	0.68	97.75	23	6.888	0.089	1.636	0.006	0.003	1.667	0.007	2.706	1.933	0.407	0.127	0.62
G25-amp33	Amp ₂ (n-Grt ₂)	47.17	0.47	9.38	0.03	13.02	0.08	13.00	11.91	1.20	0.45	96.71	23	6.927	0.052	1.624	0.003	0.153	1.429	0.010	2.845	1.874	0.342	0.084	0.67
G25-amp34	Amp ₂ '(n-Grt ₂)	47.83	0.75	7.82	0.04	12.57	0.05	13.73	11.80	1.10	0.34	96.02	23	7.050	0.083	1.359	0.005	0.169	1.361	0.006	3.016	1.864	0.314	0.064	0.69
G25-amp35	Amp ₂ '(s)	52.00	0.27	3.87	0.02	11.45	0.06	16.15	11.95	0.58	0.19	96.54	23	7.521	0.029	0.660	0.002	0.214	1.146	0.007	3.481	1.852	0.163	0.035	0.75
G25-amp36	Amp ₂ '(s)	51.61	0.30	4.64	0.04	11.59	0.05	15.48	11.99	0.68	0.13	96.51	23	7.478	0.033	0.793	0.005	0.155	1.232	0.006	3.343	1.861	0.191	0.024	0.73
G25-amp37	Amp ₂ '(s)	51.56	0.37	4.27	0.06	11.75	0.03	15.29	12.05	0.63	0.18	96.19	23	7.511	0.041	0.733	0.007	0.117	1.301	0.004	3.320	1.881	0.178	0.033	0.72
G25-amp38	Amp ₂ '(s)	52.73	0.17	2.77	0.03	11.04	0.05	16.35	12.16	0.45	0.08	95.83	23	7.667	0.019	0.475	0.003	0.140	1.187	0.006	3.543	1.895	0.127	0.015	0.75
G25-amp39	Amp ₂ '(s)	52.39	0.38	4.29	0.07	13.11	0.10	14.11	11.87	0.65	0.22	97.19	23	7.591	0.041	0.733	0.008	0.054	1.529	0.012	3.047	1.843	0.183	0.041	0.67

Notes: X_{Mg} = Mg/(Mg+Fe²⁺).

Table S5. Trace element compositions (ppm) of garnet in mafic granulites from the Haiyangsuo complex.

