Table s1. Content of petrogenic oxides (wt %) in magmatic and metamorphic rocks in the Bayankol Massif

	Amp gabbro	Monzodiorite	Qtz diorite	Grt-Ky-St schist	Schist of the Ms-Sil zone		Fine grained rock of the Crd-Kfs zone	Coarse grained rock of the Crd-Kfs zone		Diatexite
	CH-31/1	CH-75/1	CH-40	CH-44	CH-20	CH-22	CH-28	CH-30	C-1a	CH-5a
SiO_2	48.39	49.07	57.89	67.78	62.77	63.59	59.59	46.63	51.25	47.61
TiO_2	1.64	2.44	0.71	0.67	0.96	1.00	1.26	1.38	1.39	1.40
Al_2O_3	14.20	16.63	17.02	16.72	18.73	17.53	20.39	32.41	27.89	30.04
Fe_2O_3	11.00	12.07	6.24	5.19	9.48	9.56	10.82	9.56	10.67	9.44
MnO	0.18	0.21	0.12	0.15	0.15	0.22	0.23	0.16	0.16	0.19
MgO	8.39	4.46	4.31	2.81	1.62	2.57	3.36	3.35	4.51	4.69
CaO	11.30	6.75	7.72	1.14	0.43	0.27	0.93	1.81	1.05	2.45
Na_2O	2.32	4.27	2.75	0.56	0.38	0.42	1.39	1.74	1.16	2.44
K_2O	0.97	2.39	1.55	3.31	3.87	3.28	1.48	1.52	0.72	1.12
P_2O_5	0.67	1.03	0.15	0.10	0.16	0.04	0.03	0.10	0.11	0.09
LOI	0.68	0.93	0.58	1.58	1.28	1.43	1.15	1.42	1.33	0.98
Total	99.74	100.26	99.04	100.02	99.84	99.92	100.63	100.08	100.24	100.46

Table s2. Chemical composition of garnet (wt %).

	Ky-1			CH-44			CH-20			CH-22		CH-107		
	c	mid	r	c	mid	r	c	mid	r	c	r	c	ext	r
SiO_2	37.68	37.78	37.84	37.51	37.15	36.92	37.15	37.40	37.01	36.48	37.07	37.68	37.85	37.46
TiO_2	0.12	0.12	0.00	0.04	0.05	0.00	0.25	0.04	0.02	0.06	0.01	0.24	0.03	0.02
Al_2O_3	20.51	20.79	21.23	20.96	20.83	20.75	20.53	20.71	20.80	20.69	21.15	20.88	21.11	20.69
FeO	23.13	24.94	29.41	31.18	34.53	36.05	27.80	32.93	34.49	30.64	33.00	34.99	34.30	34.70
MnO	10.95	8.82	7.61	6.41	3.19	1.83	7.95	4.22	2.97	6.82	4.10	1.79	1.70	2.78
MgO	1.88	2.48	3.22	1.84	2.32	2.90	1.04	2.51	2.41	3.91	4.25	4.21	4.53	3.56
CaO	5.96	5.53	1.64	2.73	2.18	1.77	5.59	2.95	2.51	0.52	0.67	1.01	1.03	1.26
Na_2O	0.03	0.02	0.01	–	0.02	–	0.05	0.10	–	0.05	0.06	–	0.03	0.04
K_2O	–	–	–	–	–	0.02	–	0.01	0.01	–	–	–	0.01	0.01
Total	100.26	100.48	100.95	100.66	100.26	100.24	100.36	100.36	100.34	99.17	100.49	100.83	100.62	100.51
X_{Alm}	0.51	0.55	0.65	0.70	0.77	0.79	0.62	0.72	0.77	0.68	0.72	0.77	0.76	0.76
X_{Pyr}	0.07	0.10	0.13	0.07	0.09	0.12	0.04	0.10	0.10	0.15	0.17	0.16	0.18	0.14
X_{Sps}	0.25	0.20	0.17	0.15	0.07	0.04	0.18	0.09	0.07	0.15	0.09	0.04	0.04	0.06
X_{Grs}	0.17	0.16	0.05	0.08	0.06	0.05	0.16	0.08	0.07	0.01	0.02	0.03	0.03	0.04
#Mg	0.13	0.15	0.16	0.09	0.11	0.13	0.06	0.12	0.11	0.19	0.19	0.18	0.19	0.15

Table s2. Continue.

