

附表 1 大理矿区石英闪长斑岩及闪长岩体锆石 U-Pb 同位素分析结果

Appendix table 1 U-Pb data for zircons of the quartz diorite and diorite in Dalli mining area

样品号	含量 (ppm)			比值						年龄 (Ma)				谐和度 (%)	
	U	Th	Pb	Th/U	$^{207}\text{Pb}/^{206}\text{Pb}$	2 σ	$^{207}\text{Pb}/^{235}\text{U}$	2 σ	$^{206}\text{Pb}/^{238}\text{U}$	2 σ	$^{207}\text{Pb}/^{235}\text{U}$	2 σ	$^{206}\text{Pb}/^{238}\text{U}$		2 σ
DA12-1-6															
1	99	33	0.5	0.34	0.043000	0.032000	0.015000	0.013000	0.002940	0.000320	14.0	13.0	19.0	2.0	74
2	186	93	0.8	0.50	0.049000	0.011000	0.018100	0.003800	0.002693	0.000096	18.0	3.7	17.3	0.6	104
3	160	73	0.6	0.45	0.046000	0.011000	0.016100	0.003900	0.002740	0.000120	16.5	4.0	17.6	0.8	94
4	86	35	0.3	0.40	0.064000	0.024000	0.018800	0.007200	0.002690	0.000160	18.0	7.0	17.3	1.0	104
5	175	80	0.7	0.46	0.041000	0.011000	0.015900	0.004100	0.002860	0.000110	15.7	4.1	18.4	0.7	85
6	103	39	1.2	0.37	0.150000	0.025000	0.064000	0.010000	0.003120	0.000150	60.8	9.5	20.1	1.0	303
7	205	65	0.5	0.32	0.049000	0.010000	0.019100	0.003700	0.002870	0.000110	18.9	3.7	18.4	0.7	102
8	128	49	0.4	0.38	0.049000	0.012000	0.018200	0.004600	0.002870	0.000120	17.9	4.5	18.5	0.8	97
9	86	43	0.5	0.50	0.057000	0.022000	0.016000	0.006300	0.002670	0.000170	16.1	6.4	17.2	1.1	94
10	156	60	0.4	0.37	0.055000	0.012000	0.019700	0.004200	0.002650	0.000110	19.5	4.2	17.1	0.7	114
11	58	22	0.2	0.38	0.051000	0.030000	0.016900	0.009400	0.002750	0.000190	15.4	9.2	17.7	1.2	87
12	102	39	0.2	0.38	0.053000	0.019000	0.019900	0.006300	0.002730	0.000150	19.3	6.2	17.5	1.0	110
13	82	33	0.3	0.40	0.048000	0.022000	0.018400	0.007600	0.002790	0.000170	17.4	7.4	18.0	1.1	97
14	90	29	0.3	0.33	0.060000	0.023000	0.022400	0.007500	0.002870	0.000180	21.5	7.3	18.4	1.1	117
15	123	68	19.4	0.55	0.063700	0.002100	0.717000	0.026000	0.081300	0.001200	544.0	15.0	504.0	7.3	108
16	267	139	1.1	0.52	0.044000	0.008100	0.015800	0.002900	0.002667	0.000090	15.8	2.9	17.2	0.6	92
17	332	162	1.2	0.46	0.050300	0.007200	0.018100	0.002500	0.002676	0.000081	18.1	2.5	17.2	0.5	105
18	78	43	0.4	0.55	0.043000	0.021000	0.017500	0.007500	0.002700	0.000140	16.6	7.4	17.4	0.9	96
19	132	54	0.4	0.41	0.052000	0.023000	0.019400	0.007600	0.002660	0.000190	19.0	7.5	17.1	1.2	111
20	93	34	0.2	0.34	0.030000	0.020000	0.012600	0.006700	0.002690	0.000150	11.9	6.5	17.3	0.9	69

