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Overview of Gemstone Resources in China

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Supplementary Materials

Table S1. Statistics of chemical compositions of emeralds in China (wt.%).

	Davdar of Xinjiang				Dayakou of Yunnan			
	XJ1	**XJ2**	**XJ3**	**XJ4**	**YN17**	**YN1**	**YN46**	**YN65**
SiO_2	66.29	65.52	65.37	65.72	66.69	66.35	66.06	66.15
TiO_2	0.01	0.02	0.02	0.01	n.d.	n.d.	n.d.	n.d.
Al_2O_3	17.18	16.86	16.74	16.43	14.47	17.38	15.88	16.44
Sc_2O_3	0.02	0.02	0.02	0.12	n.d.	n.d.	0.04	0.02
V_2O_3	0.21	0.22	0.23	0.25	0.05	0.29	0.72	0.73
Cr_2O_3	0.18	0.17	0.17	0.54	0.05	0.06	0.04	0.04
BeO	n.d.	n.d.	n.d.	n.d.	n.d.	13.59	n.d.	n.d.
MgO	0.72	0.86	0.95	1.03	2.07	0.78	0.95	1.22
CaO	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.02
MnO	0.03	0.02	0.03	0.03	0.02	0.00	0.00	0.00
FeO	0.27	0.32	0.39	0.17	0.37	0.32	0.34	0.50
Na_2O	0.49	0.57	0.65	0.63	0.95	0.18	0.71	0.80
K_2O	0.00	0.00	0.01	0.04	0.03	0.01	0.03	0.03
Total	85.4	84.58	84.58	84.97	84.71	98.97	84.77	85.95
Data source	[1]				[2]	[3]	[4]	[5]

n.d. = not detected.

Table S2. Representative EPMA of various gem-quality minerals from China.

	Ruby	Sapphire		Tourmaline		Olivine	
	Baicheng of Xinjiang	**Changle of Shandong**	**Fuping of Hebei**	**Xinjiang**	**Yunnan**	**Songshan of Jilin**	**Damaping of Hebei**
SiO_2	n.d.	0.02–0.71	0.04–0.05	37.01–36.56	37.86–40.94	40.96–41.92	41.00–42.45
TiO_2	n.d.	0.03–0.07	n.d.	n.d.	n.d.	0.00–0.06	0.00–0.02
Al_2O_3	98.47–99.30	97.67–98.88	96.20–98.58	30.88–40.10	36.59–41.53	0.00–0.02	0.00–0.04
V_2O_5	0.04–0.14	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
P_2O_5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cr_2O_3	0.12–0.62	0.00–0.04	0.17–0.32	n.d.	n.d.	0.00-0.01	0.00-0.13
MgO	n.d.	n.d.	n.d.	n.d.	0.02–0.16	48.26–49.74	48.78–50.84
CaO	0.01–0.02	0.02–0.06	n.d.	0.05–0.36	n.d.	0.01–0.04	0.00–0.08
MnO	0.01–0.06	0.02–0.13	0.02–0.14	0.28–2.47	0.32–0.34	0.14–0.17	0.10–0.27
FeO_T	0.01–0.03	0.91–1.33	0.46–0.81	0.00–12.55	0.08–0.98	7.86-8.99	8.41–8.79

NiO	0.01–0.05	n.d.	n.d.	n.d.	n.d.	0.33–0.37	0.00–0.39
Na_2O	n.d.	n.d.	n.d.	1.82–2.27	1.22–2.15	0–0.01	0.00–0.02
K_2O	n.d.	0.01–0.09	n.d.	0.01–0.11	n.d.	0.00–0.01	0.00–0.01
F	n.d.	n.d.	n.d.	0.03–1.28	n.d.	n.d.	n.d.
Data source	[6]	[7] [8]	[9]	[10]	[11]	[12]	