	CH-28			C-1a			CH-30		CH-36			CH-77		CH-78	
	c	mid	r	c	mid	r	c	r	c	mid	r	c	r	c*	r*
SiO_2	37.55	37.91	37.73	37.22	36.78	37.31	37.16	36.75	38.09	37.35	36.45	37.59	37.27	37.33	36.91
TiO_2	0.22	0.01	0.00	0.15	0.17	0.00	0.02	0.04	0.10	0.00	0.00	0.07	0.05	0.12	0.05
Al_2O_3	20.88	20.94	21.14	20.79	20.58	20.93	21.29	21.00	21.89	21.56	20.85	21.33	20.43	20.64	20.46
FeO	33.98	34.00	35.06	35.01	34.96	35.99	33.67	36.13	30.54	33.60	34.24	30.95	34.66	33.07	34.49
MnO	2.03	1.79	2.02	1.78	1.33	0.88	0.83	1.47	1.50	1.52	2.02	1.80	1.35	2.22	2.52
MgO	4.54	4.95	3.94	5.29	5.37	4.30	5.05	3.08	6.84	4.74	3.62	6.42	5.23	5.82	4.60
CaO	1.30	1.20	1.07	0.70	0.71	1.49	1.17	1.31	1.25	1.46	1.84	1.10	1.46	0.78	0.81
Na_2O	–	–	0.03	0.02	0.02	0.04	0.05	0.01	0.03	–	0.01	0.01	0.03	0.03	0.01
K_2O	–	–	–	0.01	–	–	–	–	–	–	–	–	0.01	0.01	–
Total	100.54	100.92	101.05	100.96	100.24	101.18	99.33	99.87	100.28	100.23	99.20	99.34	100.80	100.02	99.85
X_{Alm}	0.74	0.74	0.77	0.74	0.75	0.77	0.75	0.81	0.67	0.74	0.76	0.68	0.73	0.71	0.75
X_{Pyr}	0.18	0.19	0.15	0.20	0.20	0.16	0.20	0.12	0.27	0.19	0.14	0.25	0.20	0.22	0.18
X_{Sps}	0.04	0.04	0.05	0.04	0.03	0.02	0.02	0.03	0.03	0.03	0.05	0.04	0.03	0.05	0.06
X_{Grs}	0.04	0.03	0.03	0.02	0.02	0.04	0.03	0.04	0.04	0.04	0.05	0.03	0.04	0.02	0.02
#Mg	0.19	0.21	0.17	0.21	0.21	0.18	0.21	0.13	0.29	0.20	0.16	0.27	0.21	0.24	0.19

Table s2. Ending.

	CH-5			
	c	c	r	r
SiO_2	38.56	38.33	37.73	37.37
TiO_2	0.08	0.07	0.10	0.04
Al_2O_3	21.43	21.07	20.92	20.74
FeO	25.83	26.81	29.20	32.23
MnO	1.97	1.87	2.11	2.21
MgO	10.96	10.42	8.22	5.92
CaO	1.43	1.48	1.58	2.04
Na_2O	–	–	–	0.04
K_2O	0.02	–	–	–
Total	100.28	100.05	99.86	100.62
X_{Alm}	0.53	0.55	0.61	0.68
X_{Pyr}	0.40	0.38	0.31	0.22
X_{Sps}	0.04	0.04	0.04	0.05
X_{Grs}	0.04	0.04	0.04	0.05
#Mg	0.43	0.41	0.33	0.25

Note. C, mid, ext, r – core, mid, external and rim of porphiroblast, * – atoll Grt. Here and further: #Mg = Mg / (Fe + Mg), blank – below detection limit.

Table s3. Chemical composition of cordierite (wt %).