Sample	G28-g01	G28-g02	G28-g03	G28-g04	G28-g05	G28-g06	G28-g07	G28-g08	G28-g09	G28-g10	G28-g11	G28-g12	G24-g01	G24-g02	G24-g03	G24-g04	G24-g05	G24-g06	G24-g07	G24-g08	G24-g09	G24-g10	G24-g11	G24-g12	G25-g01	G25-g02	G25-g03	G25-g04	G25-g05	G25-g06	G25-g07	G25-g08	G25-g09	G25-g10
Textural setting	Grt ₁ rim	Grt ₁ mantle	Grt ₁ core	Grt ₁ mantle	Grt ₁ rim	Grt ₂	Grt ₁ rim	Grt ₁ mantle	Grt ₁ core	Grt ₁ mantle	Grt ₁ rim	Grt ₂																						
La	0.0205	0.127	0.055	0.059	0.0126	0.067	0.69	0.79	0.073	0.067	0.031	0.022	0.038	0.073	0.225	0.059	0.0176	0.056	0.126	0.042	0.054	0.212	0.0219	7.18	0.02	0.078	0.094	0.108	0.073	0.089	0.028	4.77	12.42	0.126
Ce	0.057	0.066	0.07	0.092	0.05	0.159	1.32	1.44	0.066	0.082	0.083	0.14	0.081	0.114	0.54	0.074	0.0158	0.085	0.36	0.023	0.048	0.5	0.036	13.34	0.04	0.09	0.084	0.097	0.042	0.079	0.094	10.9	30.11	0.046
Pr	0.052	0.0128	0.077	0.066	0.044	0.026	0.167	0.124	0.084	0.047	0.053	0.133	0.027	0.06	0.089	0.048	0.048	0.044	0.074	0.006	0.031	0.075	0.049	1.44	0.043	0.064	0.076	0.051	0.072	0.051	0.06	1.28	2.83	0.057
Nd	0.67	0.52	1.17	1.08	1.12	0.68	0.93	1.17	0.5	0.59	1.31	2.82	0.73	0.51	0.72	0.81	0.41	0.99	0.5	0.29	0.64	0.74	0.63	4.75	0.6	0.55	0.7	0.64	0.46	0.52	0.52	4.86	8.29	0.88
Sm	1.76	1.9	3.77	4.35	3.23	1.74	2.93	4.21	2	2.56	3.61	5.67	1.98	3.37	2.63	2.96	0.61	1.9	0.99	0.35	1.6	1.24	1.48	1.98	0.92	0.45	1.46	0.89	0.76	1.62	1.13	1.9	1.78	1.81
Eu	1.53	1.42	2.08	2.15	1.91	1.58	2.79	2.8	1.88	1.96	2.68	3.64	0.92	1.54	1.14	1.34	0.41	1.2	0.77	0.46	0.92	1.36	1.02	1.38	0.61	0.241	1.12	0.8	0.92	1.03	0.64	1.35	0.89	1.31
Gd	20.52	13.78	22.37	21.51	18.7	9.21	5.64	3.23	8.42	7.03	6.02	12.09	13.79	12.5	11.74	11.41	6.82	8.74	6.66	2.91	5.87	4.45	3.62	4.3	3.2	1.43	3.8	3.24	3.74	3.82	3.09	3.83	4.5	4.54
Tb	9.78	6	6.1	5.93	5.48	2.22	0.88	0.331	2.12	1.15	0.69	1.76	3.81	2.92	2.94	2.97	3.08	2.36	2.58	1.02	1.04	0.81	0.67	0.48	0.81	0.259	0.54	0.7	0.72	0.51	0.79	0.61	1.2	0.78
Dy	124.35	74.52	48.11	50.12	50.83	13.31	3.47	1.08	15.08	5.78	2.5	7.66	31.37	27.47	23.79	25.28	39.26	16.28	25.71	8.27	4.71	5.41	2.94	2.22	7.65	2.23	2.73	4.41	4.85	1.81	6.02	3.2	8.13	3.48
Ho	38.85	24.82	11.03	12.08	12.86	2.58	0.5	0.138	3.23	0.88	0.317	0.91	7.52	6.39	5.13	5.91	11.08	3.58	6.2	1.74	0.7	0.95	0.391	0.25	2.06	0.42	0.43	0.74	0.84	0.247	1.26	0.37	1.51	0.48
Er	139.8	95.53	30.01	38.58	42.89	5.23	1.07	0.166	8.29	1.79	0.56	1.59	25.67	18.09	14.96	17.62	39.53	12.05	18.73	4.94	1.52	2.11	0.81	0.54	7.56	1.37	0.59	1.73	2.22	0.67	3.38	0.83	3.33	0.88
Tm	23.01	16.58	4.41	6.15	7.05	0.76	0.121	0.106	0.99	0.185	0.071	0.189	3.68	2.43	1.82	2.36	5.91	1.85	2.78	0.69	0.169	0.282	0.074	0.08	1.32	0.096	0.104	0.183	0.271	0.165	0.39	0.096	0.36	0.15
Yb	162.69	116.43	29.6	39.39	52.45	3.29	0.6	0.317	7.26	0.97	0.46	0.65	23.65	15.83	11.74	14.4	42.27	12.63	19.74	4.03	0.69	1.51	0.45	0.3	9.34	1.18	0.53	0.91	0.99	1.39	2.74	0.42	2.11	0.76
