附表 1 冈底斯东缘冲尼地区凝灰岩锆石 U-Pb 定年数据

Table 1 Zircons U-Pb data of Chongni Tuffs of the in the eastern margin of the Gangdese belt

测试号	含量（×10⁻⁶）			Th/U	同位素比值						年龄（Ma）					
	Pb	Th	U		$^{207}Pb/^{235}U$	1s	$^{206}Pb/^{238}U$	1s	$^{208}Pb/^{232}Th$	1s	$^{207}Pb/^{235}U$	1s	$^{206}Pb/^{238}U$	1s	$^{208}Pb/^{232}Th$	1s
D0021-N1,8 个测点加权年龄 278.0±3.5Ma, MSWD = 3.1,由于误差过大测点 1,2,3,4,8,10,13,16,20 排除																
D0021-N1 - 1	22	238	555	0.43	0.22550	.00600	0.03266	0.00048	0.01021	0.00046	206	5	207	3	205	9
D0021-N1 - 2	16	416	697	0.60	0.11540	0.00450	0.01792	0.00031	0.00584	0.00027	111	4	115	2	118	5
D0021-N1 - 3	11	652	1239	0.53	0.04480	0.00260	0.00696	0.00013	0.00273	0.00016	45	3	45	1	55	3
D0021-N1 - 4					35.40000	2.40000	0.34800	0.02300	0.24000	0.01700	3605	66	1900	110	4300	270
D0021-N1 - 5	20	145	331	0.44	0.36900	0.01300	0.05095	0.00083	0.01704	0.00082	320	10	320	5	341	16
D0021-N1 - 6	14	225	249	0.90	0.30000	0.01600	0.04388	0.00077	0.01358	0.00062	264	12	277	5	273	12
D0021-N1 - 7	23	323	380	0.85	0.30900	0.00950	0.04468	0.00067	0.01437	0.00060	272	7	282	4	288	12
D0021-N1 - 8	23	1471	544	2.71	0.15960	0.00680	0.02316	0.00039	0.00685	0.00028	150	6	148	3	138	6
D0021-N1 - 9	23	161	368	0.44	0.36600	0.01200	0.05181	0.00079	0.01728	0.00081	316	9	326	5	346	16
D0021-N1 - 10	3	191	178	1.07	0.09140	0.00840	0.01385	0.00031	0.00439	0.00026	88	8	89	2	89	5
D0021-N1 - 11	31	468	519	0.90	0.30620	0.00910	0.04392	0.00065	0.01436	0.00057	270	7	277	4	288	11
D0021-N1 - 12	5	41	86	0.47	0.32000	0.02200	0.04396	0.00095	0.01321	0.00093	278	17	277	6	265	18
D0021-N1 - 13	3	110	105	1.04	0.13000	0.01200	0.02026	0.00049	0.00655	0.00041	122	11	129	3	132	8
D0021-N1 - 14	9	81	151	0.53	0.33000	0.02000	0.04650	0.00089	0.01492	0.00089	287	16	293	6	299	18
D0021-N1 - 15	13	97	218	0.44	0.34600	0.01300	0.04801	0.00082	0.01574	0.00079	301	9	302	5	316	16
D0021-N1 - 16	50	81	217	0.37	1.96800	0.03700	0.19230	0.00290	0.05800	0.00250	1102	13	1133	16	1138	47
D0021-N1 - 17	7	113	123	0.92	0.31700	0.01800	0.04400	0.00084	0.01485	0.00081	276	14	278	5	298	16
D0021-N1 - 18	36	663	586	1.13	0.31500	0.01000	0.04415	0.00078	0.01418	0.00062	277	8	279	5	285	12
D0021-N1 - 19	40	665	605	1.10	0.32130	0.00840	0.04596	0.00073	0.01576	0.00066	282	7	290	5	316	13
D0021-N1 - 20	4	190	100	1.90	0.14300	0.01300	0.02123	0.00052	0.00694	0.00037	135	12	135	3	140	8
D0021-N1 - 21	10	128	152	0.84	0.32700	0.01800	0.04519	0.00084	0.01512	0.00076	284	14	285	5	303	15
D0021-N1 - 22	10	165	183	0.90	0.31200	0.01700	0.04281	0.00077	0.01312	0.00065	273	14	270	5	263	13
D0021-N1 - 23	7	34	115	0.29	0.43000	0.03300	0.05950	0.00130	0.02020	0.00160	358	24	372	8	404	31
D0021-N1 - 24	11	66	164	0.40	0.42100	0.02200	0.05800	0.00120	0.01839	0.00110	354	16	363	8	368	23
D0021-N1 - 25	11	137	193	0.71	0.32200	0.01400	0.04584	0.00081	0.01488	0.00073	281	11	289	5	299	14
D0021-N6,12 个测点加权年龄 275.64±0.93,MSWD = 0.54,由于误差较大测点 21 排除																
D0021-N6 - 1	9	105	182	0.58	0.32000	0.01600	0.04374	0.00066	0.01455	0.00046	281	12	276	4	292	9
D0021-N6 - 2	13	141	251	0.56	0.30980	0.00890	0.04356	0.00041	0.01390	0.00029	273	7	275	3	279	6
D0021-N6 - 3	4	35	76	0.46	0.30400	0.01600	0.04356	0.00060	0.01359	0.00061	266	13	275	4	273	12