	CH-107			CH-28				CH-30			CH-36	
	mtx	mtx	mtx	incl.mid	crn2	mtx	crn1a	incl.c	mtx	crn1b	incl.c	crn2
SiO_2	49.00	49.04	48.41	48.24	49.03	48.87	47.66	48.29	49.02	48.13	48.35	48.84
TiO_2	–	0.01	0.01	–	0.02	–	0.02	–	–	–	–	–
Al_2O_3	32.59	32.35	32.25	32.94	32.65	32.91	33.54	33.10	33.00	32.44	32.77	33.01
FeO	7.27	7.18	7.40	6.93	7.24	7.69	7.38	7.51	8.00	8.01	6.83	7.15
MnO	0.18	0.20	0.16	0.11	0.13	0.13	0.14	0.09	0.07	0.10	0.10	0.16
MgO	8.55	8.76	8.74	9.51	8.96	8.71	8.57	9.04	8.18	8.21	9.49	9.03
CaO	0.02	–	0.03	0.03	0.02	0.03	0.04	0.02	–	–	0.03	0.02
Na_2O	0.36	0.44	0.47	0.24	0.29	0.42	0.39	0.11	0.15	0.39	0.08	0.19
K_2O	0.01	–	–	0.01	–	0.01	0.01	0.02	–	0.01	–	0.01
Total	98.06	98.12	97.49	98.19	98.47	98.79	97.78	98.35	98.42	97.29	97.80	98.53
#Mg	0.68	0.69	0.68	0.71	0.69	0.67	0.67	0.68	0.65	0.65	0.71	0.69
T(Wy09)	767	726	707	829	803	739	749	897	876	752	912	855
T(Mi08)	755	706	683	828	798	721	733	908	883	736	926	859
T(Tr18)	770	729	710	833	807	742	752	901	880	755	917	859

Table s3. Ending.

	C-1a				CH-77		CH-78	CH-5			
	c	r	incl.mid	crn2	incl.c	mtx	incl.a	incl.c*	c	r	r
SiO_2	48.47	48.71	48.52	48.36	49.26	48.22	48.77	48.58	49.72	48.67	48.23
TiO_2	0.00	0.00	0.01	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Al_2O_3	33.10	33.00	33.37	32.89	33.55	32.99	33.03	33.37	33.73	33.23	32.84
FeO	6.98	7.56	6.62	7.30	5.46	7.57	7.38	3.75	3.58	5.33	5.90
MnO	0.04	0.04	0.06	0.07	0.04	0.10	0.16	0.08	0.13	0.20	0.15
MgO	9.47	8.97	9.64	9.06	10.04	9.20	9.12	11.30	11.05	10.23	9.95
CaO	0.02	–	0.05	0.02	–	0.04	0.02	0.05	0.03	0.01	0.04
Na_2O	0.17	0.18	0.15	0.21	0.06	0.11	0.19	0.09	0.03	0.03	0.07
K_2O	0.01	0.01	0.01	0.01	–	–	0.01	0.01	0.03	–	0.01
Total	98.41	98.62	98.58	98.09	98.43	98.41	98.78	97.24	98.46	97.70	97.22
#Mg	0.71	0.68	0.72	0.69	0.77	0.68	0.69	0.84	0.85	0.77	0.75
T(Mi08)	871	865	883	847	939	908	859	920	960	957	933
T(Wy09)	866	860	876	845	923	897	855	907	941	938	917
T(Tr18)	870	864	880	849	927	901	859	911	945	943	922

Note. Mtx – grain in matrix; c, r. – core and rim of porphyroblast; crn1a, crn1b – corona around St and Ky, respectively; crn2 – corona around Grt; incl.c, incl.mid – inclusion in core and mid part of Grt; incl.a – inclusion in atoll Grt; incl.c* – Spl-Bt-Crd bunch in Grt porphyroblast core. T(Mi08), T(Wy09), T(Tr18) – temperatures derived with T(Na-in-Crd) after [Mirwald et al., 2008; Wyhlidal et al., 2009; Tropper et al., 2018], respectively.

Table s4. Chemical composition of mica (wt %).