Lu	25.42	19.12	4.25	5.92	7.58	0.391	0.12	0.059	0.92	0.106	0.09	0.091	3.48	2.11	1.65	2.01	5.79	1.99	2.72	0.5	0.098	0.165	0.081	0.075	1.54	0.23	0.063	0.109	0.125	0.103	0.318	0.04	0.133	0.12
Y	998.95	680.03	307.13	343.22	380.99	66.74	15.57	3.5	81.04	22.01	8.1	24.4	215.1	166.53	146.93	159.6	329.46	100.64	173.82	49.87	19.13	27.77	11.04	7.47	53.2	10.56	10.07	20.54	22.08	7.72	33.73	10.4	37.82	13.36
Li	2.73	2.12	1.75	1.72	1.3	0.61	0.73	0.6	0.98	0.66	0.83	0.65	1.19	1.58	1.8	1.61	2.42	1.54	2.18	1.25	1.06	1.04	0.85	0.61	1.23	2.7	0.97	0.99	1.66	1.06	1.49	1.91	1.11	2.04
Sc	108.1	139.59	201.96	184.4	161.33	46.2	22.91	14.01	86.46	39.08	15.49	17.65	203.69	186.92	179.47	197.78	188.12	98.67	155.37	58.61	36.36	36.78	12.33	8.21	28.23	13.22	22.27	13.96	32.27	8.87	30.68	11.03	30.93	43.98
Ti	160.67	110	169.56	244.39	284.92	79.49	114.55	1540.73	75.9	77.9	165.18	182.34	142.31	345.15	319.42	388.41	88.41	440.43	678.34	826.92	115.11	103.54	102.07	101.16	179.73	2491.33	121.86	95.57	110.66	180.97	107.89	110.75	97.44	85.48
V	251	274.69	252.71	261.14	261.74	119.4	53.39	136.97	113.65	97.91	48.32	37.81	233.92	233.33	232.6	240.65	250.6	180.12	214.05	215.42	63.45	62.43	51.94	41.59	130.52	65.56	19.68	30.45	51.3	86.44	72.68	25.13	164.67	32.1
Cr	90.82	15.93	27.04	50.39	34.34	5.92	7	5.49	29.34	6.26	6.65	6.71	166.48	109.12	81.48	107.16	134.83	290.73	177.59	59.44	6.57	7.38	6.42	7.07	322.6	108.95	9.37	10.57	13.94	8.44	53.62	12.5	10.53	11.87
Co	42.95	42.16	45.31	48.63	46.54	32.88	37.76	45.33	42.22	35.26	35.04	35.72	53.5	60.35	59.25	59.62	37.7	52.75	40.03	26.86	33.47	33.63	30.07	40.16	38.93	19.9	37.07	33.52	36.11	38.86	43.86	35	39.42	36.94
Zn	62.59	62.26	68.45	70.77	72.7	36.41	44.45	641.35	46.28	39.89	57.38	47.4	41.64	63.5	63.85	62.27	32.71	58.25	31.99	25.05	32.21	33.14	31.35	37.45	48.61	28.81	45.01	35.61	36.09	39.25	50.69	39.24	35.83	28.54
Ga	9.66	10.46	10.48	10.91	11.11	15.34	12.72	28.34	10.18	14.03	12.81	12.53	7.93	7.73	8.08	8.08	8.68	7.76	9.08	8.61	10.14	13.18	12.64	12.18	11.6	10.56	10.19	7.69	9.43	13.26	9.68	9.21	14.51	10.56
Zr	1.94	2.29	4.56	5.62	5.88	1.48	3.88	4.26	2.32	1.43	4.4	4.66	4.02	11.63	15.94	19.84	1.11	20.79	1.49	1.37	3.77	5.62	1.63	2.76	2.25	1.13	2.49	1.24	1.86	1.42	1.94	2.15	1.07	2
Hf	0.135	0.36	0.157	0.29	0.37	0.57	0.136	0.258	0.088	0.33	0.32	0.202	3.48	0.36	0.42	0.29	0.25	0.36	0.294	0.33	0.212	0.42	0.39	0.32	0.38	0.175	0.38	0.33	0.44	0.182	0.39	0.069	0.62	
Th	0.075	0.148	0.026	0.07	0.064	0.05	0.074	0.1	0.147	0.078	0.076	0.039	0.126	0.08	0.065	0.064	0.031	0.022	0.079	0.065	0.059	0.1	0.037	0.057	0.12	0.088	0.037	0.139	0.054	0.066	0.077	0.5	2.58	0.132
U	0.059	0.0176	0.051	0.055	0.071	0.088	0.083	0.056	0.036	0.107	0.032	0.091	0.042	0.063	0.051	0.088	0.027	0.068	0.076	0.025	0.0163	0.021	0.051	0.067	0.077	0.065	0.094	0.089	0.035	0.136	0.061	0.122	0.174	0.023
ΣREE	548.51	370.83	163.10	187.48	204.21	41.24	21.23	15.96	50.91	23.20	18.48	37.37	116.75	93.41	79.11	87.25	155.25	63.76	87.94	25.27	18.09	19.81	12.27	38.32	35.71	8.69	12.32	14.61	16.08	12.10	20.46	34.46	77.59	15.42

