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Supplemental Material

Table S1. Information of samples from Yong'an basin

Table S2. Analysis results of trace elements from Yong'an basin

Table S3. Lithology and Nd isotopic compositions of samples from Yong'an basin

Table S4. Detrital zircon U-Pb geochronology of samples from Yong'an basin

Table S5. Element ratios of samples from Yong'an basin

Table S6. Calculation of denudation rates based on low-temperature thermochronology data

Table S1 Information of samples from Yong'an basin

Stratigraphy	Fm.	Location	Coordinate	Sample No.	Lithology	Analysis
Upper Cretaceous	Chong'an	Shangjiabang	117.20561662,25.30406144	SCA-9	Argillaceous siltstone	Trace element Nd isotope
			117.20626111,25.30413998	SCA-7	Argillaceous siltstone	
			117.20664781,25.30406294	SCA-5	Argillaceous siltstone	
			117.20909677,25.30400819	SCA-4	Fine sandstone	
			117.20991304,25.30414511	SCA-2	Fine sandstone	
Lower Cretaceous-Upper Cretaceous	Shaxian	Shangjiabang	117.21045007,25.30408764	SSX-24	Argillaceous siltstone	Trace element Nd isotope
			117.21169592,25.30397288	SSX-20	Argillaceous siltstone	
			117.21246919,25.30385748	SSX-14	Siltstone	
			117.21470303,25.30296786	SSX-11	Siltstone	U–Pb geochronology
			117.21607763,25.30230989	SSX-8	Coarse sandstone	
			117.21667898,25.30223299	SSX-7	Fine sandstone	
			117.20909677,25.30400819	SSX-4	Fine sandstone	
Lower Cretaceous	Bantou	Yong'an	117.3147636,25.96263147	JS- 10	Mudstone	Trace element Nd isotope
			117.32328236,25.95825690	JS- 6	Mud shale	
			117.32381344,25.95791445	JS- 4	Mud shale	
			117.32423186,25.95742248	JS- 2	Fine sandstone	U–Pb geochronology
Middle Jurassic	Zhangping	Zhangping	117.43989944,25.28230351	ZPD-7	Mudstone	Trace element
			117.43940592,25.28131399	ZPD-2	Mudstone	Nd isotope

Table S2 Analysis results of trace elements from Yong'an basin

Samples	ZPD-2	ZPD-7	JS-4-2	JS-6	JS-10	SSX-4	SSX-7	SSX11	SSX-14	SSX-20	SSX-24	SCA-2	SCA-4	SCA-5	SCA-7	SCA-9
ppm																
Sc	15.26	15.06	13.73	8.45	14.03	9.81	9.05	9.91	7.99	6.72	8.26	8.72	7.55	11.68	8.74	9.63
Ti	4976.2	4515.1	4054.5	2929.9	6060.1	3634.7	3099.6	3423.1	3149.2	2559.5	2968.4	3402.9	2771.6	3269.6	3777.6	3255.7
V	78.95	81.87	88.49	33.34	139.2	77.54	49.1	53.87	42.87	35.04	53.06	46.1	40.68	50.33	54.68	52.21
Cr	67.53	63.12	56.42	32.5	92.18	45.16	41.99	39.41	70.86	57.58	58.62	46.09	66.45	64.98	106.7	72.08
Mn	69.23	72.37	462.2	181.4	30.35	939.9	232	365.1	457	375.9	518.9	538.7	162.6	548.4	457	484.2
Co	3.931	4.361	7.28	6.21	2.42	12.39	6.34	6.53	8.14	5.21	6.48	6.86	5.41	7	7.83	7.42
Ni	10.46	10.4	27.9	14.54	25.6	17.95	19.87	15.91	31.16	25.08	26.24	19.93	26.39	30.21	47.35	33.35
Cu	16.24	16.09	19.6	10.55	13.7	17	14.01	13.15	10.69	10.04	12.47	11.95	8.86	13.07	12.64	12.91
Zn	53	49.71	95.11	53.61	26.08	66.48	83.23	70.48	55.63	46.25	63.42	66.24	52.81	68.31	63.86	73.17
Ga	26.57	26.01	23.75	17.34	23.48	14.82	13.45	16.61	12.91	10.19	14.16	14.18	11.34	15.44	13.71	15.28
Ge	3.092	2.738	3.17	2.28	1.73	1.78	2.03	2.91	1.79	1.43	1.97	1.98	1.41	2.01	1.98	1.98
Rb	259.7	262.6	235.6	138.8	150.4	184.8	163.9	201.6	141	112.1	172.1	168.7	134.6	194.4	146.1	193.2
Sr	31.21	26.6	106.7	123	74.87	20.43	57.51	203.3	77.52	62.61	82.17	81.39	46.89	72.26	80.57	71.27
Y	44.23	38.02	37.2	36.49	35.36	15.38	34.25	34.71	27.1	19.72	29.78	22.3	19.52	28.29	32.14	29.54
Zr	192.7	172.8	151.3	250.6	230.8	179.7	164.7	202.1	254.3	169.3	166.3	80.12	204.9	208.7	354.9	208.9
Nb	21.24	19.69	23.81	22.14	20.82	13.22	12.69	14.6	12.99	11.19	14.32	14.57	11.22	17.35	16.52	15.92
Cs	14.42	14.66	30.93	13.4	15.48	13.96	14.83	19.14	8.96	8.42	13.61	10.86	10.35	17.06	9.59	16.44