	Ky-1	CH-44	CH-20		CH-22	CH-107	CH-28			C-1a		CH-30	
	Biotite												
	mtx	mtx	incl.c	incl.r	r	incl.r	incl.c	incl.c*	incl.crn	incl.mid	incl.r	incl.a	mtx
SiO_2	35.56	35.55	35.64	35.44	36.39	36.69	36.42	36.86	36.82	36.25	35.83	37.34	36.93
TiO_2	1.40	1.97	2.84	3.26	2.19	1.80	2.21	1.74	1.75	1.70	1.78	1.49	1.92
Al_2O_3	18.87	18.92	19.45	19.38	20.37	20.06	20.46	19.63	19.49	19.44	19.89	20.17	20.17
FeO	17.87	19.91	19.24	20.01	19.02	18.20	13.93	18.26	17.12	16.34	18.04	15.89	18.31
MnO	0.12	0.03	0.11	0.06	0.18	0.05	0.01	0.04	0.04	0.03	0.02	0.02	0.03
MgO	11.67	9.13	9.61	9.01	9.81	11.03	12.86	11.13	10.12	12.91	11.26	11.76	9.30
CaO	0.01	–	–	–	–	0.01	–	–	–	0.02	0.11	0.02	0.05
Na_2O	0.08	0.07	0.28	0.37	0.25	0.37	0.38	0.25	0.20	0.12	0.14	0.18	0.19
K_2O	8.99	9.03	9.19	9.25	8.97	8.81	9.21	8.70	8.71	8.55	7.99	8.40	8.57
Total	94.57	94.60	96.37	96.84	97.25	97.03	95.58	96.70	94.26	95.61	95.25	95.28	95.48
#Mg	0.54	0.45	0.47	0.45	0.48	0.52	0.62	0.52	0.51	0.58	0.53	0.57	0.48

Table s4. Ending.

	CH-36		CH-77		CH-78	CH-5a				Ky-1	CH-44	CH-20		CH-22	CH-30	C-1a
	Biotite									Muscovite						
	mtx	incl.c	incl.c	mtx	incl.c	incl.c**	c	r	r	mtx	mtx	incl.c	mtx	mtx	rlc	rlc
SiO_2	36.28	37.02	36.54	35.69	34.92	36.66	38.20	37.96	35.82	46.35	47.28	45.63	45.37	45.41	46.24	45.24
TiO_2	1.98	2.10	1.83	1.67	2.00	1.89	2.46	2.34	2.59	0.26	0.31	0.77	0.76	0.37	0.40	0.59
Al_2O_3	19.24	19.93	19.50	18.95	19.28	19.09	16.69	16.58	18.65	35.62	35.13	34.88	35.54	35.59	37.80	37.59
FeO	18.49	17.53	17.46	17.24	18.02	10.75	12.26	13.62	15.37	1.79	1.23	1.81	1.64	1.41	1.33	0.96
MnO	0.03	0.05	0.05	0.02	0.03	0.02	0.07	0.10	0.09	–	–	0.04	–	–	–	–
MgO	10.46	11.35	11.13	10.85	11.60	16.85	16.64	15.34	13.25	0.63	0.89	0.61	0.49	0.90	0.60	0.48
CaO	–	–	–	0.01	0.01	0.02	0.02	–	0.01	0.01	–	–	–	–	–	–
Na_2O	0.20	0.22	0.16	0.14	0.36	0.20	0.24	0.17	0.13	1.41	0.69	0.67	0.74	1.04	0.56	0.51
K_2O	8.28	8.39	8.79	9.19	8.88	9.02	8.82	9.08	9.27	8.62	9.33	9.86	9.97	9.29	8.60	8.68
Total	94.97	96.60	95.47	93.77	95.16	95.49	95.41	95.21	95.16	94.69	94.85	94.32	94.52	94.06	95.76	94.22
#Mg	0.50	0.54	0.53	0.53	0.53	0.74	0.71	0.67	0.61	–	–	–	–	–	–	–

Note. Mtx – grain in matrix; incl.c, incl.mid, incl.r – inclusion in core, mid, rim of Bt porphyroblast; incl.c* – inclusion in core of Crd porphyroblast; incl.c** – Spl-Bt-Crd bunch in Grt porphyroblast core; incl.crn – inclusion in Crd corona round Grt; incl.a – inclusion in atoll Grt; rlc – relict in Sil (in sample C-1) or relict at the contact of St rounded with common Crd corona (in sample CH-30).