Continued the **Table S5**.

Sample	G28-g01	G28-g02	G28-g03	G28-g04	G28-g05	G28-g06	G28-g07	G28-g08	G28-g09	G28-g10	G28-g11	G28-g12	G24-g01	G24-g02	G24-g03	G24-g04	G24-g05	G24-g06	G24-g07	G24-g08	G24-g09	G24-g10	G24-g11	G24-g12	G25-g01	G25-g02	G25-g03	G25-g04	G25-g05	G25-g06	G25-g07	G25-g08	G25-g09	G25-g10
Textural setting	Grt ₁ rim	Grt ₁ mantle	Grt ₁ core	Grt ₁ mantle	Grt ₁ rim	Grt ₂	Grt ₁ rim	Grt ₁ mantle	Grt ₁ core	Grt ₁ mantle	Grt ₁ rim	Grt ₂																						
Σ LREE	0.80	0.73	1.37	1.30	1.23	0.93	3.11	3.52	0.72	0.79	1.48	3.12	0.88	0.76	1.57	0.99	0.49	1.18	1.06	0.36	0.77	1.53	0.74	26.71	0.70	0.78	0.95	0.90	0.65	0.74	0.70	21.81	53.65	1.11
Σ MREE	23.81	17.10	28.22	28.01	23.84	12.53	11.36	10.24	12.30	11.55	12.31	21.40	16.69	17.41	15.51	15.71	7.84	11.84	8.42	3.72	8.39	7.05	6.12	7.66	4.73	2.12	6.38	4.93	5.42	6.47	4.86	7.08	7.17	7.66
Σ HREE	523.90	353.00	133.51	158.17	179.14	27.78	6.76	2.20	37.89	10.86	4.69	12.85	99.18	75.24	62.03	70.55	146.92	50.74	78.46	21.19	8.93	11.24	5.42	3.95	30.28	5.79	4.99	8.78	10.02	4.90	14.90	5.57	16.77	6.65
(La/Yb) _N	0.00	0.00	0.00	0.00	0.00	0.01	0.82	1.79	0.01	0.05	0.05	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.06	0.10	0.03	17.17	0.00	0.05	0.13	0.09	0.05	0.05	0.01	8.15	4.22	0.12	
(La/Sm) _N	0.01	0.04	0.01	0.01	0.00	0.02	0.15	0.12	0.02	0.02	0.01	0.00	0.01	0.06	0.01	0.02	0.02	0.08	0.08	0.02	0.11	0.01	0.11	0.04	0.08	0.06	0.04	0.02	1.62	4.50	0.04			
(Gd/Yb) _N	0.10	0.10	0.63	0.45	0.29	2.32	7.78	8.43	0.96	6.00	10.83	15.39	0.48	0.65	0.83	0.66	0.13	0.57	0.28	0.60	7.04	2.44	6.65	11.86	0.28	1.00	5.93	2.95	3.13	2.27	0.93	7.54	1.76	4.94
δ_{Eu}	0.78	0.85	0.69	0.68	0.75	1.21	2.10	2.32	1.40	1.41	1.76	1.34	0.54	0.73	0.63	0.70	0.61	0.90	0.92	1.39	0.92	1.77	1.35	1.45	1.09	0.92	1.45	1.44	1.67	1.27	1.05	1.53	0.96	1.40