样品号	含量 (ppm)			比值						年龄 (Ma)				谐和度 (%)	
	U	Th	Pb	Th/U	²⁰⁷ Pb/ ²⁰⁶ Pb	2σ	²⁰⁷ Pb/ ²³⁵ U	2σ	²⁰⁶ Pb/ ²³⁸ U	2σ	²⁰⁷ Pb/ ²³⁵ U	2σ	²⁰⁶ Pb/ ²³⁸ U		2σ
DA12-1-6															
21	260	181	62.6	0.70	0.063300	0.001500	1.090000	0.025000	0.124400	0.001200	747.0	12.0	755.6	7.1	99
22	130	46	6.9	0.35	0.064500	0.002900	0.505000	0.031000	0.056300	0.002800	406.0	21.0	352.0	17.0	115
23	50	22	0.2	0.44	0.048000	0.040000	0.019000	0.011000	0.002760	0.000210	17.0	11.0	17.8	1.4	96
24	203	111	1.0	0.54	0.053000	0.010000	0.018800	0.003600	0.002664	0.000093	18.7	3.5	17.2	0.6	109
25	113	42	3.8	0.37	0.052800	0.005500	0.210000	0.022000	0.027200	0.002200	187.0	18.0	172.0	14.0	109
26	142	69	0.7	0.49	0.056000	0.014000	0.020700	0.004900	0.002720	0.000120	20.3	4.9	17.5	0.8	116
27	155	66	0.6	0.43	0.043000	0.012000	0.015600	0.004100	0.002620	0.000100	15.4	4.1	16.9	0.7	91
28	199	88	22.2	0.44	0.058600	0.001600	0.686000	0.019000	0.084700	0.001300	528.0	11.0	523.7	7.8	101
29	103	38	0.4	0.37	0.047000	0.020000	0.016200	0.006600	0.002700	0.000160	16.4	6.7	17.4	1.0	94
30	103	41	0.3	0.40	0.030000	0.016000	0.010600	0.005200	0.002770	0.000140	10.2	5.2	17.8	0.9	57
31	152	128	59.6	0.84	0.073200	0.001900	1.560000	0.045000	0.153500	0.002000	948.0	18.0	920.0	11.0	103
32	143	61	0.5	0.42	0.047000	0.014000	0.017300	0.004900	0.002600	0.000120	17.7	5.0	16.8	0.8	106
33	77	32	0.7	0.41	0.161000	0.037000	0.055000	0.010000	0.002910	0.000190	52.5	9.9	18.7	1.2	281
34	72	30	0.3	0.42	0.035000	0.027000	0.016300	0.008900	0.002700	0.000180	16.0	8.9	17.4	1.1	92
35	122	47	0.4	0.39	0.053000	0.016000	0.016400	0.004800	0.002510	0.000130	16.1	4.7	16.1	0.8	100
36	85	34	0.4	0.40	0.093000	0.026000	0.034800	0.008600	0.002760	0.000170	33.4	8.3	17.7	1.1	189
DA12-2-4															
1	313	156	1.3	0.50	0.047600	0.007900	0.015900	0.002600	0.002511	0.000086	15.9	2.6	16.2	0.6	98
2	647	385	2.9	0.60	0.042800	0.005100	0.013900	0.001600	0.002372	0.000053	13.9	1.6	15.3	0.3	91
3	805	1065	7.7	1.27	0.044700	0.004100	0.015400	0.001400	0.002477	0.000051	15.4	1.4	15.9	0.3	97
4	601	351	2.7	0.55	0.044600	0.005400	0.015500	0.001800	0.002520	0.000061	15.6	1.8	16.2	0.4	96
5	601	287	2.1	0.48	0.052100	0.005800	0.017700	0.001900	0.002470	0.000060	17.8	1.9	15.9	0.4	112

