Research Advances

Timing of the Early Paleozoic Yangtze and Cathysian Convergence: Constraint from U-Pb Geochronology of Hydrothermal Zircons from Mafic Mylonite within the Shoucheng-Piaoli Ductile Shear Zone, Northern Guangxi

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Objective

The northern Guangxi region is in the southwestern part of the Southern China continent, which is located at the junction of the southwest section of the Early Paleozoic Yangtze block and Cathaysian block. A series of NNE-trending ductile shear zones are developed in this region, and these ductile shear zones are mostly previously suggested boundary faults of the Early Paleozoic Yangtze block and Cathaysian block, such as the Shoucheng–Piaoli ductile shear zone in Northern Guangxi (Meng Yuanku et al., 2016; Zhang Xuefeng et al., 2015). The NNE-trending Shoucheng–Piaoli ductile shear zone dips towards NWW and has a sinistral thrusting feature. The objective of the study is to obtain high-precision geochronological data of the ductile shear zone, which can be used to constrain the timing of the amalgamation between the Early Paleozoic Yangtze and Cathaysian blocks and help understand tectonic evolution of the South China plate.

Methods

The LA-ICP-MS U-Pb method was applied to the hydrothermal zircon grains which were obtained from mafic mylonite within the Shoucheng-Piaoli ductile shear zone in northern Guangxi. The mafic mylonite used for zircon selection was collected from the Diaozhushan diabase quarry of Longsheng County (coordinate: 109°50′ 09″ E, 25° 40′ 14″ N). Zircon selection, mounting, photographing and CL imaging were performed at Hebei Institute of Geological and Mineral Survey. The LA-ICP-MS U-Pb zircon analysis was performed at the Guangxi Key Laboratory of Hidden Metallic Ore Exploration of the Guilin University of Technology.

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Results

Zircon grains are subhedral-anhedral with a short prismatic or irregular shape. Their grain size ranges from 80 to 150 μm, and the length to width ratio is 1:1 to 3:1, with dark CL images (Fig. 1a). They have very high contents of Th (3231.70–56152.90 ppm) and U (642.86–14075.10 ppm), which indicate that the zircons are hydrothermal in origin (Rubin et al., 1989). Among all the 17 analyzed zircon grains, 14 yield a weighted mean age of 441.0±2.0 Ma, which is interpreted as the age of the Shoucheng–Piaoli ductile shear zone. Three other zircon grains gave ages of 539±4 Ma, 540±4 Ma and 636±6 Ma, respectively, which probably represent episodic post-plutonic hydrothermal activities.

Conclusions

A high-precision U-Pb geochronological analysis of hydrothermal zircons contained in mafic mylonite within the ductile shear zones in northern Guangxi was performed in this study for the first time. The result demonstrates that the Shoucheng–Piaoli ductile shear zone was generated at 441.0±2.0 Ma. This age presents new constraint on the timing of the convergence between Yangtze and Cathysian blocks of south China. This study provides new insight into methodology of age determination of the Early Paleozoic ductile shear zones in northern Guangxi.

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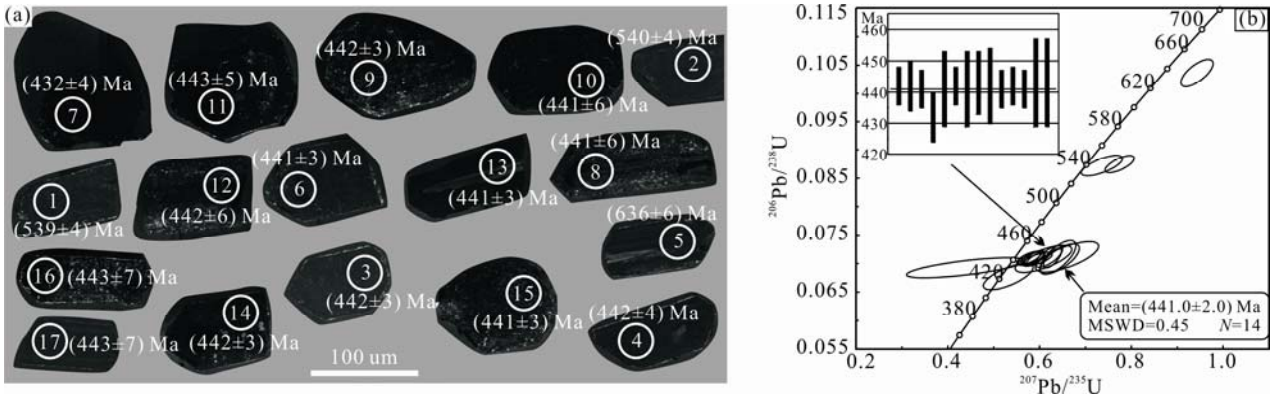