Notes: $(\text{La}/\text{Yb})_N = (\text{La}/0.237)/(\text{Yb}/0.17)$; $(\text{La}/\text{Sm})_N = (\text{La}/0.237)/(\text{Sm}/0.153)$; $(\text{Gd}/\text{Yb})_N = (\text{Gd}/0.2055)/(\text{Yb}/0.17)$; $\delta_{\text{Eu}} = (\text{Eu}/0.058)/\text{SQRT}(\text{Sm}/0.153*\text{Gd}/0.2055)$.

Table S6. Trace element compositions (ppm) of pyroxene in mafic granulites from the Haiyangsuo complex.

Sample	G28-cpx01	G28-cpx02	G28-cpx03	G28-cpx04	G28-cpx05	G28-cpx06	G28-cpx07	G28-cpx08	G28-cpx09	G28-oxp01	G28-oxp02	G28-oxp03	G24-cpx01	G24-cpx02	G24-cpx03	G24-cpx04	G25-cpx01	G25-cpx02	G25-cpx03	G25-cpx04	G25-cpx05	G25-cpx06
Textural setting	Cpx ₁ rim	Cpx ₁ mantle	Cpx ₁ core	Cpx ₁ mantle	Cpx ₁ rim	Cpx ₂	Cpx ₂	Cpx ₂	Cpx ₂	Opx	Opx	Opx	Cpx ₁ rim	Cpx ₁ core	Cpx ₁ core	Cpx ₁ rim	Cpx ₂	Cpx ₂	Cpx ₂	Cpx ₂	Cpx ₁	Cpx ₁
La	3.46	0.64	1.18	2.18	2.44	1.76	39.01	1.5	1.13	0.081	0.083	0.05	0.06	0.038	0.039	0.032	0.226	0.4	0.35	1.3	0.072	0.063
Ce	17.95	3.71	12.4	18.34	16.64	12.08	78.33	10.01	8.67	0.4	0.311	0.139	0.47	0.047	0.064	0.122	1.59	2.56	2.53	7.79	0.152	0.38
Pr	3.76	1.3	3.72	4.52	3.42	2.94	9.08	2.56	2.32	0.054	0.051	0.023	0.04	0.038	0.055	0.05	0.42	0.66	0.6	1.94	0.072	0.088
Nd	21.4	9.17	23.39	25.79	18.83	16.65	32.26	16.65	15.07	0.37	0.5	0.198	0.31	0.85	0.96	0.49	2.86	4.48	4.77	11.95	0.38	0.6
Sm	7.58	4.4	9	9.11	6.38	5.29	6.63	5.08	6.13	0.139	0.21	0.061	0.68	1.28	1.42	0.48	1.02	1.85	1.89	4.46	0.3	0.37
Eu	1.85	1.24	2.33	2.43	1.54	1.36	3.02	1.52	1.43	0.045	0.054	0.043	0.245	0.41	0.44	0.213	0.33	0.45	0.41	1.67	0.113	0.127
Gd	7.75	4.28	9.62	8.72	5.31	4.47	15.99	3.21	4.09	0.151	0.171	0.105	1.74	3.15	3.11	1.18	1.37	1.6	1.11	4.49	0.61	0.52
Tb	1.01	0.66	1.47	1.28	0.64	0.64	4.4	0.378	0.442	0.0227	0.038	0.035	0.317	0.55	0.52	0.202	0.164	0.177	0.115	0.67	0.163	0.092
Dy	5.53	3.64	7.6	6.48	3.04	3.26	41.48	2.02	1.85	0.129	0.165	0.146	1.99	3.48	3.13	1.34	0.63	0.76	0.81	3.66	1.42	0.62
Ho	0.97	0.449	1.24	0.9	0.43	0.56	10.36	0.249	0.252	0.0243	0.033	0.0212	0.287	0.53	0.54	0.231	0.103	0.125	0.143	0.56	0.33	0.137
Er	2.05	1.16	2.75	1.72	0.96	1.19	29.53	0.56	0.52	0.065	0.038	0.05	0.57	1.39	1.1	0.52	0.28	0.265	0.21	1.52	1.06	0.49
Tm	0.217	0.123	0.314	0.207	0.093	0.126	3.96	0.063	0.053	0.046	0.0121	0.0136	0.055	0.169	0.124	0.065	0.06	0.039	0.033	0.178	0.153	0.073
Yb	1.37	0.85	1.69	0.98	0.39	0.68	23.21	0.3	0.277	0.063	0.191	0.217	0.34	0.79	0.86	0.39	0.26	0.244	0.203	0.76	1.1	0.44
Lu	0.174	0.145	0.237	0.118	0.062	0.071	2.99	0.046	0.052	0.036	0.035	0.028	0.047	0.117	0.059	0.069	0.047	0.044	0.032	0.1	0.301	0.145
Y	21.08	13.12	28.43	21.81	10.52	11.39	261.04	6.33	5.65	0.356	0.248	0.297	7.1	13.55	13.72	5.69	2.47	2.53	2.69	14.36	8.57	4.32
Li	8.99	6.06	5.2	4.68	5.31	13.12	1.66	11.47	11.18	1.88	1.54	1.29	6.53	5.86	6.18	6.19	38.91	35.91	35.43	13.07	24.82	22.98
Be	1	0.93	0.97	1.38	0.9	1.04	0.135	1.1	1.4	0.45	0.12	0.09	0.35	0.52	0.52	0.49	0.213	0.73	0.43	1.15	0.58	0.49
B	2.7	3.11	4.35	3.02	4.57	3.25	9.49	3.65	4.12	4.2	2.94	2.39	3.3	5.31	3.72	2.78	7.84	8.26	8.94	21.23	7.21	5.76
Sc	90.97	89.29	84.6	83.56	87.7	179.72	119.67	195.23	107.36	11.81	13.93	10.44	67.42	68.44	69.5	70.37	88.3	78.75	82.39	67.08	41.29	61.49
Ti	2337	1910	2743	2721	2053	999	293	915	1388	686	659	393	2214	2842	2758	2125	364	484	674	5649	1548	481
V	517.93	552.94	590.95	583.18	486.63	547.56	194.1	633.24	429.16	124.86	129.27	94.2	519.8	519.28	509.13	465.28	405.24	218.19	515.91	542.74	372.82	162.68
Cr	96.4	105.73	65.81	79.82	98.56	64.88	21.48	83.99	57.19	39.52	39.61	23.78	167.51	132.47	140.35	143.73	486.05	119.78	173.59	481.05	157.19	49.93
Mn	1308	1163	1660	1534	1153	710	8477	618	649	2763	2877	2757	1018	1210	1212	884	788	627	828	429	1496	1723
Fe	89340	93764	102965	99549	90081	75305	248227	74402	74683	205934	206614	214168	81675	86737	88481	75952	58043	56214	58839	106153	82259	80091
Co	58.47	58	63.06	60.43	59.25	52.99	48.93	51.44	53.42	101.79	114.82	100.96	60.42	62.76	63.45	53.28	38.12	40.33	40.08	81.04	47.5	39.89

Continued the **Table S6**.