D0021-N6 - 4	26	140	304	0.46	0.57800	0.01200	0.07389	0.00066	0.02272	0.00046	463	8	460	4	454	9
D0021-N6 - 5	8	97	144	0.67	0.29800	0.01100	0.04356	0.00053	0.01366	0.00045	264	9	275	3	274	9
D0021-N6 - 6	13	125	241	0.52	0.34420	0.00980	0.04698	0.00048	0.01489	0.00037	299	7	296	3	299	7
D0021-N6 - 7	12	172	189	0.91	0.34200	0.01200	0.04790	0.00058	0.01486	0.00036	298	9	302	4	298	7
D0021-N6 - 8	10	114	189	0.61	0.31600	0.01100	0.04402	0.00051	0.01424	0.00042	277	9	278	3	286	8
D0021-N6 - 9	6	69	125	0.55	0.31900	0.01300	0.04355	0.00049	0.01385	0.00049	280	10	275	3	278	10
D0021-N6 - 10	11	145	199	0.73	0.32200	0.01000	0.04612	0.00051	0.01413	0.00033	282	8	291	3	284	7
D0021-N6 - 11	16	169	288	0.59	0.34580	0.00940	0.04752	0.00048	0.01477	0.00032	301	7	299	3	296	6
D0021-N6 - 12	6	151	96	1.57	0.31900	0.01600	0.04342	0.00054	0.01372	0.00034	278	13	274	3	275	7
D0021-N6 - 13	11	110	198	0.55	0.32500	0.01100	0.04642	0.00049	0.01469	0.00036	285	8	293	3	295	7
D0021-N6 - 14	6	57	106	0.54	0.33500	0.01800	0.04692	0.00079	0.01505	0.00064	291	14	296	5	302	13
D0021-N6 - 15	13	132	252	0.53	0.33800	0.01000	0.04615	0.00045	0.01475	0.00039	295	8	291	3	296	8
D0021-N6 - 16	16	181	320	0.56	0.31900	0.01000	0.04398	0.00054	0.01396	0.00041	280	8	277	3	280	8
D0021-N6 - 17	21	161	369	0.44	0.37810	0.00880	0.04979	0.00055	0.01665	0.00037	325	7	313	3	334	7
D0021-N6 - 18	6	69	114	0.60	0.31600	0.01700	0.04373	0.00073	0.01418	0.00059	277	13	276	5	285	12
D0021-N6 - 19	12	167	207	0.81	0.31000	0.01300	0.04380	0.00051	0.01355	0.00037	273	10	276	3	272	7
D0021-N6 - 20	19	264	300	0.88	0.36590	0.00980	0.05048	0.00052	0.01603	0.00025	316	7	318	3	322	5
D0021-N6 - 21	11	94	178	0.53	0.53900	0.01700	0.04900	0.00056	0.02152	0.00061	437	11	308	4	430	12
D0021-N6 - 22	7	67	130	0.52	0.35800	0.01500	0.04659	0.00059	0.01489	0.00051	309	11	294	4	299	10
D0021-N6 - 23	12	151	235	0.64	0.32900	0.01000	0.04387	0.00046	0.01410	0.00035	288	8	277	3	283	7
D0021-N6 - 24	11	155	223	0.69	0.32600	0.01300	0.04345	0.00057	0.01387	0.00045	285	10	274	4	278	9
D0021-N6 - 25	9	68	178	0.38	0.33900	0.01100	0.04740	0.00053	0.01459	0.00049	296	9	299	3	293	10