Ba	686.9	682.5	512.1	562.5	341.1	346.2	417	962.3	480.1	365.8	572	361.1	291.8	509.3	438.7	461.1
La	67.49	63.76	49.22	53.65	53.93	12.71	38.55	92.93	36.07	30.82	41.88	39.6	26.87	44.31	42.94	40.4
Ce	130.1	120.8	99.33	103.5	94.19	29.21	69.83	153.8	64.78	57.62	80.96	69.5	60.43	93.87	77.26	82.24
Pr	15.66	14.83	11.39	12.01	12.39	2.22	8.87	21.12	7.9	6.35	10.31	9.47	6.31	9.5	9.63	9.39
Nd	57.79	54.43	40.79	43.58	44.79	8.42	33.79	69.82	28.93	23.26	37.85	35.14	23.2	34.02	34.58	35.34
Sm	10.6	9.64	7.36	7.85	7.23	1.53	6.52	11.76	5.39	4.13	6.69	5.98	4.25	6.1	6.2	6.42
Eu	1.749	1.607	1.1	1.12	1.38	0.35	1.51	2.1	1.04	0.78	1.27	1.07	0.75	1.07	1.08	1.18
Gd	9.499	8.333	6.68	6.94	6.05	1.8	6.39	8.56	4.9	3.81	5.9	4.76	3.77	5.65	5.73	5.88
Tb	1.435	1.22	1.03	1.05	0.93	0.33	1.05	1.22	0.79	0.57	0.88	0.7	0.57	0.84	0.9	0.87
Dy	7.891	6.835	6.03	5.94	5.61	2.13	6.03	6.3	4.57	3.33	5.04	3.99	3.34	4.89	5.31	4.99
Ho	1.536	1.366	1.29	1.26	1.22	0.53	1.22	1.22	0.95	0.71	1.02	0.79	0.71	1.02	1.13	1.03
Er	4.09	3.646	3.54	3.47	3.43	1.59	3.19	3.22	2.65	1.96	2.79	2.21	2.02	2.77	3.17	2.84
Tm	0.575	0.511	0.53	0.53	0.51	0.26	0.46	0.45	0.39	0.29	0.4	0.32	0.31	0.41	0.48	0.42
Yb	3.782	3.401	3.54	3.61	3.31	1.84	3.02	2.98	2.68	1.95	2.7	2.12	2.02	2.77	3.22	2.77
Lu	0.566	0.514	0.55	0.55	0.51	0.3	0.46	0.45	0.41	0.3	0.42	0.32	0.32	0.43	0.51	0.44
Hf	5.599	5.119	4.65	7.44	6.4	5.24	4.76	5.76	6.97	4.86	4.89	2.58	5.64	6.11	9.72	6.08
Ta	1.599	1.526	1.73	1.59	1.47	0.92	0.9	1.06	0.93	0.83	1.05	1.05	0.81	1.25	1.2	1.19
Pb	37.39	30.45	26.09	26.82	13.63	21.74	17.53	28.05	19.25	16.97	25.89	29.93	18.99	26.64	23.44	31.41
Th	25	23.27	24.22	22.49	20.07	12.46	10.95	14.75	12.44	10.36	14.75	13.15	11.16	15.97	15.74	14.9
U	4.241	3.495	6.94	5.09	4.38	3.92	2.78	6.39	2.78	2.31	3.33	2.86	2.84	3.5	3.72	3.36

La/Lu	119.24	124.05	89.82	97.19	106.37	42.65	83.62	205.60	87.13	103.08	100.92	124.92	83.71	103.77	84.36	92.66
La/Sc	4.42	4.23	3.58	6.35	3.84	1.30	4.26	9.38	4.52	4.59	5.07	4.54	3.56	3.79	4.92	4.20
Th/La	0.37	0.36	0.49	0.42	0.37	0.98	0.28	0.16	0.34	0.34	0.35	0.33	0.42	0.36	0.37	0.37
Cr/Th	2.70	2.71	2.33	1.45	4.59	3.62	3.83	2.67	5.70	5.56	3.97	3.50	5.95	4.07	6.78	4.84
Th/Sc	1.64	1.55	1.76	2.66	1.43	1.27	1.21	1.49	1.56	1.54	1.79	1.51	1.48	1.37	1.80	1.55
Co/Th	0.16	0.19	0.30	0.28	0.12	0.99	0.58	0.44	0.65	0.50	0.44	0.52	0.48	0.44	0.50	0.50
Cr/Ni	6.46	6.07	2.02	2.24	3.60	2.52	2.11	2.48	2.27	2.30	2.23	2.31	2.52	2.15	2.25	2.16
ΣREE	312.76	290.89	232.38	245.05	235.47	63.22	180.88	375.93	161.44	135.85	198.09	175.95	134.88	207.65	192.13	194.20
LREE	283.39	265.07	209.20	221.72	213.91	54.44	159.07	351.53	144.11	122.95	178.95	160.76	121.82	188.87	171.68	174.97
HREE	29.37	25.83	23.18	23.34	21.56	8.77	21.81	24.40	17.34	12.90	19.14	15.20	13.07	18.77	20.45	19.23
(La/Yb) _N	12.03	12.64	9.38	10.02	10.99	4.66	8.60	21.03	9.07	10.68	10.44	12.62	8.98	10.77	8.99	9.85
(Gd/Yb) _N	2.08	2.03	1.56	1.59	1.51	0.81	1.75	2.38	1.51	1.62	1.80	1.86	1.55	1.69	1.47	1.76
Eu/Eu*	0.52	0.54	0.47	0.46	0.62	0.64	0.70	0.61	0.61	0.59	0.60	0.60	0.56	0.55	0.55	0.58
Ce/Ce*	0.93	0.91	0.98	0.94	0.85	1.22	0.88	0.81	0.89	0.94	0.91	0.84	1.08	1.05	0.88	0.98