	Garnet		**Serpentine jade**		**Turquoise**	**Aquamarine**		
	Jinan of Shandong	**Nanminghe of Hebei**	**Xiuyan of Liaoning**	**Taian of Shandong**	**Ma'anshan of Anhui**	**Fugong of Yunnan**	**Xin Jiang**	**Pingwu of Sichuan**
SiO_2	36.75–38.09	35.66–36.37	44.06–44.82	41.90–44.70	0.00–0.23	63.87–66.08	64.31–65.70	63.19
TiO_2	0.64–0.87	0.00–0.03	n.d.	0.00–0.23	0.00–0.10	0.00–0.05	0.03~0.04	0.01
Al_2O_3	10.40–12.19	0.38–0.71	0.16–0.22	0.05–0.65	36.56–39.94	16.55–17.49	18.39–18.71	17.31
P_2O_5	n.d.	n.d.	0.07–0.09	n.d.	37.15–39.95	0.00–0.04	n.d.	n.d.
Cr_2O_3	0.00–0.03	0.00–0.02	n.d.	n.d.	n.d.	0.00–0.06	n.d.	n.d.
BeO	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
MgO	0.02–0.04	0.66–0.78	40.65–41.95	35.95–41.46	0.00–0.03	0.00–0.37	0.00–0.06	0.07
CaO	35.40–35.83	32.14–32.71	0.07–0.18	0.00–0.09	0.02–0.13	0.00–0.01	0.18–0.61	0.30
CuO	n.d.	n.d.	n.d.	n.d.	1.55–9.24	n.d.	n.d.	n.d.
MnO	0.14–0.17	0.03–0.16	0.01–0.05	0.00–0.18	n.d.	0.00–0.05	n.d.	n.d.
FeO_T	11.68–14.64	27.74–28.33	0.37–1.65	1.35–9.44	0.07–2.32	0.16–0.63	0.64–1.08	0.21
Na_2O	n.d.	n.d.	0.11–0.12	0.00–0.31	0.00–0.16	0.20–0.72	0.00–0.29	1.47
K_2O	n.d.	n.d.	0.10–0.12	0.00–0.14	0.01–0.14	0.00–0.05	0.00–0.03	0.09
Data source	[13]	[14]	[15]	[16]	[17]	[18]	[19] [20]	[21]

Note: n.d. = not detected.

Table S3. Representative Electron microprobe analysis (EPMA) of different nephrite jade from Xinjiang province, China.

Location	Xinjiang											
	Hetian			Yutian			Qiemo		Ruoqiang		Manasi	
Sample	MYH-1-1	MYH-1-2	MYH-1-3	YT-1-1	YT-1-2	YT-1-3	QM-1-1	QM-1-2	RQ-1-1	RQ-1-2	MNS-1-1	MNS-1-2
P_2O_5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
SiO_2	57.74	57.67	56.38	58.01	56.88	58.49	58.59	58.28	58.34	58.77	57.11	57.20
TiO_2	0.01	n.d.	0.01	0.01	0.00	0.04	0.00	0.05	0.00	0.00	0.00	0.05
Al_2O_3	0.70	0.65	0.63	0.29	0.49	0.67	0.75	1.68	0.76	0.72	0.23	0.64
Cr_2O3	n.d.	0.02	n.d.	0.05	0.03	0.99	0.01	0.02	0.00	0.00	0.05	0.05
FeO	0.65	0.96	4.31	0.41	1.09	0.00	0.36	0.22	0.97	0.98	3.87	6.24
MnO	0.06	0.05	0.06	0.08	0.08	0.06	0.04	0.11	0.09	0.08	0.23	0.17
MgO	22.95	22.78	20.68	24.02	23.02	22.62	24.42	24.23	24.09	23.75	23.52	19.66
CaO	12.90	12.50	12.95	12.90	13.11	13.24	13.08	13.38	12.93	12.82	12.77	12.86
Na_2O	0.08	0.11	0.07	0.09	0.00	0.06	0.16	0.23	0.09	0.10	0.03	0.07
K_2O	0.03	0.09	n.d.	0.06	0.13	0.03	0.08	0.12	0.14	0.08	0.02	0.04
Total	95.11	94.88	95.12	95.92	94.83	96.20	97.48	98.40	97.42	97.33	97.93	97.04
Na^+	0.02	0.03	0.02	0.02	0.00	0.02	0.04	0.06	0.14	0.04	0.01	0.02
Mg^{2+}	4.78	4.76	4.38	4.91	4.81	4.67	4.94	4.87	4.90	4.82	4.83	4.10
Al^{3+}	0.12	0.11	0.11	0.05	0.07	0.11	0.12	0.27	0.12	0.12	0.04	0.11
K^+	0.01	0.02	n.d.	0.01	0.02	0.01	0.01	0.02	0.03	0.01	0.00	0.01

Si^{4+}	8.06	8.08	8.01	8.03	7.99	8.11	7.95	7.85	7.96	8.00	7.86	8.01
Ca^{2+}	1.93	1.88	1.97	1.91	1.97	1.89	1.90	1.93	1.89	1.87	1.89	1.93
P^{5+}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Fe^{2+}	0.08	0.10	0.51	0.01	0.00	0.12	0.04	0.01	0.11	0.12	0.45	0.73
Fe^{3+}	n.d.	0.02	n.d.	0.00	0.00	0.00	0.01	0.01	0.00	0.00	n.d.	n.d.
Ti^{4+}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n.d.	n.d.	0.00	0.00
Ba^{2+}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cr^{3+}	0.00	n.d.	n.d.	0.05	0.12	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Mn^{2+}	0.01	n.d.	n.d.	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.03	0.02
Ni^{2+}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
$Mg^{2+}/(Mg^{2+}+Fe^{2+})$	0.98	0.98	0.90	1.00	1.00	0.97	0.99	1.00	0.98	0.98	0.92	0.85

Note: n.d. = not discernible. All the original data were summarized from [22][23][24][25][26][27][28].