Sample	G28-cpx01	G28-cpx02	G28-cpx03	G28-cpx04	G28-cpx05	G28-cpx06	G28-cpx07	G28-cpx08	G28-cpx09	G28-oxp01	G28-oxp02	G28-oxp03	G24-cpx01	G24-cpx02	G24-cpx03	G24-cpx04	G25-cpx01	G25-cpx02	G25-cpx03	G25-cpx04	G25-cpx05	G25-cpx06
Textural setting	Cpx ₁ rim	Cpx ₁ mantle	Cpx ₁ core	Cpx ₁ mantle	Cpx ₁ rim	Cpx ₂	Cpx ₂	Cpx ₂	Cpx ₂	Opx	Opx	Opx	Cpx ₁ rim	Cpx ₁ core	Cpx ₁ core	Cpx ₁ rim	Cpx ₂	Cpx ₂	Cpx ₂	Cpx ₁	Cpx ₁	
Zn	167.87	179.3	184.21	171.45	176.65	177.88	70.97	178.32	168.12	690.57	710.59	699.33	133.92	139.24	139.2	120.72	94.05	99.7	100.04	217.41	119.68	110.92
Ga	13.1	12.92	18.32	18.65	14.66	16.39	18.03	16.09	18.01	12.35	11.51	9.76	13.24	14.69	14.67	11.18	8.01	9.6	9.96	24.22	10.52	6.35
Ge	4.31	2.31	2.35	2.37	2.26	5.35	3.52	5.05	3.94	3.54	2.42	2.17	4.03	5.35	3.49	3.11	2.95	3.73	3.52	3.78	3.34	3.29
As	1.18	1.17	1.03	1.13	1.13	0.98	2.17	0.79	1.27	3.54	2.42	2.17	1.26	1.64	2.37	1.12	2.27	1.83	1.98	1.94	1.88	1.98
Zr	66.17	43.26	115.51	127.22	52.4	19.05	3.86	14.72	17.13	0.96	1.06	0.307	38.49	63.17	58.47	24.46	5.35	7.15	6.67	7.44	22.35	10.49
Hf	3.76	3.2	4.65	4.81	3.35	2.19	0.186	1.53	1.8	0.182	0.252	0.115	2.21	2.54	2.65	1.96	0.8	0.66	0.45	0.84	0.8	0.69
Th	0.041	0.021	0.031	0.036	0.073	0.06	0.41	0.055	0.044	0.184	0.136	0.073	0.0179	0.0158	0.059	0.0056	0.025	0.044	0.04	0.054	0.075	0.063
U	0.0137	0.037	0.055	0.034	0.041	0.034	0.084	0.048	0.039	0.033	0.06	0.037	0.041	0.032	0.026	0.0267	0.04	0.03	0.044	0.1	0.042	0.06
Σ REE	75.07	31.77	76.94	82.78	60.18	51.08	300.25	44.15	42.29	1.63	1.89	1.13	7.15	12.84	12.42	5.38	9.36	13.65	13.21	41.05	6.23	4.15
Σ LREE	46.57	14.82	40.69	50.83	41.33	33.43	158.68	30.72	27.19	0.91	0.95	0.41	0.88	0.97	1.12	0.69	5.10	8.10	8.25	22.98	0.68	1.13
Σ MREE	17.18	9.92	20.95	20.26	13.23	11.12	25.64	9.81	11.65	0.34	0.44	0.21	2.67	4.84	4.97	1.87	2.72	3.90	3.41	10.62	1.02	1.02
Σ HREE	11.32	7.03	15.30	11.69	5.62	6.53	115.93	3.62	3.45	0.39	0.51	0.51	3.61	7.03	6.33	2.82	1.54	1.65	1.55	7.45	4.53	2.00
(La/Yb) _N	1.81	0.54	0.50	1.60	4.49	1.86	1.21	3.59	2.93	0.92	0.31	0.17	0.13	0.03	0.03	0.06	0.62	1.18	1.24	1.23	0.05	0.10
(La/Sm) _N	0.29	0.09	0.08	0.15	0.25	0.21	3.80	0.19	0.12	0.38	0.26	0.53	0.06	0.02	0.02	0.04	0.14	0.14	0.12	0.19	0.15	0.11
(Gd/Yb) _N	4.68	4.17	4.71	7.36	11.26	5.44	0.57	8.85	12.21	1.98	0.74	0.40	4.23	3.30	2.99	2.50	4.36	5.42	4.52	4.89	0.46	0.98
δ Eu	0.74	0.87	0.77	0.83	0.81	0.86	0.90	1.15	0.87	0.95	0.87	1.64	0.69	0.62	0.64	0.87	0.85	0.80	0.87	1.14	0.81	0.89

Notes: (La/Yb)_N = (La/0.237)/(Yb/0.17); (La/Sm)_N = (La/0.237)/(Sm/0.153); (Gd/Yb)_N = (Gd/0.2055)/(Yb/0.17); δ Eu = (Eu/0.058)/SQRT(Sm/0.153*Gd/0.2055).

Table S7. Trace element compositions (ppm) of amphibole in mafic granulites from the Haiyangsuo complex.

Sample	G28-amp01	G28-amp02	G28-amp03	G24-amp01	G24-amp02	G24-amp03	G24-amp04	G25-amp01	G25-amp02
Textural setting	Amp ₁	Amp ₁	Amp ₁	Cum	Act	Amp ₁ core	Amp ₁ rim	Amp ₂	Amp ₂
La	22.22	15.11	10.8	0.06	1.37	0.309	0.077	0.088	1.99
Ce	108.65	90.9	66.94	0.307	5.15	5.61	0.99	0.33	12.55
Pr	20.93	19.2	14.98	0.094	1.12	2.35	0.52	0.078	3.37
Nd	112.43	104.94	89.12	0.61	4.94	20.45	5.68	0.63	25.34
Sm	34.31	33.48	29.57	0.28	1.16	9.2	4.16	0.33	8.95
Eu	9.14	8	7.87	0.123	1.79	1.83	0.75	0.168	1.98
Gd	33.25	31.4	25.09	0.286	0.79	10.59	5.99	0.94	7.81
Tb	4.26	4.01	2.63	0.046	0.15	1.44	0.87	0.167	0.88
Dy	20.16	19.26	12.43	0.215	0.5	8.32	5.04	1.43	3.98
Ho	3.21	2.73	1.71	0.032	0.134	1.45	0.9	0.38	0.55
Er	6.45	5.61	2.99	0.154	0.53	2.67	2.02	1.16	1.49
Tm	0.62	0.5	0.302	0.0172	0.074	0.313	0.192	0.155	0.154
Yb	2.09	1.52	1.1	0.32	0.64	1.61	0.7	1.24	0.85
Lu	0.204	0.107	0.142	0.047	0.066	0.15	0.091	0.3	0.136
Y	74.5	67.69	39.02	0.9	4.08	32.16	21.95	9.28	12.72
Li	1.23	1.26	1	4.51	7.03	3.47	5.11	23.92	15.32
Be	1.38	2.29	1.68	0.49	0.45	0.68	1.08	0.44	1.31
B	7.83	4.79	4.81	4.37	6.09	7.6	8.56	12.26	8.34
Sc	111.97	117.1	102.05	13.91	39.43	89.14	66.41	39.33	76.33
Ti	16094	15499	13371	943	1959	8511	6309	614	7184
V	1076.27	937.89	1295.11	176.44	574.96	933.34	671.92	278.57	2906.26
Cr	159.98	132.05	133.96	93.65	96.32	353.11	255.01	90.35	218.21
Mn	516	499	492	1789	429	762	714	1616	454
Fe	154693	153844	164252	155034	102013	125065	120071	78507	116168
Co	105.91	104.37	98.22	119.47	107.94	89.14	82.63	44.26	85.25
Zn	354.86	347.06	335.13	458.1	267.98	218.29	214.91	111.46	223.01
Ga	47.78	45.36	55.21	5.38	27.28	29.96	28.3	6.08	31.3
Ge	5.74	9.26	8.03	4.03	5.35	3.49	3.11	1.93	4.91
As	2.9	2.1	1.82	1.31	2.94	2.94	2.58	2.6	2.2