Table S3 Lithology and Nd isotopic compositions of samples from Yong'an basin

Stratigraphy	Formation	Location	Sample No.	Lithology	$^{143}\text{Nd}/^{144}\text{Nd}$	2 σ	Epsilon Nd
Late Cretaceous	Chong'an	Shangjiabang	SCA-9	Argillaceous siltstone	0.512159	0.000011	−9.3
			SCA-7	Argillaceous siltstone	0.512173	0.000009	−9.1
			SCA-5	Argillaceous siltstone	0.512183	0.00001	−8.9
			SCA-4	Fine sandstone	0.512165	0.000009	−9.2
			SCA-2	Fine sandstone	0.512170	0.000009	−9.1
Lower Cretaceous-Upper Cretaceous	Shaxian	Shangjiabang	SSX-24	Argillaceous siltstone	0.512198	0.000009	−8.6
			SSX-20	Argillaceous siltstone	0.512186	0.00001	−8.8
			SSX-14	Siltstone	0.512201	0.00001	−8.5
			SSX-11	Siltstone	0.512213	0.000011	−8.3
			SSX-7	Fine sandstone	0.512253	0.00001	−7.5
			SSX-4	Fine sandstone	0.512208	0.000011	−8.4
Lower Cretaceous	Bantou	Yong'an	JS- 10	Mudstone	0.511880	0.000012	−14.8
			JS- 6	Mud shale	0.51200	0.000009	−12.4
			JS- 4	Mud shale	0.511988	0.00001	−12.7
Middle Jurassic	Zhangping	Zhangping	ZPD-7	Mudstone	0.511809	0.000011	−16.2
			ZPD-2	Mudstone	0.511772	0.00001	−16.9

Table S4 Detrital zircon U-Pb geochronology of samples from Yong'an basin**Sample SSX-8 from the late Early Cretaceous Shaxian Formation**

Spots	Th (ppm)	U (ppm)	Th/U	²⁰⁷ Pb/ ²⁰⁶ Pb		²⁰⁷ Pb/ ²³⁵ U		²⁰⁶ Pb/ ²³⁸ U		rho	²⁰⁷ Pb/ ²⁰⁶ Pb		²⁰⁷ Pb/ ²³⁵ U		²⁰⁶ Pb/ ²³⁸ U		Concord ance
				Ratio	1σ	Ratio	1σ	Ratio	1σ		Age(Ma)	1σ	Age(Ma)	1σ	Age(Ma)	1σ	
SSX-8-01	188	338	0.56	0.054	0.002	0.154	0.005	0.021	0.0003	0.346	369	87.955	145	4.729	133	1.590	91%
SSX-8-02	456	394	1.16	0.053	0.002	0.128	0.005	0.018	0.0003	0.426	320	88.880	123	4.390	114	1.832	92%
SSX-8-03	277	300	0.93	0.047	0.002	0.134	0.007	0.021	0.0003	0.297	64.9	124.060	128	5.876	132	1.895	96%
SSX-8-04	338	805	0.42	0.053	0.001	0.149	0.004	0.020	0.0002	0.484	322	51.848	141	3.299	130	1.567	92%
SSX-8-05	123	122	1.01	0.052	0.003	0.141	0.007	0.020	0.0003	0.322	295	122.205	134	6.587	126	2.120	94%
SSX-8-06	280	361	0.78	0.048	0.002	0.154	0.005	0.023	0.0003	0.382	79.7	81.475	145	4.834	149	2.012	97%
SSX-8-07	426	497	0.86	0.051	0.002	0.126	0.004	0.018	0.0002	0.410	261	74.988	120	3.795	114	1.549	94%
SSX-8-08	85.9	87.5	0.98	0.077	0.006	0.222	0.014	0.022	0.0005	0.379	1131	147.220	203	11.257	142	3.251	64%
SSX-8-09	440	364	1.21	0.049	0.002	0.123	0.005	0.019	0.0003	0.434	132	88.878	118	4.250	118	1.944	99%
SSX-8-10	180	208	0.86	0.050	0.003	0.119	0.006	0.018	0.0003	0.349	189	118.503	114	5.014	114	1.825	99%
SSX-8-11	106	131	0.81	0.053	0.003	0.125	0.006	0.018	0.0003	0.375	309	129.613	120	5.853	114	2.199	95%
SSX-8-12	282	493	0.57	0.051	0.001	0.169	0.005	0.024	0.0003	0.481	235	61.100	158	4.019	153	1.998	96%
SSX-8-13	183	250	0.73	0.049	0.002	0.158	0.007	0.023	0.0004	0.356	150	96.283	149	5.966	149	2.258	99%
SSX-8-14	181	253	0.71	0.052	0.002	0.126	0.006	0.018	0.0003	0.339	287	105.540	120	5.168	113	1.730	93%
SSX-8-15	157	176	0.89	0.052	0.003	0.120	0.007	0.017	0.0003	0.353	265	131.463	115	5.902	110	2.098	95%
SSX-8-16	332	479	0.69	0.051	0.002	0.135	0.006	0.019	0.0004	0.445	257	91.653	129	5.069	124	2.282	95%
SSX-8-17	192	312	0.62	0.071	0.003	0.202	0.009	0.021	0.0004	0.377	965	85.958	187	7.965	131	2.285	65%
SSX-8-18	186	351	0.53	0.050	0.002	0.162	0.005	0.024	0.0004	0.477	198	77.765	152	4.653	151	2.350	99%
SSX-8-19	159	315	0.51	0.050	0.002	0.158	0.006	0.023	0.0003	0.372	211	95.355	149	5.621	147	2.186	98%
SSX-8-20	358	563	0.64	0.048	0.001	0.153	0.004	0.023	0.0003	0.516	120	62.030	144	3.792	145	2.085	99%