4 附表 2 冲尼凝灰岩锆石微量元素数据（×10^{-6}）

5 Table 2 Zircons trace element data of Chongni Tuffs

测点号	D002 1-N1 -1	D002 1-N1 -2	D002 1-N1 -3	D002 1-N1 -4	D002 1-N1 -5	D002 1-N1 -6	D002 1-N1 -7	D002 1-N1 -8	D002 1-N1 -9	D002 1-N1 -10	D002 1-N1 -11	D002 1-N1 -12	D002 1-N1 -13	D002 1-N1 -14	D002 1-N1 -15	D002 1-N1 -16	D002 1-N1 -17	D002 1-N1 -18	D002 1-N1 -19	D002 1-N1 -20	D002 1-N1 -21	D002 1-N1 -22	D002 1-N1 -23	D002 1-N1 -24	D002 1-N1 -25
Sc	192.8	197.7	181.3		234.2	268.1	290.7	257.2	194.8	249.7	364.2	343.7	210.6	346.4	280.4	179.3	275	291.1	390	208.7	286.9	320.1	338	243.4	344.6
Ti	1.62	2.74	2.93		3.23	8.41	8.7	19.9	2.81	4.2	5.47	10.5	9.6	7.55	4.1	6.1	8.6	15.6	7.39	9.9	8.36	10.2	10.7	11.2	8.14
Y	767	2386	1343		847	2590	5850	9580	1417	1425	1003	1941	712	1316	988	528.5	2420	5500	1155	1320	4600	2660	1446	1658	2835
Nb	2.65	3.44	7.87		2.98	1.95	3.95	6.37	1.61	0.97	3.57	1.25	1.43	2.2	3.04	1.19	1.11	10.74	4.09	1.4	1.38	2.11	0.85	0.91	1.88
La	-	0.003	12.4		-	-	0.017	0.346	-	0.031	0.009	0.044	-	0.073	-	-	0.156	0.018	0.036	0.001	0.003	1.95	-	-	-
Ce	7.89	15.89	61.9		12.29	22.2	46.5	111.8	8.69	6.6	63.4	13.45	10.97	9.88	9.8	5.31	15.53	56.3	90.7	26.6	26.6	29.7	0.88	1.32	15.75
Pr	0.012	0.343	4.67		-	0.056	0.215	4.54	0.07	0.409	0.532	0.056	0.039	0.044	0.030	0.031	0.153	0.4	0.795	0.188	0.243	1.42	0.066	0.058	0.045
Nd	0.47	5.93	20.3		1.21	1.05	4.04	71.7	1.66	7.2	10.12	0.85	0.87	0.91	0.53	0.83	1.89	6.31	14.07	3.05	4.51	8.2	1.29	0.95	1.3
Sm	1.58	11.36	7.91		1.63	4.32	11.8	105.8	4.48	11.39	27	2.71	2.87	1.55	1.63	1.48	4.31	15.1	34.8	5.61	10.9	6.26	3.05	3.44	4.71
Eu	0.524	0.322	0.6		0.455	1.03	2.63	19.97	0.613	1.05	4.77	0.7	0.396	1.01	0.174	0.269	1.29	0.35	6.61	1.78	2.76	1.39	0.113	0.046	1.18
Gd	11.41	56	25.6		11.1	33.7	81.5	409	29.2	45.2	173.7	23.5	15.56	15.6	13.77	10.1	33.7	93.9	212.4	32.1	75.6	37.6	22.7	23.4	38.2
Tb	4.13	17.32	8.29		4.04	13.38	29.92	106.7	9.62	12.98	61.5	9.19	5.41	6.3	4.98	3.38	12.5	33.2	71.9	10.29	26.7	13.85	8.69	8.93	14.85
Dy	59.1	207.2	103.9		57.1	181	403.8	1063	122.5	139.6	783	134	64.2	93.8	74.7	43.8	173.6	424	904	119.6	354	187.6	114.3	121.4	208.6
Ho	24.39	74.5	39.9		26	75.7	164.1	312.3	46.8	48.5	304	58.5	23.76	42	31.28	16.78	70.2	158.8	343	42.4	137.7	77.7	44	48.6	86.5
Er	130	335.7	201.4		139.6	394	832	1184	230	209.4	1456	312.8	113.5	223.7	170.2	85.3	365	743	1613	199	672	395	214	243	428.8
Tm	29.85	64.1	43.7		34.4	86	181.8	201.9	46.3	39.56	291.5	68.4	22.44	49.7	37.42	18.22	76.7	152	324.1	39	132.1	82.9	44.4	49.5	87.7
Yb	295.1	540	413		358	807	1679	1483	412	325.3	2611	664	199.8	476	372.1	169.1	715	1312	2854	340	1185	781	407	450	790
Lu	64.7	103.6	82.3		82.1	170.8	345.5	238	81.6	62.7	508	142.8	38.82	105.4	80.5	34.07	150	249	561	65.9	238	162.3	77.9	85.9	160
Hf	1192	1001	1254		1092	1027	9690	8820	1137	9860	9040	9570	1016	8820	1013	9230	9740	1275	9170	1036	9900	1028	1233	1231	9310
Ta	1.49	1.88	4.1		1.045	0.47	1.27	1.28	0.851	0.452	0.74	0.391	0.675	0.664	1.31	0.529	0.304	4.24	0.682	0.623	0.285	0.548	0.527	0.591	0.438
Th	238.3	416.3	652		145.1	225	323.3	1471	161.2	190.7	468	41.03	109.5	80.8	96.5	80.6	112.5	663	665	190.4	128	165	33.64	65.7	136.6
U	555.3	697	1239		331	249	380.1	543.7	368	177.7	518.5	86.4	105.2	151.4	218.2	217.2	122.8	586	605	100.4	152	183	115.4	164.4	192.8
Pb	21.55	15.51	10.51		20.06	14.09	22.69	23.25	23.35	3.403	30.55	4.577	2.960	8.838	12.61	49.76	7.462	35.87	40.47	3.590	9.554	10.39	7.250	10.53	11.28

