

The stellar nucleogenesis of elements necessary for the life origin

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STable 1: The abundance of heavy elements in the interstellar gas, (Cardelli 1994);

STable 2: The linear regression for RT1 stellar group;

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SFigure 1: The mass distributions of fission products produced in the thermal, fast, and high neutron fission yields of ^{232}Th (a) and ^{235}U (b);

SFigure 2: The statistic distributions of the stellar radius for RT1–RT4 stellar groups;

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Supplementary Tables

STable 1. The abundance of heavy elements in the interstellar gas, (Cardelli, 1994).

	Species	Z	log Abundances				
			Interstellar Gas, ζ Oph	Solar photosphere*		CI chondrites meteorites	
				AG89	GSAS15	AG89	GSAS15
1	Ga	31	2.06	2.88	3.02	3.13	3.08
2	Ge	32	3.02	3.41	3.63	3.63	3.58
3	As	33	2.10	–	–	2.37	2.3
4	Kr	36	2.97	–	3.25	3.23	-2.27
5	Sn	50	2.19	2.00	2.02	2.14	2.07
6	Tl	81	1.27	0.90	0.9	0.82	0.77
7	Pb	82	1.34	1.85	1.92	2.05	2.04

* AG89 is abundances obtained from E. Anders and N. Grevesse (1989) Abundances of the elements: Meteoritic and solar // *Geochimica et Cosmochimica Acta*. Vol. 53. pp. 197-214, Vol. 53. pp. 197-214; GSAS15 – Grevesse N, Scott P, Asplund M, Sauval AJ (2015) The elemental composition of the Sun III. The heavy elements Cu to Th. // *Astronomy & Astrophysics* 573 (A27). doi:10.1051/0004-6361/201424111

STable 2. The linear regression (R) for RT1 stellar group is shown. The elements, which have positive $R > 0.15$, were marked grey color. The bias is the slope between abundance and effective temperature; R – correlation coefficient; SD – standard deviation; N – number of stars in statistical sampling; The II label in the Element column is marked the ionization state. R_s is stellar radius and R_k – solar radius.

RT1 stellar group (859 stars)											
4400 < T < 5200 K, $R_s > 2 R_k$ R > 0.12 and N > 10											
№	Element	$10^4 \times$ bias	R	SD	N	№	Element	$10^4 \times$ bias	R	SD	N
1	Li	8.91	0.322	0.489	766	20	Fe	-1.03	-0.100	0.191	850
2	Be II	20.30	0.500	0.396	57	21	Co	-2.96	-0.269	0.198	839
3	C	-3.04	-0.302	0.180	806	22	Ni	-2.81	-0.243	0.210	849
4	O	-1.51	-0.185	0.149	806	23	Cu	-6.76	-0.420	0.271	785
5	Na	-1.72	-0.130	0.246	854	24	Zn	-10.90	-0.462	0.387	836
6	Mg	-2.74	-0.285	0.172	843	25	Sr	1.59	0.162	0.181	785
7	Al	-3.62	-0.333	0.191	855	26	Zr	2.59	0.214	0.222	804
8	Si	-3.45	-0.340	0.178	853	27	Zr II	-16.50	-0.559	0.350	45
9	Si II	-16.80	-0.597	0.301	37	28	Ba II	4.10	0.333	0.217	811
10	S	-9.93	-0.527	0.299	858	29	Hf	13.00	0.642	0.199	40
11	K	6.76	0.470	0.162	148	Lanthanides					
12	Ca II	-13.10	-0.418	0.390	28	30	La II	-3.47	-0.214	0.296	792
13	Sc	-1.52	-0.144	0.195	841	31	Ce	1.90	0.154	0.214	259
14	Ti	-1.45	-0.151	0.178	841	32	Nd	-16.60	-0.584	0.422	16
15	Ti II	-1.48	-0.119	0.211	283	33	Nd II	-1.68	-0.137	0.228	764
16	V	-3.42	-0.260	0.237	846	34	Sm II	-6.97	-0.348	0.353	794
17	V II	-18.70	-0.738	0.228	32	35	Eu	-10.90	-0.389	0.366	36
18	Cr	-2.27	-0.194	0.215	844	36	Gd II	4.39	0.184	0.321	48
19	Mn	-2.98	-0.200	0.273	848	37	Dy II	-8.82	-0.365	0.407	10

STable 3. The linear regression for RT2 stellar group. Designations are similar to designations shown in STable 2.