SSX-8-21	231	291	0.79	0.049	0.002	0.135	0.006	0.020	0.0003	0.316	143	112.020	128	5.518	128	1.840	99%
SSX-8-22	372	504	0.74	0.050	0.001	0.125	0.003	0.018	0.0002	0.464	183	63.878	120	3.154	117	1.506	97%
SSX-8-23	230	331	0.70	0.053	0.002	0.159	0.005	0.022	0.0003	0.357	324	112.025	149	4.820	139	1.707	92%
SSX-8-24	238	345	0.69	0.053	0.002	0.168	0.005	0.023	0.0003	0.489	324	66.660	158	4.334	147	2.115	93%
SSX-8-25	335	310	1.08	0.052	0.002	0.157	0.007	0.022	0.0004	0.366	287	100.910	148	6.342	142	2.365	95%
SSX-8-26	266	446	0.60	0.055	0.002	0.185	0.005	0.025	0.0003	0.427	394	68.513	172	4.475	157	1.877	90%
SSX-8-27	442	452	0.98	0.086	0.007	0.256	0.035	0.018	0.0005	0.223	1343	152.315	232	28.265	114	3.442	31%
SSX-8-28	127	141	0.90	0.055	0.003	0.147	0.008	0.020	0.0004	0.320	413	160.168	139	7.200	127	2.230	90%
SSX-8-29	243	339	0.72	0.049	0.002	0.124	0.005	0.019	0.0003	0.338	146	99.985	119	4.774	119	1.692	99%
SSX-8-30	95.3	370	0.26	0.050	0.002	0.218	0.009	0.031	0.0005	0.393	213	85.173	200	7.289	200	3.110	99%
SSX-8-31	416	318	1.31	0.050	0.002	0.150	0.006	0.022	0.0003	0.410	213	87.025	142	5.038	139	2.139	97%
SSX-8-32	236	324	0.73	0.049	0.002	0.114	0.005	0.017	0.0003	0.355	132	99.985	109	4.383	109	1.628	99%
SSX-8-33	277	311	0.89	0.052	0.003	0.179	0.016	0.026	0.0016	0.709	283	114.798	167	13.507	163	9.969	97%
SSX-8-34	185	182	1.02	0.060	0.003	0.163	0.009	0.020	0.0004	0.346	587	118.500	153	7.888	127	2.420	81%
SSX-8-35	161	174	0.93	0.054	0.003	0.134	0.007	0.018	0.0003	0.341	389	124.988	128	6.247	118	2.082	92%
SSX-8-36	172	383	0.45	0.051	0.002	0.157	0.005	0.022	0.0003	0.436	239	78.690	148	4.437	143	1.979	96%
SSX-8-37	156	232	0.67	0.052	0.002	0.125	0.006	0.018	0.0003	0.348	333	104.615	120	5.236	115	1.845	96%
SSX-8-38	258	233	1.11	0.050	0.003	0.113	0.006	0.017	0.0003	0.313	172	122.205	108	5.051	108	1.647	99%
SSX-8-39	187	204	0.92	0.053	0.003	0.121	0.006	0.017	0.0003	0.349	332	112.950	116	4.994	107	1.698	92%
SSX-8-40	165	184	0.90	0.049	0.003	0.115	0.006	0.017	0.0003	0.347	128	122.200	111	5.397	111	1.959	99%
SSX-8-41	145	139	1.04	0.050	0.003	0.137	0.007	0.020	0.0004	0.372	213	130.538	130	6.260	129	2.430	98%
SSX-8-42	187	173	1.08	0.055	0.003	0.128	0.006	0.017	0.0003	0.349	394	114.803	122	5.544	111	1.844	90%
SSX-8-43	153	302	0.51	0.051	0.002	0.161	0.006	0.023	0.0004	0.454	243	78.690	151	4.973	147	2.334	97%
SSX-8-44	102	124	0.82	0.073	0.004	0.202	0.013	0.020	0.0004	0.304	1033	120.373	187	11.014	126	2.454	61%
SSX-8-45	685	1173	0.58	0.051	0.001	0.121	0.003	0.017	0.0002	0.537	256	53.695	116	2.326	110	1.244	94%
SSX-8-46	274	415	0.66	0.049	0.002	0.161	0.006	0.024	0.0004	0.461	132	77.765	151	4.863	153	2.413	98%