Continued the **Table S7**.

Sample	G28-amp01	G28-amp02	G28-amp03	G24-amp01	G24-amp02	G24-amp03	G24-amp04	G25-amp01	G25-amp02
Rb	10.99	11.68	10.26	0.091	0.45	1.96	2.13	0.083	28.01
Sr	59.44	61.89	57.58	1.74	14.43	55.6	49	8.21	36.9
Zr	49.81	43.83	29.56	1.17	5.1	50.48	13.24	45.99	10.03
Nb	19.7	19.92	18.15	0.46	0.45	7.14	3.89	0.075	3.61
Ba	469.05	380.27	340.96	0.45	4.69	55.57	38.36	0.45	143.67
Hf	4.94	4.93	3.29	0.243	0.34	3.05	1.35	1.31	1.2
Th	0.099	0.032	0.095	0.038	0.075	0.128	0.116	0.069	0.059
U	0.056	0.048	0.053	0.042	0.059	0.1	0.065	0.0178	0.046
Σ REE	377.92	336.77	265.67	2.59	18.41	66.29	27.98	7.40	70.03
Σ LREE	264.23	230.15	181.84	1.07	12.58	28.72	7.27	1.13	43.25
Σ MREE	76.70	72.88	62.53	0.69	3.74	21.62	10.90	1.44	18.74
Σ HREE	36.99	33.74	21.30	0.83	2.09	15.95	9.81	4.83	8.04
(La/Yb) _N	7.63	7.13	7.04	0.13	1.54	0.14	0.08	0.05	1.68
(La/Sm) _N	0.42	0.29	0.24	0.14	0.76	0.02	0.01	0.17	0.14
(Gd/Yb) _N	13.16	17.09	18.87	0.74	1.02	5.44	7.08	0.63	7.60
δ_{Eu}	0.83	0.75	0.88	1.33	5.72	0.57	0.46	0.92	0.72

Notes: (La/Yb)_N = (La/0.237)/(Yb/0.17); (La/Sm)_N = (La/0.237)/(Sm/0.153); (Gd/Yb)_N = (Gd/0.2055)/(Yb/0.17); δ_{Eu} = (Eu/0.058)/SQRT(Sm/0.153*Gd/0.2055).

Table S8. Mineral volumes (vol%) of whole section and microdomains 1 and 2 of the Opx-bearing mafic granulite sample G28.

	Grt	Pl	Cpx	Opx	Amp	Qtz	Cum	Ilm
Whole section	20.2	17.06	21.39	1.36	23.52	1.78	1.41	2.87
Microdomain 1	29.17	19.84	15.28	0.94	18.03	0.75	0.66	2.36
Microdomain 2	39.55	30.06	6.03	0.3	11.99	1.17	0.2	1.08

Table S9. Calculated bulk-rock compositions (mol%) used for pseudosection modeling of mafic granulites from the Haiyangsuo complex.