样品号	含量 (ppm)			比值						年龄 (Ma)				谐和度 (%)	
	U	Th	Pb	Th/U	²⁰⁷ Pb/ ²⁰⁶ Pb	2σ	²⁰⁷ Pb/ ²³⁵ U	2σ	²⁰⁶ Pb/ ²³⁸ U	2σ	²⁰⁷ Pb/ ²³⁵ U	2σ	²⁰⁶ Pb/ ²³⁸ U		2σ
DA12-2-4															
6	446	203	1.3	0.45	0.050800	0.007000	0.017000	0.002300	0.002415	0.000064	17.1	2.3	15.6	0.4	110
7	555	298	2.2	0.53	0.047800	0.005400	0.016300	0.001800	0.002504	0.000066	16.3	1.8	16.1	0.4	101
8	497	213	1.6	0.43	0.046900	0.006300	0.015500	0.002000	0.002478	0.000057	15.6	2.0	16.0	0.4	98
9	531	274	1.9	0.51	0.045800	0.005900	0.015100	0.001900	0.002383	0.000063	15.2	1.9	15.4	0.4	99
10	578	358	2.5	0.62	0.048000	0.005800	0.015700	0.001800	0.002423	0.000054	15.8	1.8	15.6	0.4	101
11	1027	527	3.9	0.51	0.048700	0.004400	0.016100	0.001400	0.002460	0.000047	16.2	1.3	15.8	0.3	102
12	565	271	1.8	0.48	0.048600	0.005900	0.016500	0.002000	0.002454	0.000059	16.6	2.0	15.8	0.4	105
13	765	527	3.5	0.69	0.048000	0.004200	0.015400	0.001200	0.002366	0.000048	15.5	1.2	15.2	0.3	102
14	404	185	1.3	0.46	0.043000	0.006500	0.014500	0.002100	0.002432	0.000064	14.5	2.1	15.7	0.4	93
15	577	381	2.7	0.65	0.047700	0.005900	0.015200	0.001800	0.002407	0.000057	15.3	1.8	15.5	0.4	99
16	636	329	2.3	0.52	0.044600	0.005500	0.014300	0.001700	0.002410	0.000054	14.3	1.7	15.5	0.4	92
17	900	636	4.9	0.65	0.045800	0.004700	0.015200	0.001600	0.002392	0.000048	15.3	1.6	15.4	0.3	99
18	438	218	1.7	0.49	0.046200	0.007100	0.014800	0.002200	0.002432	0.000069	14.8	2.2	15.7	0.4	95
19	715	394	3.0	0.55	0.044300	0.004300	0.015200	0.001500	0.002488	0.000049	15.3	1.5	16.0	0.3	96
20	637	451	3.1	0.70	0.047300	0.005600	0.015700	0.001900	0.002399	0.000057	15.7	1.8	15.4	0.4	102
21	920	575	4.1	0.62	0.049600	0.004300	0.016400	0.001400	0.002398	0.000044	16.5	1.4	15.4	0.3	107
22	538	258	1.8	0.48	0.044200	0.005800	0.014600	0.001900	0.002389	0.000057	14.7	1.9	15.4	0.4	96
23	731	391	2.7	0.53	0.042600	0.004500	0.014500	0.001500	0.002459	0.000053	14.6	1.5	15.8	0.3	92
24	560	303	2.1	0.53	0.047100	0.005600	0.015700	0.001900	0.002397	0.000061	15.8	1.9	15.4	0.4	102
25	353	152	1.0	0.43	0.051000	0.007500	0.016300	0.002400	0.002424	0.000079	16.6	2.4	15.6	0.5	106
26	507	240	1.7	0.47	0.043500	0.005700	0.014300	0.001800	0.002440	0.000061	14.3	1.8	15.7	0.4	91
27	471	234	1.6	0.50	0.041300	0.006200	0.013900	0.002000	0.002394	0.000067	14.0	2.0	15.4	0.4	91

样品号	含量 (ppm)			比值						年龄 (Ma)				谐和度 (%)	
	U	Th	Pb	Th/U	²⁰⁷ Pb/ ²⁰⁶ Pb	2σ	²⁰⁷ Pb/ ²³⁵ U	2σ	²⁰⁶ Pb/ ²³⁸ U	2σ	²⁰⁷ Pb/ ²³⁵ U	2σ	²⁰⁶ Pb/ ²³⁸ U		2σ
DA12-2-4															
28	731	438	3.4	0.60	0.051400	0.004700	0.016800	0.001500	0.002408	0.000055	16.9	1.5	15.5	0.4	109
29	652	318	2.1	0.49	0.043400	0.005400	0.014000	0.001700	0.002390	0.000054	14.1	1.7	15.4	0.4	92
30	309	241	1.6	0.77	0.042800	0.008400	0.013600	0.002500	0.002307	0.000078	13.5	2.5	14.9	0.5	91
31	505	240	1.6	0.47	0.049100	0.006200	0.015900	0.002000	0.002372	0.000057	15.9	2.0	15.3	0.4	104
32	506	261	1.9	0.51	0.043300	0.005600	0.014400	0.001900	0.002427	0.000063	14.4	1.9	15.6	0.4	92
33	169	69	0.5	0.40	0.056000	0.014000	0.016500	0.004100	0.002380	0.000110	16.3	4.1	15.3	0.7	106
34	533	267	2.2	0.50	0.057200	0.006000	0.019000	0.002000	0.002401	0.000060	19.0	2.0	15.5	0.4	123
35	678	393	84.0	0.58	0.498000	0.027000	0.670000	0.110000	0.008200	0.000970	470.0	59.0	52.5	6.2	895
36	196	141	0.9	0.72	0.046000	0.012000	0.015200	0.003800	0.002380	0.000100	15.1	3.8	15.4	0.7	98