SSX-8-47	123	183	0.67	0.050	0.002	0.149	0.006	0.022	0.0003	0.328	191	105.540	141	5.707	138	1.942	97%
SSX-8-48	159	263	0.60	0.049	0.002	0.138	0.005	0.021	0.0004	0.451	150	94.430	131	4.749	131	2.262	99%
SSX-8-49	715	529	1.35	0.050	0.002	0.150	0.004	0.022	0.0002	0.377	191	72.210	142	3.946	139	1.550	98%
SSX-8-50	269	445	0.60	0.049	0.002	0.156	0.005	0.023	0.0003	0.392	161	79.618	147	4.433	147	1.847	99%
SSX-8-51	236	482	0.49	0.051	0.001	0.172	0.005	0.025	0.0003	0.390	228	63.878	161	4.435	156	1.793	96%
SSX-8-52	305	261	1.17	0.049	0.002	0.117	0.005	0.017	0.0003	0.332	150	112.945	112	4.672	112	1.613	99%
SSX-8-53	317	373	0.85	0.135	0.007	0.429	0.029	0.021	0.0004	0.307	2168	95.532	362	20.546	133	2.729	7%
SSX-8-54	147	244	0.60	0.049	0.002	0.118	0.005	0.018	0.0002	0.330	150	111.095	113	4.601	112	1.576	99%
SSX-8-55	333	574	0.58	0.049	0.001	0.157	0.005	0.023	0.0003	0.360	132	76.843	148	4.343	148	1.657	99%
SSX-8-56	139	200	0.70	0.055	0.002	0.168	0.007	0.022	0.0004	0.379	406	87.955	158	6.074	143	2.226	90%
SSX-8-57	333	184	1.81	0.051	0.003	0.141	0.007	0.020	0.0003	0.321	254	122.205	134	6.281	130	2.058	96%
SSX-8-58	181	279	0.65	0.052	0.002	0.124	0.005	0.018	0.0003	0.349	272	98.133	119	4.717	113	1.647	95%
SSX-8-59	200	300	0.67	0.053	0.002	0.130	0.006	0.018	0.0003	0.333	317	94.435	124	5.290	112	1.687	90%
SSX-8-60	456	376	1.22	0.054	0.002	0.151	0.006	0.020	0.0003	0.389	391	91.658	143	5.205	130	1.956	90%
SSX-8-61	534	255	2.09	0.050	0.002	0.118	0.005	0.017	0.0003	0.333	209	101.838	114	4.716	110	1.592	96%
SSX-8-62	148	194	0.76	0.074	0.005	0.178	0.012	0.017	0.0004	0.300	1050	133.798	166	10.495	111	2.260	60%
SSX-8-63	176	191	0.92	0.052	0.002	0.160	0.007	0.023	0.0004	0.353	276	110.170	151	6.283	145	2.271	96%
SSX-8-64	365	888	0.41	0.052	0.001	0.159	0.004	0.022	0.0003	0.473	276	57.400	150	3.428	142	1.640	94%
SSX-8-65	264	197	1.34	0.054	0.002	0.152	0.006	0.021	0.0003	0.373	365	98.138	143	5.418	132	1.979	91%
SSX-8-66	273	526	0.52	0.047	0.002	0.134	0.005	0.021	0.0003	0.366	35.3	88.880	128	4.400	132	1.756	96%
SSX-8-67	36.6	51.3	0.71	0.068	0.007	0.176	0.013	0.022	0.0006	0.391	857	209.255	165	11.049	139	3.912	83%
SSX-8-68	152	179	0.85	0.049	0.002	0.137	0.006	0.020	0.0003	0.314	165	108.318	130	5.799	130	1.906	99%
SSX-8-69	235	459	0.51	0.053	0.002	0.156	0.005	0.021	0.0003	0.368	345	77.770	147	4.450	136	1.613	92%
SSX-8-70	166	244	0.68	0.051	0.002	0.125	0.005	0.018	0.0003	0.407	254	99.985	120	4.595	115	1.892	96%
SSX-8-71	224	519	0.43	0.049	0.001	0.164	0.005	0.024	0.0003	0.440	167	69.433	154	4.055	153	1.892	99%
SSX-8-72	98.8	109	0.90	0.048	0.003	0.128	0.007	0.020	0.0004	0.341	94.5	140.715	123	6.246	128	2.341	95%

SSX-8-73	233	362	0.64	0.049	0.002	0.164	0.006	0.024	0.0003	0.400	169	86.098	154	5.128	154	2.180	99%
SSX-8-74	390	352	1.11	0.049	0.002	0.115	0.005	0.017	0.0003	0.340	150	105.540	111	4.515	110	1.595	99%
SSX-8-75	472	493	0.96	0.049	0.001	0.156	0.004	0.023	0.0003	0.454	132	59.253	147	3.653	147	1.761	99%
SSX-8-76	137	192	0.72	0.050	0.003	0.121	0.006	0.017	0.0003	0.364	198	123.130	116	5.511	111	2.016	95%
SSX-8-77	152	267	0.57	0.084	0.004	0.294	0.017	0.024	0.0004	0.304	1303	72.223	262	13.524	153	2.690	47%
SSX-8-78	116	110	1.05	0.074	0.004	0.209	0.011	0.021	0.0004	0.335	1031	116.670	193	9.143	134	2.320	64%
SSX-8-79	439	299	1.47	0.053	0.002	0.122	0.006	0.017	0.0003	0.343	309	99.063	117	4.985	109	1.662	92%
SSX-8-80	181	173	1.04	0.086	0.006	0.286	0.024	0.022	0.0005	0.253	1347	135.188	255	18.612	141	2.919	42%
SSX-8-81	286	338	0.84	0.049	0.002	0.118	0.004	0.018	0.0003	0.462	139	79.620	113	3.582	113	1.725	99%
SSX-8-82	177	175	1.01	0.065	0.003	0.183	0.010	0.020	0.0004	0.342	789	109.250	170	8.645	129	2.399	71%
SSX-8-83	360	648	0.56	0.051	0.001	0.166	0.004	0.024	0.0003	0.530	243	57.398	156	3.848	150	2.093	96%
SSX-8-84	166	184	0.90	0.051	0.002	0.142	0.006	0.021	0.0004	0.430	228	105.540	135	5.420	132	2.409	97%
SSX-8-85	145	167	0.87	0.051	0.003	0.124	0.006	0.018	0.0003	0.340	228	120.355	119	5.768	115	1.993	96%
SSX-8-86	205	257	0.80	0.054	0.002	0.168	0.007	0.023	0.0004	0.406	354	85.175	157	5.727	144	2.266	90%
SSX-8-87	310	633	0.49	0.051	0.001	0.161	0.005	0.023	0.0003	0.395	250	67.580	152	3.976	144	1.592	95%
SSX-8-88	166	168	0.99	0.065	0.003	0.183	0.009	0.021	0.0004	0.392	772	103.693	170	7.870	132	2.575	74%
SSX-8-89	125	138	0.90	0.054	0.003	0.125	0.008	0.017	0.0003	0.317	365	144.428	120	6.828	111	2.110	92%
SSX-8-90	312	249	1.25	0.052	0.002	0.150	0.007	0.021	0.0004	0.394	300	102.763	142	6.230	134	2.453	94%
Sample JS-2 from the Early Cretaceous Bantou Formation																	
JS-2-1	175	317	0.55	0.049	0.002	0.171	0.006	0.025	0.0004	0.401	143	79.618	160	5.410	160	2.311	99%
JS-2-2	197	182	1.08	0.050	0.002	0.164	0.007	0.024	0.0003	0.309	187	111.095	154	6.494	153	2.127	99%
JS-2-3	381	346	1.10	0.051	0.002	0.170	0.006	0.025	0.0003	0.346	235	88.875	160	5.254	157	1.909	98%
JS-2-4	831	890	0.93	0.049	0.001	0.184	0.005	0.027	0.0003	0.374	167	53.695	172	3.959	171	1.588	99%
JS-2-5	138	134	1.03	0.049	0.003	0.156	0.009	0.023	0.0004	0.299	167	133.315	147	7.669	147	2.436	99%
JS-2-6	189	236	0.80	0.054	0.002	0.177	0.007	0.024	0.0003	0.356	387	89.805	166	6.246	151	2.167	90%
JS-2-7	188	168	1.12	0.055	0.003	0.184	0.009	0.025	0.0004	0.321	394	114.803	172	7.708	159	2.466	92%