测点号	D002 1-N6 -1	D002 1-N6 -2	D002 1-N6 -3	D002 1-N6 -4	D002 1-N6 -5	D002 1-N6 -6	D002 1-N6 -7	D002 1-N6 -8	D002 1-N6 -9	D002 1-N6 -10	D002 1-N6 -11	D002 1-N6 -12	D002 1-N6 -13	D002 1-N6 -14	D002 1-N6 -15	D002 1-N6 -16	D002 1-N6 -17	D002 1-N6 -18	D002 1-N6 -19	D002 1-N6 -20	D002 1-N6 -21	D002 1-N6 -22	D002 1-N6 -23	D002 1-N6 -24	D002 1-N6 -25
Sc	321.1	412.7	275.8	433.1	243	275.4	310.5	281.1	316.5	272.4	245.5	272.8	448.2	227	309.5	355.6	207.7	261.3	244.9	256	243.5	270.1	294.1	298.9	316.8
Ti	7.31	8.49	6.45	7.15	7.03	4.64	4.55	9.61	8.97	5.5	2.73	10.6	10.7	3.68	5.09	7.1	2.85	6.62	7.39	9.61	7.36	3.65	4.69	11.4	4.53
Y	1763	3209	1315	4240	993	1896	1076	1227	1857	1553	1857	2014	1842	925	1390	3011	1302	1538	1436	2495	996	651.2	1463	2114	1443
Nb	1.4	2.23	0.807	1.23	0.467	3.36	1.72	0.779	1.32	1.28	2.37	1.19	2.38	0.742	3.32	2.3	4.37	0.66	0.885	2.14	2.26	0.964	1.4	1.57	2.03
La	0.57	0.296	0.005	0.102	0.000	-	-	-	2.99	2.09	0.003	0.94	0.000	-	0.041	0.051	0.012	-	0.134	1.15	0.007	-	0.078	12.4	-
Ce	16.49	25.49	8.99	6.94	9.71	12.82	12.9	11.19	21.8	17.37	12.17	38.5	9.53	7.58	17.62	23.84	12.61	10.35	15.26	24.4	13.51	7.98	21.28	46.5	6.91
Pr	0.231	0.154	0.029	0.242	0.045	0.077	0.031	0.041	1	0.641	0.099	0.604	0.129	0.031	0.053	0.08	0.048	0.06	0.109	0.68	0.038	0.013	0.071	4	0.037
Nd	1.61	1.58	0.66	4.69	0.93	1.72	0.61	0.8	5.7	4.03	2.02	7	2.28	0.65	0.8	1.09	0.88	0.95	1	5.96	0.57	0.41	0.93	19	0.7
Sm	2.2	4.23	1.9	11.29	2.12	4.26	1.67	1.69	3.44	3.61	4.79	9.55	5.12	1.72	2.22	3.62	2.55	2.73	2.09	8.39	1.84	0.96	2.08	6.1	2.2
Eu	0.744	1.51	0.709	1.23	0.938	0.807	0.546	0.908	1.246	1.103	0.838	4.81	1.51	0.586	0.513	1.06	0.222	0.85	0.752	1.36	0.405	0.321	0.5	1.48	0.829