Table s5. Chemical composition of feldspar (wt %).

	Ky-1	CH-44	CH-20		CH-22	CH-28	CH-30		CH-36		CH-77	CH-78	CH-5a	
	Plagioclase													
	mtx	mtx	incl*	mtx	mtx	mtx	incl.c	mtx	incl.c	mtx	incl.c	incl.a	incl	incl
SiO_2	62.36	62.65	58.57	60.34	62.66	60.37	60.81	63.07	60.56	60.21	44.74	62.82	48.72	47.41
TiO_2	–	–	0.01	0.01	–	–	0.05	0.04	–	–	–	–	0.01	0.01
Al_2O_3	23.55	23.62	26.30	24.97	22.77	24.84	25.00	23.81	24.82	25.25	35.99	23.50	32.67	34.27
FeO	0.29	0.29	0.46	0.04	0.03	0.11	0.27	0.17	0.17	0.05	0.16	0.03	0.16	0.05
MnO	–	–	0.05	–	–	–	0.01	–	–	–	–	–	0.01	0.03
MgO	0.01	0.01	–	–	–	–	0.01	–	–	0.01	–	–	–	–
CaO	5.38	5.82	7.95	6.35	3.89	6.36	6.47	5.54	6.22	6.64	7.26	5.10	15.84	17.29
Na_2O	8.69	8.33	7.26	7.85	9.78	8.06	8.31	8.25	8.46	7.76	7.29	8.70	2.58	1.77
K_2O	0.08	0.08	0.04	0.07	0.06	0.06	0.05	0.03	0.05	0.06	0.06	0.08	0.02	0.03
Total	100.35	100.65	100.70	99.65	99.19	99.81	101.01	100.93	100.30	99.99	95.52	100.23	100.00	100.87
An	0.25	0.28	0.38	0.31	0.18	0.30	0.30	0.27	0.29	0.32	0.36	0.24	0.77	0.84
Ab	0.75	0.72	0.62	0.69	0.82	0.70	0.70	0.73	0.71	0.68	0.64	0.75	0.23	0.16
Or	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00

Table s5. Ending.

	CH-28	C-1a	CH-30	CH-36	CH-5a
	K-feldspar				
	mtx				
SiO_2	64.90	63.69	64.67	65.22	64.73
TiO_2	–	–	0.01	0.01	–
Al_2O_3	18.90	19.78	19.08	19.10	19.02
FeO	0.03	0.34	0.18	0.40	0.05
MnO	–	0.06	0.04	0.06	–
MgO	0.01	0.02	0.05	0.01	0.02
CaO	0.07	0.55	0.85	0.19	0.27
Na_2O	2.28	2.32	3.22	2.72	2.90
K_2O	13.42	13.40	12.26	12.50	12.87
Total	99.61	100.16	100.36	100.21	99.86
An	0.00	0.03	0.04	0.01	0.01
Ab	0.20	0.20	0.27	0.25	0.25
Or	0.79	0.77	0.69	0.74	0.74

Note. Mtx – grain in matrix, incl.c – inclusion in core of Grt porphiroblast; incl.c* – inclusion in Qtz inclusion in core of Grt porphiroblast; incl.a – inclusion in atoll Grt.

Table s6. Chemical composition of staurolite (wt %).

	Ky-1	CH-44	CH-20		CH-28	CH-30			CH-36		CH-78	
	mtx	mtx	mtx	incl.c	rlc	rlc	rlc *	rlc	rlc	rlc	rlc.c	rlc.r
SiO_2	27.50	26.99	26.42	26.51	27.30	27.34	26.89	27.50	27.84	28.01	26.32	28.27
TiO2	0.76	0.06	0.47	0.77	0.67	0.23	0.06	0.76	0.38	0.66	0.56	0.80
Al_2O_3	53.24	54.54	54.26	55.32	53.49	54.52	55.15	53.24	53.40	53.00	54.27	53.17
FeO	13.26	13.08	13.68	13.55	11.93	13.59	13.11	13.26	13.39	13.47	12.87	12.54
MnO	0.08	0.08	0.19	0.23	0.11	0.07	0.08	0.08	0.12	0.19	0.19	0.16
MgO	1.94	1.64	1.36	1.65	1.65	1.79	1.64	1.94	1.95	1.70	1.73	1.78
ZnO	0.95	1.06	1.13	1.01	2.19	0.93	1.06	0.86	0.94	1.18	2.09	1.96
Total	97.71	97.50	97.57	98.18	97.43	98.50	98.04	97.71	98.06	98.26	98.02	98.69
#Mg	0.21	0.18	0.15	0.18	0.20	0.19	0.18	0.21	0.18	0.21	0.19	0.20