Sample	Metamorphic period		H ₂ O	SiO ₂	Al ₂ O ₃	CaO	MgO	FeO	K ₂ O	Na ₂ O	TiO ₂	O	
Opx-bearing mafic granulite G28	M ₁	<i>T-X(H₂O)</i> of M ₁	X(0)	0.5	48.92	8.54	12.94	9.78	14.64	0.35	2.02	1.75	0.56
			X(1)	5.69	46.37	8.09	12.27	9.27	13.88	0.33	1.92	1.66	0.53
	M ₁	<i>P-X(O)</i>	X(0)	2.39	48.25	8.42	12.76	9.64	14.44	0.35	1.99	1.73	0.02
			X(1)	2.28	45.99	8.03	12.17	9.19	13.77	0.33	1.9	1.65	4.7
	M ₁		2.37	47.88	8.36	12.66	9.57	14.33	0.34	1.98	1.71	0.8	
	M ₂ from microdomain 1	<i>P-T</i>	1.23	49.02	9.99	12.52	8.79	14.21	0.16	2.26	1.32	0.36	
Opx-absent mafic granulite G24		<i>P-T</i>	0.8	51.32	12.43	11.18	5.98	14.11	0.12	2.8	0.64	0.3	
			1.2	50.17	8.65	13.35	12.47	10.45	0.28	1.52	0.87	1.04	
Cpx-bearing garnet amphibolite G25		<i>P-T</i>	1.7	53.48	8.87	10.76	10.85	9.23	0.45	2.41	0.89	1.36	

Table S10. Comparison of mineral assemblages and *P-T* conditions of granulites from the Haiyangsuo complex and from the Jiaobei terrane.

Rock type	Prograde stage	Peak HP/MP granulite-facies stage	Post-peak MP granulite-facies stage	Amphibolite-facies retrograde stage	Reference
HP mafic granulite	Grt core + inclusion-phase minerals of Cpx + Pl ± Qtz 740–770 °C, 9–10 kbar	High-Ca Grt core + high-Al Cpx core + high-Na Pl ± Qtz 850–880 °C, 14.5–16.5 kbar	Opx + Cpx + Pl + Mag ± Amp 780–830 °C, 6.5–8.5 kbar	Amp + Pl + Mag ± Qtz 590–650 °C, 6.2–8.2 kbar	Liu et al., 2013
Mafic granulite	Grt core + inclusion-phase minerals of Amp + Cpx + Pl + Qtz ± Ep ± Rut 690–702 °C, 9.4–9.8 kbar	Grt mantle/rim + matrix-phase minerals of Cpx + Pl + Qtz ± Rut 780–890 °C, 13.1–15.1 kbar	Cpx + Pl + Opx 820–880 °C, 7.8–8.4 kbar	Amp + Pl, Cpx + Ilm + Qtz 690–760 °C, 6.4–7.2 kbar	Tam et al., 2012b
HP mafic granulite	Grt + Cpx + Pl + Qtz ± Amp ± Fe-Ti oxides 757–805 °C, 12.8–14.4 kbar	Symplectitic Opx + Cpx + Pl ± Amp ± Fe-Ti oxides 780–840 °C, 5.0–8.0 kbar	Symplectitic Amp + Pl + Fe-Ti oxides 665–730 °C, 5.5–7.3 kbar	Liu et al., 2017	
Granulites from the Jiaobei terrane in the southeastern North China block	MP pelitic granulite	Grt core + mineral inclusions such as Bi + Pl + Qtz + Ilm ± Mu ± St 870–900 °C, 9.4–10 kbar	Grt mantle + sil + Kf + Bi + Pl + Qtz + Ilm 840–900 °C, 6.3–6.6 kbar	Grt rim1 + Crd + Sil + Pl + Kf + Qtz + Grt rim2 + Crd + Bi + Pl + Kf + Ilm + Qtz + Ilm 815–830 °C, 4–5.2 kbar	Tam et al., 2012a
HP pelitic granulite	Grt core + inclusion-type minerals of Bi + Ky + Mu + Pl + Qtz + Ilm 645–670 °C, 9.3–10.7 kbar	Grt mantle + Kf + Ky + Pl + Bi + Rut + Ilm + Qtz 860–890 °C, 14.8–16.2 kbar	Grt rim + Sil + Pl + Bi + ilm + Qtz 710–740 °C, 6.3–8.5 kbar	Tam et al., 2012c	
HP pelitic granulite	Grt + Ky + Kf + Pl + Rut + Ilm + L 850–900 °C, 13.0–17.0 kbar from pseudosection modeling	Grt + Sil + Kf + Pl + Bi + L 800–900 °C, 7.0–17.0 kbar from pseudosection modeling	Zou et al., 2019		
Pelitic granulite	Grt + Ky + Pl ± Bi ± Kf + Rut + L 860–870 °C, 13.0–14.0 kbar	Grt + Sil + Crd + Pl + L ~ 840 °C, 4.0–7.0 kbar	Grt rims + Bi + Pl ~ 600 °C, 4.0–6.0 kbar	Zou et al., 2020	
Granulites from the Haiyangsuo complex in the northern Sulu orogen	Opx-bearing granulite G28	Grt + Cpx + Opx + Amp + Pl + Ilm + L 830–895 °C, 7.0–8.3 kbar from pseudosection modelling, 820–915 °C, 8.7–11.4 kbar from thermobarometry			This study
	Opx-absent granulite G24	Grt + Cpx + Amp + Pl + Ilm ± Opx + L 850–960 °C, 8.2–9.5 kbar from pseudosection modeling, 700–850 °C, 9.0–11.5 kbar from thermobarometry			This study