Gd	18.2	34.8	15.26	73.1	13.78	27.5	13.49	12.72	21.34	21.34	31.9	49.3	33.9	13.2	14.41	31	18.62	20.6	16.26	49.7	13.57	7.91	16.06	25.9	17.89
Tb	7.12	14.24	5.85	26.5	4.95	10.11	5.3	5	7.99	7.74	10.97	14.93	11.64	4.88	5.69	12.66	7.13	7.66	6.2	16.22	5.36	2.94	6.27	9.44	6.8
Dy	109.3	212.3	85.1	346	66.6	137.9	71.2	74.6	117.8	103.4	141.3	174	150	65.8	86.2	194.7	97.2	105.3	92.5	203.8	73.1	45.4	91.7	136.1	97.8
Ho	48.8	93.1	38.04	131.7	27.62	55.4	30.29	33.38	52.5	43.6	55	62.8	57.7	26.99	38.65	84.8	39.66	44.2	39.72	76.2	30.46	20.48	41.07	59.6	42.24
Er	278.3	503	212.6	631	150.7	286.6	167.4	189.4	294.6	235	276.2	291	279.3	145.6	219.7	456.7	199.1	235.9	221.8	359.2	161.7	114.2	231.9	326.5	227
Tm	65.5	112.2	49.61	125.5	35.4	62.7	39	44.54	67.4	54.8	57.6	57.8	56.3	32.89	53.3	105.9	42.28	52.9	50.6	71.1	35.73	26.81	54.9	76.1	50.29
Yb	674	1096	505.3	1106	364	606	407	469.1	679	561	544	519	503.3	330.5	563	1062	392.3	532	521	626	347.4	290.5	584.1	781	500.1
Lu	152.3	236.6	115.7	209.3	83.5	126.9	94.6	109.8	153.4	124.6	111	102.7	98.9	73.2	129.3	226.3	78	115.7	116.6	121.2	74.5	68.91	136.1	173.5	109.4
Hf	9750	9880	9660	1178	8720	9860	1082	8250	9370	1061	1000	9110	9560	1102	1132	1040	1216	1007	1040	1041	1160	1050	1041	9820	1012
Ta	0.45	0.466	0.268	0.785	0.163	1.13	0.655	0.241	0.331	0.49	0.905	0.466	0.75	0.364	1.099	0.581	1.621	0.215	0.3	0.821	0.929	0.459	0.429	0.429	0.615
Th	104.8	141.2	35.18	140.4	96.5	125.3	172	114.3	69.1	144.5	169.4	151	109.5	56.8	132.4	180.7	161.2	69	167.3	263.5	93.5	67.4	151	154.8	67.6
U	181.6	250.7	76.3	304.2	143.7	240.7	189	188.7	124.7	199.3	288	96.2	198	106.1	251.9	320.2	369.4	114.1	207.3	299.5	178	129.9	235.3	223.1	178.4
Pb	9.07	12.98	3.76	26.00	7.51	12.95	11.89	9.99	6.45	11.04	16.14	6.08	10.87	5.64	13.37	15.97	21.19	5.80	11.67	19.26	11.03	7.17	12.45	11.34	9.456