注:测试单位:中国地质科学院地质研究所;测试条件:束斑直径 30μm、剥蚀频率 5Hz、能量密度 2J/cm²;测试者:于超,赵苗;谐和度计算公式为(²⁰⁷Pb/²³⁵U)_{Ma} / (²⁰⁶Pb/²³⁸U)_{Ma} × 100%

附表 2 大理矿区锆石稀土元素分析结果 (10⁻⁶)Appendix table 2 The rare elements analytical resultsof zircons in Dalli mining area (10⁻⁶)

DA12-1-6																		
点号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ti	3.36	5.32	6.81	4.48	6.8	15	4.64	5.39	3.57	5.6	4.07	5.29	4.69	3.93	17.7	6.26	3.34	4.79
La	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	0.054	-	-	0.057
Ce	6.56	10.61	12.71	6.28	13.66	6.97	8.38	9.76	6.78	8.12	4.14	7.61	6.52	4.61	5.87	19.74	12.95	5.05
Pr	0.011	0.031	0.047	0.040	0.046	0.022	0.024	0.032	0.093	0.025	0.027	0.029	0.029	0.010	0.065	0.036	0.015	0.065
Nd	0.27	0.73	1.14	0.81	1.07	0.39	0.53	0.66	1.71	0.76	0.38	0.63	0.57	0.327	0.58	1.06	0.29	0.89
Sm	1.48	2.13	3.04	2.1	3.15	1.8	1.45	1.96	3.77	1.82	1.06	2.02	1.5	1.07	1.62	3.13	0.81	1.38
Eu	0.70	1.06	1.54	1.12	1.43	0.80	0.78	1.19	1.64	1.15	0.72	1.03	0.87	0.58	0.33	1.42	0.39	0.75
Gd	10.5	14.61	22.54	12.79	22.54	10.5	10.21	15.89	18.53	12.87	9.24	13.88	11.53	6.83	9.38	26.9	6.23	7.95
Tb	5.15	5.55	8.79	5.17	8.9	4.13	3.75	6.31	6.32	4.53	3.4	5.29	4.37	2.58	3.35	10.57	2.6	2.86
Dy	73	68.4	114.3	64.3	117.2	53.6	48.3	85.1	73.2	61.1	43.4	71.7	59.1	34.6	41.1	141.4	37.8	34.5
Ho	35.6	29.85	50.1	28.43	50.4	23.9	21.67	38.11	29.26	25.9	19.12	31.44	26.1	15.13	16.7	61.7	18.77	14.62
Er	178.7	147.8	242.5	141.9	251	119.3	111.5	193.4	140.9	131.4	98.4	156.1	129.8	78.3	79.2	304.6	111	72.7
Tm	44.1	34.8	56	34.56	58.1	28.6	27.4	45.41	32.68	32.3	24.09	36.99	30.9	19.22	18.02	70.5	30.9	18.23
Yb	449	379.9	579	375.7	601	310	309	494	336	355	270.9	398	331	221.4	175.1	741	402	202.4
Lu	97.1	87.3	126.7	88.2	130.1	70.6	73.2	110.2	76.7	80.1	63.3	89.5	76.5	52.4	35.25	158.3	93.8	48.8
∑REE	902	783	1218	761	1259	631	616	1002	728	715	538	814	679	437	387	1540	718	410
Eu/Eu*	0.53	0.56	0.55	0.64	0.50	0.54	0.60	0.63	0.58	0.70	0.68	0.58	0.62	0.64	0.25	0.46	0.52	0.67
Ce/Ce*	-	-	-	-	-	-	-	-	-	-	58	-	-	-	25	-	-	21
Lu/Gd	64.7	41.8	39.3	48.3	40.4	47.1	50.2	48.5	29.0	43.6	48.0	45.1	46.4	53.7	26.3	41.2	105.4	43.0
T _{Zr} (°C)	656	693	714	679	714	787	682	694	661	697	671	693	683	669	804	707	656	684
DA12-1-6																		