Fig. 1. Cathodoluminescent images of zircon grains (a) and zircon U-Pb concordia and weighted mean age diagrams (b).

References

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Appendix 1 Zircon LA-ICP-MS U-Pb dating results

Spot No.	w_B (ppm)		Th/U	Isotopic ratios						Apparent ages (Ma)					
	Th	U		$^{207}Pb/^{206}Pb$	±1σ	$^{207}Pb/^{235}U$	±1σ	$^{206}Pb/^{238}U$	±1σ	$^{207}Pb/^{206}Pb$	±1σ	$^{207}Pb/^{235}U$	±1σ	$^{206}Pb/^{238}U$	±1σ
17008-01				0.066 03	0.002 14	0.735 75	0.018 41	0.087 19	0.000 73	807	38	560	11	539	4
17008-02	7 224.16	5 715.68	1.26	0.069 05	0.001 57	0.774 48	0.013 01	0.087 45	0.000 61	900	23	582	7	540	4
17008-03	11 103.61	6 617.84	1.68	0.062 88	0.001 62	0.588 31	0.009 02	0.070 92	0.000 56	704	19	470	6	442	3
17008-04	18 861.14	14 075.10	1.34	0.046 78	0.007 56	0.628 22	0.008 00	0.070 95	0.000 70	38	14	495	5	442	4
17008-05	7 217.90	5 437.13	1.33	0.065 58	0.002 00	0.943 09	0.014 34	0.103 63	0.000 97	793	17	674	7	636	6
17008-06	12 292.07	2 734.40	4.50	0.062 69	0.001 36	0.576 53	0.010 32	0.070 84	0.000 47	698	27	462	7	441	3
17008-07	9 647.51	5 091.03	1.90	0.046 05	0.005 58	0.439 74	0.053 05	0.069 26	0.000 72		241	370	37	432	4
17008-08	13 230.73	997.11	13.27	0.055 40	0.005 77	0.608 58	0.025 22	0.070 81	0.000 97	428	68	483	16	441	6
17008-09	7 137.10	2 236.58	3.19	0.059 24	0.001 86	0.576 41	0.010 83	0.070 94	0.000 49	576	29	462	7	442	3
17008-10	56 152.90	2 943.54	19.08	0.064 44	0.003 16	0.643 88	0.017 49	0.070 81	0.001 08	756	32	505	11	441	6
17008-11	5 612.20	5 632.42	1.00	0.064 17	0.002 24	0.620 31	0.012 22	0.071 21	0.000 76	747	24	490	8	443	5
17008-12	3 231.70	642.86	5.03	0.057 12	0.003 73	0.531 72	0.022 18	0.067 71	0.000 94	496	67	433	15	442	6
17008-13	4 554.36	8 438.86	0.54	0.061 30	0.001 96	0.591 77	0.008 10	0.070 83	0.000 44	650	19	472	5	441	3
17008-14	12 400.05	2 960.75	4.19	0.064 36	0.001 64	0.584 71	0.010 23	0.070 95	0.000 50	753	25	467	7	442	3
17008-15	5 439.17	2 604.94	2.09	0.034 95	0.003 34	0.594 49	0.013 53	0.070 74	0.000 49	-76	35	474	9	441	3
17008-16	12 484.34	1 047.00	11.92	0.071 61	0.003 90	0.659 85	0.028 11	0.071 17	0.001 09	975	62	515	17	443	7
17008-17	35 028.63	11 507.04	3.04	0.062 06	0.006 00	0.639 84	0.016 02	0.071 08	0.001 21	676	27	502	10	443	7