附表 3 冲尼凝灰岩锆石 Hf 同位素数据

Table 3 Zircons Hf isotopic data of Chongni Tuffs

测点号	年龄（Ma）	$^{176}Yb/^{177}Hf$	$^{176}Lu/^{177}Hf$	$^{176}Hf/^{177}Hf$	2σ	$(^{176}Hf/^{177}Hf)_i$	$\varepsilon_{Hf}(0)$	$\varepsilon_{Hf}(t)$	t_{DM}^{1}(Ma)	t_{DM}^{C}(Ma)	$f_{Lu/Hf}$
D0021N1-5	320	0.040983	0.001240	0.282517	0.000018	0.282510	-9.5	-2.6	1047	1477	-0.96
D0021N1-6	277	0.110822	0.003268	0.283007	0.000021	0.282990	7.9	13.4	369	417	-0.90
D0021N1-7	282	0.219241	0.006290	0.282952	0.000026	0.282918	5.9	11.0	496	577	-0.81
D0021N1-9	326	0.051274	0.001331	0.282403	0.000019	0.282395	-13.5	-6.6	1211	1730	-0.96
D0021N1-11	277	0.336858	0.009060	0.282947	0.000022	0.282900	5.7	10.2	550	621	-0.73
D0021N1-12	277	0.080497	0.002309	0.282917	0.000018	0.282905	4.7	10.4	493	611	-0.93
D0021N1-14	293	0.060274	0.001874	0.282767	0.000018	0.282756	-0.7	5.5	705	938	-0.94
D0021N1-15	302	0.044418	0.001427	0.282807	0.000019	0.282799	0.8	7.2	639	836	-0.96
D0021N1-17	278	0.072210	0.002072	0.282991	0.000020	0.282980	7.3	13.1	382	440	-0.94
D0021N1-18	279	0.288072	0.007450	0.283137	0.000021	0.283098	12.5	17.3	195	167	-0.78
D0021N1-19	290	0.303043	0.008624	0.283074	0.000029	0.283027	10.2	15.0	317	324	-0.74
D0021N1-21	285	0.083902	0.002543	0.282988	0.000014	0.282975	7.2	13.1	390	446	-0.92
D0021N1-22	270	0.119732	0.003548	0.282983	0.000017	0.282965	7.0	12.4	409	478	-0.89
D0021N1-23	372	0.028007	0.000789	0.282361	0.000013	0.282356	-15.0	-6.9	1252	1790	-0.98
D0021N1-24	363	0.056270	0.001615	0.282322	0.000015	0.282311	-16.4	-8.7	1335	1894	-0.95
D0021N6-1	276	0.066374	0.002076	0.282983	0.000015	0.282972	7.0	12.8	393	459	-0.94
D0021N6-2	275	0.089174	0.002701	0.282979	0.000017	0.282965	6.9	12.5	405	475	-0.92
D0021N6-3	275	0.054854	0.001667	0.283000	0.000018	0.282991	7.6	13.4	364	415	-0.95
D0021N6-4	460	0.090734	0.002408	0.282411	0.000016	0.282390	-13.2	-3.7	1236	1659	-0.93
D0021N6-5	275	0.034386	0.001111	0.283013	0.000016	0.283007	8.0	14.0	340	380	-0.97
D0021N6-6	296	0.057853	0.001755	0.282802	0.000015	0.282792	0.6	6.8	652	856	-0.95
D0021N6-7	302	0.064513	0.001983	0.282797	0.000016	0.282786	0.4	6.7	663	866	-0.94