点号	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Ti	5.83	3.37	4.6	3.24	3.86	6.4	5.12	5.68	5.57	8.05	5.11	5.32	26.6	6.11	3.97	4.59	3.77	4.66
La	0.01	-	-	-	0.013	0.007	-	0.016	-	0.01	-	0.0005	1.16	0.006	0.022	0.016	-	0.016
Ce	8.87	4.51	18.8	4.99	3.99	16.24	7.14	11.28	10.76	11.53	7.91	7.25	28.4	11.74	5.63	5.66	6.58	5.48
Pr	0.037	0.007	0.283	0.013	0.021	0.050	0.020	0.054	0.040	0.036	0.033	0.022	0.396	0.045	0.027	0.045	0.035	0.021
Nd	0.96	0.223	5.3	0.38	0.41	1.14	0.52	0.96	0.66	0.74	0.59	0.78	3.15	0.95	0.52	0.95	0.86	0.72
Sm	2.15	0.85	12.7	1.05	1.33	2.88	1.67	2.77	1.91	1.84	2.1	1.9	4.25	2.75	1.31	1.97	2.23	2.08
Eu	1.15	0.452	0.72	0.448	0.661	1.31	0.81	1.33	1.2	0.169	1.05	1.11	0.6	1.24	0.86	1.02	1.08	0.89
Gd	16.52	5.38	57.6	7.61	7.12	23.7	10.84	19.48	17.27	12.19	14.46	14.53	17.5	18.9	10.79	12.35	13.52	12.47
Tb	6.14	2.1	20.8	2.84	2.67	9.4	4.18	7.41	6.66	4.57	5.36	5.37	5.51	7.57	3.8	4.49	5.1	4.52
Dy	82.7	25.3	230	37.1	34.1	124.6	58	95.2	90.1	60.2	73.5	71	69.8	102.3	51.5	56.9	65	58.6
Ho	35.6	11.03	87.4	16.18	14.82	53	24.57	39.8	37.73	24.69	31.94	29.89	28.1	43.1	21.8	23.25	27.43	24.81
Er	180.7	56.4	359	78.5	74.1	255.6	124.1	195.1	192.2	118.5	159.4	150.3	136.6	212.8	110.2	116.1	138.9	126.3
Tm	43	14.12	69.7	18.78	19.03	60.4	30.3	45.4	47	27.18	38.27	36.77	29.5	50.8	27.96	28.1	34.55	31
Yb	474	157.9	603	201.4	214	615	332.8	480	513	267.4	412.3	398	293	541	318	319	387.6	353
Lu	106.8	39.47	99.9	44.9	51	133.8	74.9	104.9	115.1	51.6	97.5	91.7	56.5	118.6	71.9	69.4	88.6	78.9
∑REE	959	318	1565	414	423	1297	670	1004	1034	581	844	809	674	1112	624	639	771	699
Eu/Eu*	0.57	0.63	0.08	0.47	0.64	0.47	0.56	0.54	0.62	0.11	0.56	0.62	0.21	0.51	0.68	0.61	0.58	0.52
Ce/Ce*	119	-	-	-	61	222	-	99	-	154	-	556	11	179	58	53	-	77
Lu/Gd	45.3	51.4	12.1	41.3	50.1	39.5	48.4	37.7	46.7	29.6	47.2	44.2	22.6	43.9	46.6	39.3	45.9	44.3
T_{Zr} (°C)	701	657	681	654	667	709	690	698	697	729	690	693	848	705	669	681	665	682
DA12-2-4																		
点号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ti	5.22	4.74	18.5	4.31	3.86	4.66	3.74	3.21	5.55	4.28	4.93	3.68	5.24	3.91	4.05	6.06	3.32	4.69
La	-	0.019	0.027	-	-	0.003	-	-	-	0.006	-	-	-	-	0.001	0.0005	0.014	-