JS-2-8	304	355	0.86	0.051	0.002	0.177	0.006	0.025	0.0003	0.359	233	85.173	165	5.405	162	2.039	98%
JS-2-9	148	135	1.10	0.064	0.002	0.648	0.023	0.074	0.0010	0.380	743	75.918	507	13.905	460	5.879	90%
JS-2-10	180	177	1.02	0.053	0.002	0.200	0.009	0.028	0.0008	0.586	322	98.138	185	7.872	177	4.777	95%
JS-2-11	129	163	0.79	0.049	0.002	0.184	0.008	0.027	0.0004	0.357	143	96.280	171	6.846	174	2.655	98%
JS-2-12	57.1	70.9	0.81	0.057	0.004	0.242	0.013	0.032	0.0007	0.370	494	157.388	220	10.968	205	4.148	93%
JS-2-13	137	182	0.75	0.077	0.002	1.776	0.034	0.168	0.0019	0.593	1128	41.820	1037	12.363	999	10.435	96%
JS-2-14	79.1	109	0.72	0.051	0.003	0.175	0.010	0.026	0.0005	0.327	235	142.573	164	8.455	163	2.946	99%
JS-2-15	3.99	167	0.02	0.051	0.002	0.312	0.013	0.045	0.0008	0.425	250	96.283	276	9.930	283	4.835	97%
JS-2-16	103	140	0.73	0.061	0.002	0.588	0.020	0.071	0.0011	0.462	635	77.765	470	12.606	441	6.601	93%
JS-2-17	175	168	1.04	0.050	0.002	0.169	0.007	0.025	0.0004	0.361	187	99.985	158	6.173	159	2.380	99%
JS-2-18	74.6	410	0.18	0.059	0.002	0.547	0.021	0.066	0.0010	0.375	554	64.803	443	13.751	414	5.766	93%
JS-2-19	134	167	0.80	0.053	0.002	0.182	0.008	0.025	0.0004	0.338	343	96.285	170	6.516	160	2.224	93%
JS-2-20	236	279	0.85	0.049	0.002	0.165	0.005	0.024	0.0003	0.327	161	79.618	155	4.715	155	1.647	99%
JS-2-21	176	369	0.48	0.051	0.001	0.299	0.009	0.042	0.0006	0.456	257	61.100	265	7.087	265	3.599	99%
JS-2-22	281	299	0.94	0.049	0.002	0.170	0.005	0.025	0.0003	0.417	169	69.433	159	4.590	159	2.044	99%
JS-2-23	121	167	0.73	0.049	0.002	0.152	0.007	0.023	0.0003	0.312	154	107.390	144	6.004	144	1.992	99%
JS-2-24	186	225	0.83	0.050	0.002	0.171	0.007	0.025	0.0003	0.332	198	97.208	160	6.194	160	2.195	99%
JS-2-25	67.3	122	0.55	0.109	0.002	4.856	0.095	0.321	0.0034	0.544	1791	27.007	1795	16.493	1794	16.685	99%
JS-2-26	207	216	0.96	0.050	0.002	0.173	0.008	0.025	0.0004	0.323	191	108.318	162	6.599	161	2.273	99%
JS-2-27	232	179	1.30	0.055	0.003	0.194	0.010	0.026	0.0003	0.257	398	116.655	180	8.319	165	2.111	91%
JS-2-29	186	196	0.95	0.050	0.002	0.179	0.007	0.026	0.0004	0.398	209	87.950	167	5.795	167	2.469	99%
JS-2-30	184	179	1.02	0.047	0.002	0.164	0.007	0.026	0.0004	0.324	33.4	166.645	154	6.016	165	2.220	93%
JS-2-31	193	209	0.92	0.052	0.002	0.191	0.008	0.027	0.0004	0.333	276	89.800	178	6.827	171	2.346	95%
JS-2-32	222	240	0.93	0.049	0.002	0.160	0.006	0.024	0.0003	0.360	161	96.283	151	5.430	152	2.091	99%
JS-2-33	92.6	133	0.70	0.048	0.002	0.231	0.010	0.035	0.0005	0.336	98	112.945	211	8.517	223	3.300	94%
JS-2-34	203	622	0.33	0.057	0.001	0.564	0.011	0.072	0.0008	0.533	472	45.365	454	7.162	449	4.520	98%