Table S4. Representative Electron microprobe analysis (EPMA) of different nephrite jade from other locations, China.

Location	Qinghai						Liaoning			Henan			Guangxi		
	--			Qilian			Xiuyan			Luanchuan			Dahua		
Sample	QH-1	QH-2	QG-3	QL-1	QL-2	QL-3	XY-1	XY-2	XY-3	LC-1	LC-2	LC-3	DH-1	DH-2	DH-3
P_2O_5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.00	0.00	0.00	n.d.	n.d.	n.d.	0.01	0.01	0.02
SiO_2	56.86	55.40	58.04	56.83	56.95	57.82	60.04	60.20	60.93	58.16	59.13	59.29	58.30	58.57	58.10
TiO_2	0.09	0.05	0.06	0.04	0.00	0.01	0.02	0.00	0.01	0.01	0.02	0.03	0.03	n.d.	n.d.
Al_2O_3	0.41	3.59	0.22	0.47	0.23	0.23	0.00	0.11	0.46	0.12	0.03	0.03	0.32	0.36	0.65
Cr_2O_3	0.26	0.12	0.00	0.16	0.33	0.18	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.01	0.05
FeO	2.03	3.72	2.01	3.91	5.48	4.12	0.45	0.16	1.27	0.75	0.69	0.70	0.76	0.79	0.80
MnO	0.09	0.09	0.04	0.02	0.09	0.07	0.06	0.03	0.05	0.09	0.07	0.10	0.16	0.15	0.17
MgO	21.08	19.89	22.15	22.01	20.80	22.21	23.50	22.97	22.65	23.92	23.15	23.76	23.26	23.53	23.28
CaO	12.64	13.22	12.70	12.62	12.85	13.22	13.46	13.11	12.04	12.79	13.57	13.58	13.87	14.08	13.46
Na_2O	0.10	0.44	0.13	0.04	0.04	0.01	0.00	0.02	0.07	0.04	0.02	0.03	0.05	0.05	0.08
K_2O	0.10	0.11	0.22	0.01	0.00	0.00	0.01	0.03	0.11	0.01	0.02	0.01	0.02	0.04	0.13
Total	93.43	96.52	95.58	96.11	96.77	97.88	97.83	96.62	97.60	95.93	96.72	97.63	96.93	97.64	97.01
Na^{+}	0.00	0.12	0.00	0.12	0.13	0.09	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02
Mg^{2+}	4.50	4.17	4.61	4.58	4.34	4.57	4.67	4.65	4.43	4.92	4.72	4.81	4.75	4.78	4.75
Al^{3+}	0.07	0.59	0.04	0.08	0.04	0.04	0.00	0.02	0.11	0.02	0.01	0.01	0.05	0.06	0.11
K^{+}	0.02	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Si^{4+}	8.15	7.79	8.10	7.93	7.96	7.98	8.00	8.00	8.00	8.03	8.09	8.05	7.99	7.98	7.96
Ca^{2+}	1.94	1.99	1.90	1.90	1.94	1.97	1.92	1.91	1.69	1.89	1.99	1.98	2.04	2.06	1.98
P^{5+}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.00	0.00	0.00	n.d.	n.d.	n.d.	0.00	0.00	0.00
Fe^{2+}	0.24	0.44	0.23	0.40	0.63	0.45	0.05	0.02	0.14	0.09	0.08	0.08	0.09	0.09	0.09
Fe^{3+}	n.d.	n.d.	n.d.	0.06	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	n.d.	n.d.	n.d.
Ti^{4+}	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n.d.	n.d.

Ba^{2+}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.00	0.00
Cr^{3+}	0.03	0.01	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Mn^{2+}	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02
Ni^{2+}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.00	0.00	0.00	0.01	0.00	0.00	n.d.	n.d.	n.d.
$Mg^{2+}/(Mg^{2+}+Fe^{2+})$	0.95	0.90	0.95	0.92	0.87	0.91	0.99	1.00	0.97	0.98	0.98	0.98	0.98	0.98	0.98

Note: n.d. = not discernible. All the original data were summarized from [29][30][31][32][33].

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