Ce	10.39	22.16	51.8	14.28	19.56	10.36	17.46	13.83	16.72	17.72	34.3	18.73	24.15	13.36	18.25	19.07	31.3	14.84
Pr	0.036	0.049	0.275	0.037	0.031	0.024	0.022	0.028	0.032	0.097	0.045	0.026	0.049	0.016	0.078	0.043	0.129	0.032
Nd	0.46	0.6	4.99	0.54	0.42	0.42	0.66	0.43	0.62	1.74	0.9	0.54	0.74	0.363	1.73	0.72	2.21	0.55
Sm	1.18	1.37	12.6	0.93	1.19	0.91	1.35	0.99	1.26	2.35	2.33	1.12	1.45	0.77	2.63	1.69	3.82	1.2
Eu	0.47	0.70	6.06	0.56	0.64	0.57	0.58	0.57	0.57	1.10	0.97	0.59	0.75	0.47	1.29	0.76	1.43	0.71
Gd	6.24	8.59	61.6	6.81	8.02	6.24	7.81	7.56	7.07	12.73	13.46	7.89	8.96	6.24	14.09	9.99	18	7.14
Tb	2.28	3.2	19.03	2.64	2.96	2.15	3.03	2.83	2.75	4.48	5.41	2.84	3.12	2.25	4.74	3.55	6.1	2.56
Dy	30.3	42	212.6	33.6	39.5	26	40.9	38.4	39	54	74.1	39.8	41	30.63	58.6	48.9	73	35.7
Ho	12.88	18.39	78.8	15.41	18.37	11.19	17.82	16.45	17.75	22.04	32.4	18.01	17.48	13.27	23.64	21.91	28.9	15.48
Er	68.5	97.3	352	80.9	100.1	60	94.6	88.6	95.6	113.7	167.8	95.6	87.1	69.8	117.6	117.8	144.9	82.9
Tm	17.39	24.68	78.4	21.5	26.31	15.92	24.6	23.21	24.92	28.54	42.8	24.66	21.97	18.42	28.26	30.69	35	21.63
Yb	193.4	272	786	241	298	184	271.3	257	279.6	306.2	462	275	234.7	212.8	301.3	343.3	369	245.4
Lu	46.9	65	165.9	56.9	71.6	44.2	67	62.6	68.6	72.3	106.3	67.5	55.1	51.6	71	82.9	82.4	58.6
∑REE	390	556	1830	475	587	362	547	513	554	637	943	552	497	420	643	681	796	487
Eu/Eu*	0.52	0.61	0.64	0.66	0.61	0.71	0.53	0.62	0.56	0.59	0.51	0.59	0.61	0.64	0.63	0.55	0.51	0.72
Ce/Ce*	-	185	154	-	-	317	-	-	-	188	-	-	-	-	460	1043	185	-
Lu/Gd	52.6	53.0	18.9	58.5	62.5	49.6	60.1	58.0	67.9	39.8	55.3	59.9	43.0	57.9	35.3	58.1	32.0	57.5
T_{Zr} (°C)	691	684	809	676	667	682	665	653	697	675	687	663	692	668	671	704	655	683
DA12-2-4																		
点号	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Ti	5.14	3.91	7.71	3.12	4.89	5.16	4.21	3.53	5.42	5.22	3.41	7.04	4.02	5.06	4.06	4.27	4.75	10.23
La	-	-	0.324	-	-	0.006	0.01	-	-	0.004	-	-	0.012	-	-	0.001	0.117	-
Ce	21.07	17.85	29.5	14.46	24.31	19.11	10.64	14.35	16.15	22.1	19.72	15.41	15.04	14.97	6.03	18.35	20.84	14.7
Pr	0.039	0.127	0.112	0.024	0.045	0.042	0.019	0.023	0.041	0.027	0.030	0.108	0.038	0.037	0.012	0.035	0.096	0.035
Nd	0.83	2.27	1.26	0.47	0.74	0.62	0.38	0.61	0.63	0.87	0.5	1.99	0.43	0.61	0.209	0.53	0.94	0.97

