

Research Advances

Early Permian Strata Exist in the Olongbluk Block

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Objective

Whether the Early Permian successions are still preserved in the Olongbluk Block is controversial, which is resulted from the diverse understanding on the formation age of fossil assemblages from the lower Zhabusagaxiu Formation. Some scholars assigned an early Permian deposition age for the lower Zhabusagaxiu Formation, whereas others believed it was deposited during the Late Carboniferous and no stable Permian strata exist in the Olongbluk Block. Therefore, clarifying the sedimentary timing of the lower Zhabusagaxiu Formation is a key and basis for constraining Permian tectono-sedimentary processes of the Olongbluk Block. In this study, zircon U-Pb geochronology study was conducted on detrital zircons from the lower Zhabusagaxiu Formation exposed in the Shihuigou area, western Olongbluk Block. Ages of the youngest detrital zircons are further used to provide constraints on the depositional timing of the lower Zhabusagaxiu Formation.

Methods

The sample P1ZS was sandstone collected from basal Zhabusagaxiu Formation in the Shihuigou area (GPS: 37° 24' 35.07" N; 96° 04' 11.64" E). Zircon U-Pb isotopic analysis was carried out at the State Key Laboratory of

Continental Dynamics of Northwest University, China. Zircon U-Pb analytical details including description of the instruments, working parameters and calibration procedures largely follow analytical techniques described in Liu et al. (2008).

Results

Zircons from the Zhabusagaxiu Formation are generally broken fragments ranging in length from 80 μm to 130 μm with aspect ratios of 1:1 to 1.5:1 (Fig. 1). The dated zircons all display igneous oscillatory zoning or plate internal structure, with Th/U ratios significantly larger than 0.4, jointly suggesting a magmatic origin for these grains. All data are plotted near the concordia (Fig. 1a) with concordance >10% (Appendix 1), and thus are reliable for chronological discussion. More than 24 zircons with crystallization age younger than 298 Ma, which is the boundary age of the Carboniferous and Permian according to the international chronostratigraphic timescale. These ages fall in the range of 298–267 Ma and define a weighted mean age of 288 ± 3 Ma (Fig. 1b), providing a robust lower estimate for the Zhabusagaxiu Formation. Meanwhile, these syn-depositional zircons indicate extensive magmatism and rapid unroofing in the source area, arguing against the traditional continental margin basin origin for the Zhabusagaxiu Formation.

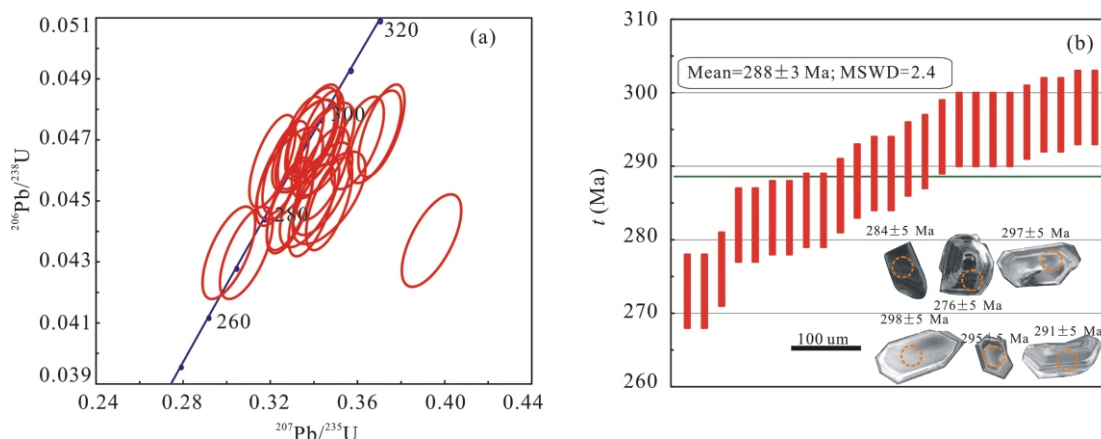


Fig. 1. U-Pb concordia diagram (a) and weighted mean age diagram (b).

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Conclusion

(1) Detrital zircons of 298–267 Ma constrain the Zhabusagaxiu Formation to be deposited during the Early Permian, certifying the existence of Permian strata in the Olongbluk Block.