Note. Mtx – grain in matrix, inclusion in core of Grt porphiroblast; rlc – relict in Crd corona; rlc * – relict from Fig. 5.

Table s7. Chemical composition of spinel (wt %).

	CH-30				CH-77	CH-36	CH-78	CH-5a			
	incl-1	incl-1	incl-1-c	incl-1-r	incl-1	incl-2	incl-2	incl-3	incl-3*	mtx	mtx
SiO_2	0.25	0.28	0.05	0.23	0.06	0.15	0.01	0.00	0.03	0.02	0.03
TiO_2	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.02	0.01	0.04
Al_2O_3	59.57	59.68	59.26	59.13	58.40	57.91	57.71	59.21	58.72	59.78	57.57
FeO	33.23	25.56	29.99	29.82	24.00	23.73	19.83	31.64	30.70	32.44	36.60
MnO	0.10	0.04	0.07	0.07	0.09	0.09	0.11	0.18	0.16	0.40	0.53
MgO	4.32	3.55	3.87	4.17	3.56	3.30	3.11	9.35	9.96	6.79	5.25
ZnO	3.31	10.21	5.58	5.75	12.76	13.93	19.29	0.71	0.72	0.66	0.85
Na_2O	0.14	0.39	0.22	0.26	0.56	0.54	0.00	0.06	0.03	0.00	0.02
Total	100.92	99.74	99.04	99.43	99.49	99.64	100.07	101.17	100.33	100.20	100.91
#Mg*	0.18	0.15	0.16	0.18	0.15	0.14	0.13	0.34	0.36	0.27	0.20

Note. Incl-1, incl-2, incl-3 – inclusion in Sil, St, Grt, respectively; incl-3* – Spl-Bt-Crd bunch in Grt porphyroblast core; c, r – core and rim of grain. #Mg* = Mg / (Fe+Mg+Mn+Zn).

Table s8. Chemical composition of amphibole (wt %) from gabbronorite of Bayan-Kol intrusion and P-T conditions of it formation.

	Sh3		Sh4	
SiO_2	41.31	41.54	43.33	42.48
TiO_2	3.54	1.87	0.49	1.88
Al_2O_3	13.09	12.91	13.15	13.23
Cr_2O_3	0.20	0.21	0.15	0.24
FeO	8.40	8.54	8.89	8.55
MnO	0.12	0.08	0.09	0.09
MgO	14.82	15.34	15.68	15.32
CaO	11.24	11.38	11.10	11.32
Na_2O	2.74	2.63	2.58	2.44
K_2O	1.07	1.04	1.06	1.19
Total	96.68	95.80	96.89	97.00
#Mg	0.76	0.76	0.76	0.76
P(Sc92)	7.8	7.7	7.7	7.8
P(Ho87)	8.0	7.9	8.0	8.1
P(HZ86)	7.5	7.4	7.4	7.5
Pav	7.8	7.7	7.7	7.8
T(RR12)	1028	993	950	981
T(P16)	1022	985	938	971
Tav	1025	989	943	975

Note. Amp geobarometer: P(Sc92) – [Schmidt, 1992]; P(Ho87) – [Hollister et al., 1987]; P(HZ86) – [Hammarstrom, Zen, 1986]; Pav – average estimate after three barometers; Amp температур: T(RR12) – [Ridolfi, Renzulli, 2011]; T(P16) – [Putirka, 2016]; Tav – average estimate after two termometers.