Sm	1.61	3.39	2.14	1.11	1.78	1.18	0.85	1.04	1.2	1.5	1.23	3.27	1.23	1.28	0.322	1.01	1.39	2.77
Eu	0.73	1.44	1.11	0.56	0.70	0.55	0.38	0.56	0.58	0.68	0.51	1.52	0.60	0.59	0.21	0.53	0.64	0.86
Gd	9.62	16.52	13.23	7.14	9.73	8	4.99	7.29	7.11	9.9	8.11	16.5	6.92	7.71	2.45	8.04	8	19.8
Tb	3.66	5.16	5.23	2.57	3.74	2.76	1.929	2.9	2.66	3.61	2.95	5	2.5	2.64	0.916	2.97	2.76	6.79
Dy	48.3	62.8	71.9	35.6	49.6	37	26.88	37.2	35.3	50.9	39.4	60.1	35.2	37.1	13.01	37.9	35.6	83.2
Ho	21.85	24.9	31.8	15.63	22.06	16.63	11.9	16.62	15.86	21.84	17.14	23.03	15.38	15.98	5.55	16.65	15.77	32.95
Er	117.9	122	165.3	84.3	121.1	86.2	65	89.2	83.3	116	91.7	111.1	83.8	85.2	30.6	89.1	80.6	144.9
Tm	29.81	30	41.7	21.84	31.07	21.96	17.06	22.96	21.47	30.2	23.81	26.44	21.47	22.62	8.02	23.37	20.1	31.09
Yb	331.7	314	454	238.7	338.4	242.5	194.7	255	238.4	335	258.1	268.8	237.7	249.8	92.5	265	223.4	279.7
Lu	81.8	71.3	105.5	58.7	81.7	57.5	48.6	61.3	59.7	79	59.9	58.9	58.5	60.5	22.5	64.1	50.6	55.3
∑REE	669	672	923	481	685	494	383	509	482	672	523	592	479	499	182	528	461	673
Eu/Eu*	0.55	0.57	0.62	0.58	0.50	0.53	0.54	0.60	0.58	0.52	0.48	0.61	0.61	0.55	0.70	0.55	0.57	0.34
Ce/Ce*	-	-	39	-	-	316	195	-	-	554	-	-	175	-	-	788	50	-
Lu/Gd	59.5	30.2	55.8	57.5	58.8	50.3	68.2	58.9	58.8	55.9	51.7	25.0	59.2	54.9	64.3	55.8	44.3	19.6
T_{Zr} (°C)	690	668	725	651	686	690	674	660	695	691	657	717	670	689	671	675	684	750

注：测试单位：中国地质科学院地质研究所；测试条件：束斑直径 30μm、剥蚀频率 5Hz、能量密度 2J/cm²；测试者：于超，赵苗；Eu/Eu*=Eu/√Sm × Gd；Ce/Ce*=Ce/√La × Pr；

T_{Zr} (°C) = (4800±86)/((5.711±0.072)-log(Ti))-273.15 (Ferry and Watson, 2007)