D0021N6-8	278	0.063319	0.002044	0.282960	0.000016	0.282950	6.2	12.0	426	509	-0.94
D0021N6-9	275	0.075088	0.002248	0.283000	0.000019	0.282989	7.6	13.3	369	421	-0.93
D0021N6-10	291	0.055301	0.001726	0.282839	0.000015	0.282829	1.9	8.0	598	774	-0.95
D0021N6-11	299	0.078782	0.002167	0.282793	0.000021	0.282781	0.3	6.5	672	878	-0.94
D0021N6-12	274	0.069081	0.001826	0.282560	0.000017	0.282550	-8.0	-2.2	1003	1414	-0.95
D0021N6-13	293	0.051993	0.001422	0.282456	0.000018	0.282448	-11.6	-5.4	1140	1632	-0.96
D0021N6-14	296	0.052846	0.001583	0.282841	0.000019	0.282832	2.0	8.3	592	764	-0.95
D0021N6-15	291	0.048223	0.001651	0.282823	0.000015	0.282814	1.3	7.5	620	809	-0.95
D0021N6-16	277	0.075215	0.002078	0.282710	0.000019	0.282700	-2.6	3.1	791	1076	-0.94
D0021N6-17	313	0.094023	0.002763	0.283011	0.000020	0.282995	8.0	14.4	358	382	-0.92
D0021N6-18	276	0.079676	0.002333	0.283031	0.000018	0.283019	8.7	14.4	324	351	-0.93
D0021N6-19	276	0.071505	0.002148	0.282986	0.000016	0.282975	7.1	12.9	389	452	-0.94
D0021N6-20	318	0.054914	0.001622	0.282662	0.000016	0.282653	-4.3	2.4	850	1157	-0.95
D0021N6-22	294	0.038509	0.001217	0.282832	0.000017	0.282825	1.7	8.0	599	781	-0.96
D0021N6-23	277	0.065007	0.002056	0.283006	0.000017	0.282995	7.8	13.6	359	405	-0.94
D0021N6-24	274	0.061817	0.001858	0.283011	0.000018	0.283002	8.0	13.8	349	392	-0.94
D0021N6-25	299	0.052142	0.001534	0.282792	0.000016	0.282784	0.2	6.6	662	873	-0.95

注: $\varepsilon_{Hf}(t)=10^4\times([(^{176}Hf/^{177}Hf)_s-(^{176}Lu/^{177}Hf)_s\times(e^{\lambda t}-1)]/[(^{176}Hf/^{177}Hf)_{CHUR,0}-(^{176}Hf/^{177}Hf)_{CHUR}\times(e^{\lambda t}-1)]-1)$

$t_{DM}^1=1/\lambda\times(1+[(^{176}Hf/^{177}Hf)_s-(^{176}Hf/^{177}Hf)_{DM}]/[(^{176}Lu/^{177}Hf)_s-(^{176}Lu/^{177}Hf)_{DM}])$;

$t_{DM}^C=t_{DM}^1-(t_{DM}^1-t)[(f_{cc}-f_s)/(f_{cc}-f_{DM})]$; $f_{Lu/Hf}=(^{176}Lu/^{177}Hf)_s/(^{176}Lu/^{177}Hf)_{CHUR}-1$;

$\lambda=1.865\times10^{-11}$/a (Scherer et al., 2001); $(^{176}Lu/^{177}Hf)_{CHUR}=0.0336$, $(^{176}Hf/^{177}Hf)_{CHUR,0}=0.282785$ (Bouvier *et al.*, 2008);

$(^{176}Lu/^{177}Hf)_{DM}=0.0384$, $(^{176}Hf/^{177}Hf)_{DM}=0.28325$（Griffin *et al.*, 2000）;

$(^{176}Lu/^{177}Hf)_{mean\ crust}=0.015$ (Griffin *et al.*, 2002); $f_{cc}=[(^{176}Lu/^{177}Hf)_{mean\ crust}/(^{176}Lu/^{177}Hf)_{CHUR}]-1$;

附表 4 冲尼凝灰岩主量元素（wt%）及微量元素（$\times 10^{-6}$）数据

Table 4 Bulk rock major (wt%) and trace element ($\times 10^{-6}$) compositions of Chongni Tuffs