JS-2-35	102	401	0.25	0.054	0.001	0.388	0.010	0.052	0.0005	0.400	361	55.550	333	7.405	328	3.336	98%
JS-2-36	202	186	1.09	0.050	0.002	0.180	0.009	0.026	0.0004	0.304	189	109.243	168	7.555	168	2.461	99%
JS-2-37	44.8	398	0.11	0.138	0.002	6.791	0.116	0.355	0.0032	0.521	2198	30.403	2085	15.246	1959	15.140	93%
JS-2-39	266	248	1.07	0.050	0.002	0.187	0.007	0.027	0.0003	0.341	191	90.725	174	5.904	174	2.163	99%
JS-2-40	119	144	0.83	0.051	0.003	0.180	0.009	0.026	0.0004	0.297	220	122.205	168	7.477	166	2.348	98%
JS-2-41	271	330	0.82	0.050	0.002	0.181	0.006	0.026	0.0003	0.375	176	76.840	169	5.385	168	2.164	99%
JS-2-43	87.4	105	0.83	0.052	0.003	0.186	0.010	0.026	0.0005	0.384	298	125.910	173	8.421	167	3.353	96%
JS-2-44	294	877	0.33	0.051	0.001	0.181	0.005	0.025	0.0003	0.420	261	54.623	169	4.058	162	1.753	95%
JS-2-45	185	203	0.91	0.052	0.002	0.192	0.009	0.027	0.0004	0.342	300	103.688	178	7.494	171	2.647	95%
JS-2-46	241	292	0.83	0.115	0.002	5.065	0.073	0.318	0.0021	0.455	1877	26.540	1830	12.315	1782	10.292	97%
JS-2-47	151	557	0.27	0.053	0.001	0.297	0.008	0.040	0.0007	0.615	343	47.218	264	6.293	254	4.143	96%
JS-2-48	195	219	0.89	0.051	0.002	0.156	0.006	0.023	0.0005	0.566	220	99.985	147	5.624	146	3.346	99%
JS-2-49	305	354	0.86	0.051	0.002	0.179	0.007	0.026	0.0004	0.364	256	95.355	167	5.912	163	2.245	97%
JS-2-50	168	249	0.68	0.115	0.002	4.528	0.087	0.285	0.0034	0.630	1876	30.708	1736	15.988	1616	17.291	92%
JS-2-51	248	195	1.27	0.056	0.002	0.422	0.013	0.055	0.0006	0.365	443	68.513	358	8.978	345	3.657	96%
JS-2-52	220	179	1.23	0.050	0.003	0.167	0.008	0.025	0.0003	0.296	209	120.353	157	6.864	157	2.168	99%
JS-2-53	152	197	0.77	0.049	0.002	0.171	0.007	0.025	0.0003	0.294	172	93.505	160	6.073	160	1.913	99%
JS-2-54	143	338	0.42	0.057	0.005	0.348	0.031	0.044	0.0004	0.094	509	199.820	303	23.376	278	2.295	91%
JS-2-55	272	236	1.15	0.052	0.002	0.183	0.008	0.025	0.0003	0.304	283	94.430	170	6.553	162	2.034	95%
JS-2-56	182	179	1.02	0.055	0.003	0.209	0.010	0.028	0.0004	0.339	413	109.250	193	8.103	177	2.726	91%
JS-2-57	107	103	1.04	0.055	0.004	0.140	0.008	0.019	0.0004	0.341	398	149.985	133	7.391	122	2.441	91%
JS-2-58	208	199	1.04	0.051	0.002	0.172	0.007	0.025	0.0004	0.343	233	103.688	161	6.180	160	2.244	99%
JS-2-59	60.7	119	0.51	0.050	0.003	0.183	0.009	0.027	0.0005	0.349	211	133.315	170	7.529	173	2.859	98%
JS-2-60	486	864	0.56	0.054	0.001	0.437	0.009	0.058	0.0006	0.502	383	45.365	368	6.178	364	3.552	98%
JS-2-61	167	159	1.05	0.052	0.003	0.173	0.009	0.025	0.0003	0.281	265	123.130	162	7.464	156	2.161	96%
JS-2-62	187	215	0.87	0.050	0.002	0.175	0.008	0.026	0.0003	0.292	187	112.020	164	6.650	164	2.079	99%