附表3 大理矿区锆石 Hf 同位素分析结果

Appendix table 3 Hfisotopic analytical results of zircons in Dalli mining area

样品号	年龄(Ma)	$^{176}\text{Yb}/^{177}\text{Hf}$	$^{176}\text{Lu}/^{177}\text{Hf}$	2 σ	$^{176}\text{Hf}/^{177}\text{Hf}$	2 σ	$^{176}\text{Hf}/^{177}\text{Hf}$ (t)	$\epsilon_{\text{Hf}}(\text{t})$	2 σ	T_{DM}	$T_{\text{DM}}(\text{Hf})^{\text{C}}$
DA12-1-6											
1	17.2	0.02791	0.0011780	0.000007	0.282853	0.000020	0.282853	3.2	0.7	568	894
2	17.5	0.03986	0.0015811	0.000011	0.282837	0.000020	0.282836	2.7	0.7	598	931
3	18.0	0.03141	0.0012808	0.000024	0.282879	0.000019	0.282878	4.2	0.7	533	835
4	17.4	0.02900	0.0012056	0.000014	0.282876	0.000020	0.282875	4.0	0.7	537	843
5	17.8	0.02523	0.0010773	0.000011	0.282899	0.000016	0.282899	4.9	0.6	501	789
6	18.7	0.02516	0.0010632	0.000004	0.282878	0.000020	0.282878	4.2	0.7	531	835
DA12-2-4											
1	16.2	0.02454	0.0009926	0.000004	0.282861	0.000019	0.282861	3.5	0.7	554	876
2	16.2	0.03484	0.0013789	0.000005	0.282853	0.000019	0.282852	3.2	0.7	572	895
3	15.9	0.02788	0.0011101	0.000010	0.282876	0.000015	0.282876	4.0	0.5	534	842
4	16.1	0.02305	0.0009090	0.000022	0.282819	0.000015	0.282819	2.0	0.5	612	971
5	16.0	0.02215	0.0009215	0.000009	0.282860	0.000016	0.282859	3.4	0.6	555	880
6	15.6	0.02879	0.0011894	0.000029	0.282835	0.000016	0.282834	2.5	0.6	594	936
7	15.8	0.02700	0.0010849	0.000009	0.282877	0.000018	0.282877	4.1	0.6	533	840
8	15.5	0.02176	0.0008761	0.000014	0.282831	0.000016	0.282831	2.4	0.6	594	944
9	15.4	0.02485	0.0010241	0.000007	0.282859	0.000017	0.282858	3.4	0.6	558	882
10	15.6	0.02839	0.0011930	0.000005	0.282869	0.000019	0.282869	3.8	0.7	546	859
11	15.7	0.02398	0.0009918	0.000008	0.282834	0.000018	0.282834	2.5	0.6	592	937
12	15.5	0.01866	0.0007701	0.000023	0.282822	0.000017	0.282822	2.1	0.6	606	965

注：测试单位：中国科学院地质与地球物理研究所；测试条件：束斑直径 60 μm 、剥蚀频率 8Hz；测试者：梁明娟，史鹏亮；

$$\epsilon_{\text{Hf}}(\text{t})=10000\left\{\left[\left(\frac{{}^{176}\text{Hf}}{{}^{177}\text{Hf}}\right)_{\text{s}}-\left(\frac{{}^{176}\text{Lu}}{{}^{177}\text{Hf}}\right)_{\text{s}}\times(e^{2t}-1)\right] / \left[\left(\frac{{}^{176}\text{Hf}}{{}^{177}\text{Hf}}\right)_{\text{CHUR},0}-\left(\frac{{}^{176}\text{Lu}}{{}^{177}\text{Hf}}\right)_{\text{CHUR}}\times(e^{2t}-1)\right]-1\right\}; T_{\text{DM}}=1/\lambda\times\ln\left\{1+\left[\left(\frac{{}^{176}\text{Hf}}{{}^{177}\text{Hf}}\right)_{\text{s}}-\left(\frac{{}^{176}\text{Hf}}{{}^{177}\text{Hf}}\right)_{\text{DM}}\right] / \left[\left(\frac{{}^{176}\text{Lu}}{{}^{177}\text{Hf}}\right)_{\text{s}}-\left(\frac{{}^{176}\text{Lu}}{{}^{177}\text{Hf}}\right)_{\text{DM}}\right]\right\}; T_{\text{DM}}(\text{Hf})^{\text{C}}=1/\lambda\times\ln\left\{1+\right.$$

$$\left[\frac{{}^{176}\text{Hf}/{}^{177}\text{Hf}}{s} - \frac{{}^{176}\text{Hf}/{}^{177}\text{Hf}}{\text{DM}-t} \right] / \left[\frac{{}^{176}\text{Lu}/{}^{177}\text{Hf}}{c} - \frac{{}^{176}\text{Lu}/{}^{177}\text{Hf}}{\text{DM}} \right] + t$$
; 其中 $({}^{176}\text{Hf}/{}^{177}\text{Hf})_{\text{CHUR},0} = 0.282772$; $({}^{176}\text{Lu}/{}^{177}\text{Hf})_{\text{CHUR}} = 0.0332$; $({}^{176}\text{Hf}/{}^{177}\text{Hf})_{\text{DM}} = 0.28325$; $({}^{176}\text{Lu}/{}^{177}\text{Hf})_{\text{DM}} = 0.0384$; $\lambda = 1.867 \times 10^{-11} \text{a}^{-1}$; $({}^{176}\text{Lu}/{}^{177}\text{Hf})_c = 0.015$,
t=锆石结晶年龄(Blichert-Toft and Albarede, 1997; Griffin et al., 2000; Söderlund et al., 2004)。