(2) Syn-depositional zircons reveal extensive magmatism along with rapid unroofing in the source area, arguing against the consensus of continental margin basin origin for the Zhabusagaxiu Formation.

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References

Liu, X.M., Gao, S., Diwu, C.R., Yuan, H.L., and Hu, Z.C., 2007. Simultaneous in-situ, determination of U-Pb age and trace elements in zircon by LA-ICP-MS in 20 μm spot size. *Chinese Science Bulletin*, 52: 1257–1264.

Appendix 1 LA-ICP-MS U-Pb data for dated zircons from sandstone sample P1ZS

Analysis	Th	U	Th/U	Isotopic ratios						Ages					
				$^{207}\text{Pb}/^{206}\text{Pb}$	1σ	$^{207}\text{Pb}/^{235}\text{U}$	1σ	$^{206}\text{Pb}/^{238}\text{U}$	1σ	$^{207}\text{Pb}/^{206}\text{Pb}$	1σ	$^{207}\text{Pb}/^{235}\text{U}$	1σ	$^{206}\text{Pb}/^{238}\text{U}$	1σ
P1ZS01	211	250	0.84	0.0506	0.0018	0.301	0.008	0.0433	0.001	222	82	267	6	273	5
P1ZS02	285	344	0.83	0.0520	0.0019	0.309	0.008	0.0433	0.001	285	82	274	6	273	5
P1ZS03	220	216	1.02	0.0655	0.0022	0.394	0.009	0.0437	0.001	790	70	338	6	276	5
P1ZS04	228	577	0.40	0.0553	0.0018	0.339	0.007	0.0447	0.001	423	71	297	6	282	5
P1ZS05	222	285	0.78	0.0534	0.0018	0.329	0.007	0.0448	0.001	347	74	289	6	282	5
P1ZS06	177	552	0.32	0.0562	0.0018	0.347	0.007	0.0449	0.001	458	71	303	5	283	5
P1ZS07	346	406	0.85	0.0533	0.0017	0.329	0.007	0.0449	0.001	341	72	289	5	283	5
P1ZS08	164	200	0.82	0.0547	0.0019	0.338	0.009	0.0450	0.001	400	77	296	6	284	5
P1ZS09	83	134	0.62	0.0558	0.0023	0.347	0.011	0.0451	0.001	445	89	302	8	284	5
P1ZS10	239	331	0.72	0.0551	0.0020	0.344	0.009	0.0454	0.001	416	77	301	6	286	5
P1ZS11	140	254	0.55	0.0515	0.0017	0.324	0.007	0.0457	0.001	261	73	285	5	288	5
P1ZS12	321	356	0.90	0.0544	0.0019	0.344	0.008	0.0459	0.001	386	75	300	6	289	5
P1ZS13	442	380	1.16	0.0521	0.0021	0.329	0.010	0.0459	0.001	291	88	289	8	289	5
P1ZS14	161	228	0.70	0.0514	0.0017	0.327	0.007	0.0461	0.001	258	74	287	5	291	5
P1ZS15	262	377	0.70	0.0504	0.0017	0.321	0.007	0.0463	0.001	215	74	283	5	292	5
P1ZS16	274	423	0.65	0.0535	0.0018	0.342	0.008	0.0466	0.001	348	74	299	6	294	5
P1ZS17	264	312	0.84	0.0538	0.0019	0.345	0.009	0.0467	0.001	363	78	301	7	294	a
P1ZS18	363	433	0.84	0.0523	0.0021	0.336	0.010	0.0468	0.001	298	88	294	8	295	5
P1ZS19	346	360	0.96	0.0522	0.0019	0.336	0.009	0.0468	0.001	294	80	294	6	295	5
P1ZS20	407	363	1.12	0.0557	0.0019	0.360	0.008	0.0469	0.001	439	72	312	6	295	5
P1ZS21	297	385	0.77	0.0517	0.0017	0.334	0.007	0.0469	0.001	272	73	293	5	295	5
P1ZS22	243	306	0.79	0.0529	0.0017	0.343	0.007	0.0471	0.001	324	72	300	5	296	5
P1ZS23	203	178	1.14	0.0567	0.0020	0.368	0.008	0.0471	0.001	479	75	318	6	297	5
P1ZS24	206	337	0.61	0.0569	0.0019	0.371	0.007	0.0473	0.001	487	71	321	5	298	5