JS-2-63	128	180	0.71	0.050	0.002	0.177	0.007	0.026	0.0003	0.319	206	99.985	166	6.313	164	2.136	98%
JS-2-64	102	177	0.58	0.155	0.002	9.803	0.140	0.455	0.0038	0.585	2407	22.838	2416	13.222	2417	16.854	99%
JS-2-65	132	165	0.80	0.049	0.002	0.221	0.009	0.033	0.0006	0.467	139	99.985	202	7.181	212	3.818	95%
JS-2-66	203	259	0.79	0.049	0.002	0.175	0.007	0.026	0.0004	0.336	154	92.580	163	6.263	163	2.247	99%
JS-2-67	387	429	0.90	0.050	0.002	0.160	0.005	0.023	0.0003	0.429	183	72.210	151	4.581	148	2.056	98%
JS-2-68	271	287	0.94	0.049	0.002	0.159	0.006	0.024	0.0003	0.348	139	91.653	150	5.185	150	1.919	99%
JS-2-69	317	250	1.27	0.049	0.002	0.166	0.006	0.025	0.0003	0.347	200	88.875	156	5.518	156	2.048	99%
JS-2-70	205	207	0.99	0.050	0.002	0.185	0.009	0.027	0.0004	0.331	191	111.095	173	7.360	172	2.608	99%
JS-2-71	573	730	0.79	0.052	0.001	0.219	0.005	0.031	0.0003	0.454	272	53.695	201	4.161	194	1.975	96%
JS-2-72	122	190	0.64	0.048	0.002	0.164	0.008	0.024	0.0004	0.318	124	84.250	154	6.970	154	2.362	99%
JS-2-73	207	354	0.58	0.049	0.002	0.180	0.006	0.026	0.0004	0.404	167	81.468	168	5.444	168	2.357	99%
JS-2-74	308	242	1.27	0.051	0.002	0.153	0.006	0.022	0.0003	0.390	254	98.133	144	5.474	137	2.151	94%
JS-2-75	283	254	1.12	0.049	0.002	0.173	0.007	0.025	0.0003	0.331	165	89.800	162	5.916	162	2.095	99%
JS-2-76	194	363	0.53	0.053	0.001	0.346	0.009	0.047	0.0005	0.403	339	61.105	302	6.832	296	3.052	98%
JS-2-77	165	227	0.73	0.049	0.002	0.172	0.007	0.025	0.0004	0.338	169	99.985	161	6.256	161	2.260	99%
JS-2-78	331	455	0.73	0.054	0.002	0.181	0.006	0.024	0.0003	0.366	367	73.140	169	4.869	155	1.755	91%
JS-2-79	199	196	1.01	0.050	0.002	0.176	0.008	0.026	0.0004	0.336	189	101.835	165	6.789	165	2.440	99%
JS-2-80	321	425	0.76	0.051	0.002	0.160	0.006	0.023	0.0003	0.369	235	77.765	151	5.176	145	1.948	95%
JS-2-81	196	211	0.93	0.049	0.002	0.170	0.008	0.025	0.0003	0.302	169	107.393	159	6.588	159	2.121	99%
JS-2-82	210	279	0.75	0.050	0.002	0.168	0.006	0.025	0.0003	0.331	172	90.728	157	5.298	158	1.873	99%
JS-2-83	343	374	0.92	0.052	0.002	0.178	0.005	0.025	0.0003	0.373	287	76.843	166	4.518	159	1.722	95%
JS-2-85	276	599	0.46	0.051	0.001	0.292	0.007	0.041	0.0005	0.516	257	49.993	260	5.181	260	2.971	99%
JS-2-86	252	367	0.69	0.049	0.002	0.158	0.006	0.023	0.0003	0.353	146	87.025	149	5.071	150	1.907	99%
JS-2-88	216	217	1.00	0.047	0.002	0.155	0.007	0.024	0.0003	0.316	35.3	164.795	146	5.957	154	2.112	94%
JS-2-89	184	239	0.77	0.053	0.002	0.191	0.008	0.026	0.0004	0.391	345	88.880	178	6.591	167	2.603	93%
JS-2-90	126	143	0.88	0.055	0.003	0.195	0.009	0.026	0.0004	0.344	417	112.950	181	7.895	167	2.702	91%

JS-2-91	403	452	0.89	0.051	0.002	0.157	0.005	0.022	0.0002	0.312	257	71.285	148	4.603	140	1.451	94%
JS-2-92	162	185	0.87	0.050	0.002	0.175	0.008	0.026	0.0004	0.340	209	112.020	164	6.773	164	2.464	99%
JS-2-93	164	159	1.03	0.053	0.004	0.159	0.009	0.023	0.0004	0.336	339	147.203	150	7.805	145	2.709	97%
JS-2-94	104	148	0.70	0.050	0.003	0.177	0.009	0.026	0.0004	0.317	187	120.353	165	7.441	165	2.522	99%
JS-2-95	200	272	0.74	0.049	0.002	0.170	0.006	0.025	0.0003	0.346	146	87.025	160	5.559	160	2.054	99%

Table S5 Element ratios of samples from Yong'an basin

Element ratio	Granite	Andesite	Zhangping Fm.	Bantou Fm.	Shaxian Fm.	Chong'an Fm.	Felsic sources	Mafic sources
La/Sc	8	0.9	4.23~4.42	3.58~6.35	1.30~9.38	3.56~4.92	2.5~16.33	0.43~0.86
Th/Sc	3.57	0.22	1.55~1.64	1.43~2.66	1.21~1.79	1.37~1.80	0.84~20.5	0.05~0.22
Cr/Th	0.44	9.77	2.70~2.71	1.45~4.59	2.67~5.70	3.50~6.78	4.00~15.0	25.0~500
Co/Th	0.17	4.65	0.16~0.19	0.12~0.30	0.44~0.99	0.44~0.52	0.22~1.5	7.1~8.3
Eu/Eu*	0.34	0.66	0.52~0.54	0.47~0.62	0.59~0.70	0.55~0.60	0.40~0.94	0.71~0.95