样品名	D0021-DH1	D0021-DH2	D0021-DH6	D0021-DH8	D0021-DH9
SiO2	72.65	66	64.94	63.56	63.47
TiO2	0.49	0.56	0.66	1.13	1.09
Al2O3	14.17	15.61	15.79	20.53	15.25
$Fe2O3^{T}$	3.15	3.91	5.57	7.25	7.8
MnO	0.04	0.06	0.11	0.05	0.1
MgO	0.92	1.14	1.44	1.01	2
CaO	1.03	3.09	2.85	0.22	2.91
Na2O	3.17	2.41	4.94	1.36	2.21
K2O	1.84	2.51	1.3	1.58	1.92
P2O5	0.08	0.1	0.07	0.03	0.09
LOI	1.98	4.01	2.29	3.36	3.12
SUM	99.52	99.41	99.94	100.07	99.94
$Mg^{\#}$	34.2	34.2	31.5	19.9	31.4
Sc	11.31	14.39	17.40	25.27	17.99
V	58.66	74.38	96.38	168.67	158.41
Cr	6.34	8.26	30.42	63.15	14.28
Co	5.48	6.35	7.71	11.90	9.49
Ni	3.66	4.34	8.23	12.74	5.51
Cu	10.63	15.09	3.76	16.92	3.64
Zn	42.88	55.16	69.43	66.92	96.69
Ga	13.65	17.26	13.80	20.20	17.59
Cs	1.02	1.21	1.87	1.63	2.05
Rb	41.54	56.72	32.47	46.30	46.04
Ba	353.96	486.80	228.65	193.57	334.32
Th	3.13	3.47	2.02	3.31	2.57
U	1.28	1.44	0.82	2.12	0.89
Nb	2.98	3.32	2.62	3.96	4.16
Ta	0.21	0.24	0.17	0.28	0.26
La	11.79	14.81	9.95	18.98	8.12
Ce	26.98	32.61	20.00	40.13	18.09
Pb	5.50	5.54	6.59	6.87	5.32
Pr	3.60	4.45	2.50	4.75	2.24
Sr	121.86	129.55	235.35	221.54	193.66
Nd	16.33	20.46	11.83	20.65	10.34
Zr	153.56	172.43	91.67	181.13	91.94
Hf	4.52	5.00	2.77	5.06	2.81
Sm	4.49	5.54	2.78	4.51	2.57
Eu	1.35	1.47	1.24	1.21	0.99
Ti	3011	3518	4051	7004	6748
Gd	4.65	6.09	3.40	3.95	2.87
Tb	0.78	1.03	0.63	0.61	0.56
Dy	4.63	6.02	3.72	3.26	3.30
Y	30.35	39.22	22.77	20.13	21.28
Ho	1.01	1.30	0.80	0.70	0.74
Er	3.16	3.95	2.38	2.17	2.23
Tm	0.49	0.62	0.37	0.37	0.35
Yb	3.39	4.07	2.45	2.75	2.40
Lu	0.55	0.65	0.39	0.45	0.37

注:LOI 为烧失量; $Mg^{\#}=100\times Mg/(Mg+Fe)$,摩尔比

Bouvier A..,Vervoort J.D. and Patchett P.J., 2008. The Lu–Hf and Sm–Nd Isotopic Composition of Chur: Constraints from Unequilibrated Chondrites and Implications for the Bulk Composition of Terrestrial Planets. *Earth and Planetary Science Letters*, 273(1-2): 48-57. https://doi.org/10.1016/j.epsl.2008.06.010

Griffin W.L., Pearson N.J., Belousova E., et al., 2000. The Hf Isotope Composition of Cratonic Mantle: Lam-Mc-Icpms Analysis of Zircon Megacrysts in Kimberlites. *Geochimica et Cosmochimica Acta*, 64(1): 133-147. https://doi.org/10.1016/S0016-7037(99)00343-9

Griffin W.L., Wang X., Jackson S.E., et al., 2002. Zircon Chemistry and Magma Mixing, Se China: In-Situ Analysis of Hf Isotopes, Tonglu and Pingtan Igneous Complexes. *Lithos*, 61(3-4): 237-269. https://doi.org/10.1016/S0024-4937(02)00082-8