RT2 stellar group (1989 stars)											
5600 < T < 6500 K R > 0.12 and N > 10											
N _e	Element	10 ⁴ x bias	R	SD	N	N _e	Element	10 ⁴ x bias	R	SD	N
1	Li	18.20	0.555	0.548	1035	12	Mo	6.30	0.289	0.253	34
2	Be	8.46	0.377	0.515	10	13	Pd	7.85	0.498	0.244	36
3	Al	-1.93	-0.162	0.262	1966	14	Ag	10.20	0.582	0.253	36
4	P	-3.71	-0.314	0.259	71	15	Ba	4.95	0.532	0.214	13
5	Ca II	-1.73	-0.144	0.274	735	Lanthanides					
6	Sc	-2.85	-0.178	0.223	177	16	La	2.60	0.182	0.383	34
7	V II	-1.38	-0.126	0.253	583	17	La II	3.46	0.258	0.287	102 4
8	Cu	-2.22	-0.152	0.319	1897	18	Ce	4.63	0.346	0.302	50
9	Zn	-1.88	-0.157	0.263	1744	19	Nd	3.02	0.213	0.327	93
10	Y	3.18	0.216	0.326	1187	20	Sm	3.86	0.301	0.343	31
11	Zr	5.71	0.350	0.340	1160	21	Eu	4.36	0.178	0.467	374

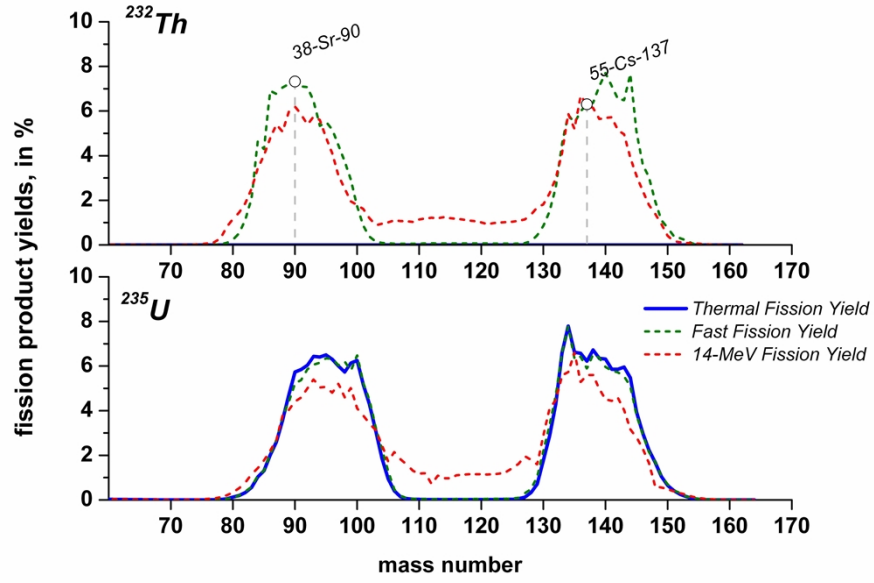
STable 4. The linear regression for RT3 stellar group.
Designations are similar to designations shown in STable 2.

RT3 stellar group (136 stars)											
T > 6500 K R > 0.12 and N > 10											
N _o	Element	10 ⁴ x bias	R	SD	N	N _o	Element	10 ⁴ x bias	R	SD	N
1	Li	7.07	0.234	0.727	23	19	Sr	-4.32	-0.191	0.568	72
2	C	-1.27	-0.175	0.202	110	20	Sr II	8.84	0.548	0.392	24
3	N	4.83	0.352	0.354	15	21	Y	3.11	0.174	0.458	80
4	Na	4.15	0.420	0.254	132	22	Y II	4.07	0.364	0.337	49
5	Mg	1.34	0.188	0.198	129	23	Zr	-3.19	-0.199	0.410	67
6	Al	3.06	0.301	0.245	101	24	Zr II	3.76	0.302	0.385	39
7	Si	1.58	0.251	0.173	132	25	Ba	5.90	0.440	0.303	59
8	S	2.33	0.262	0.242	132	26	Ba II	11.30	0.689	0.356	62
9	K	6.57	0.355	0.333	16	Lanthanides					
10	Ti II	1.87	0.217	0.258	66	27	La	5.74	0.333	0.405	74
11	V	5.21	0.431	0.309	115	28	Ce	6.14	0.433	0.318	71
12	Cr II	2.52	0.333	0.217	66	29	Ce II	-3.41	-0.121	0.329	20
13	Mn	2.74	0.291	0.253	124	30	Nd	6.45	0.490	0.291	60
14	Fe	1.73	0.220	0.213	131	31	Sm	5.37	0.430	0.278	51
15	Co	6.53	0.454	0.332	112	32	Sm II	-19.80	-0.368	0.509	12
16	Ni	2.05	0.224	0.251	134	33	Eu	5.75	0.245	0.576	62
17	Cu	6.85	0.455	0.368	98	34	Eu II	-4.16	-0.138	0.341	20
18	Zn	4.55	0.389	0.307	115						

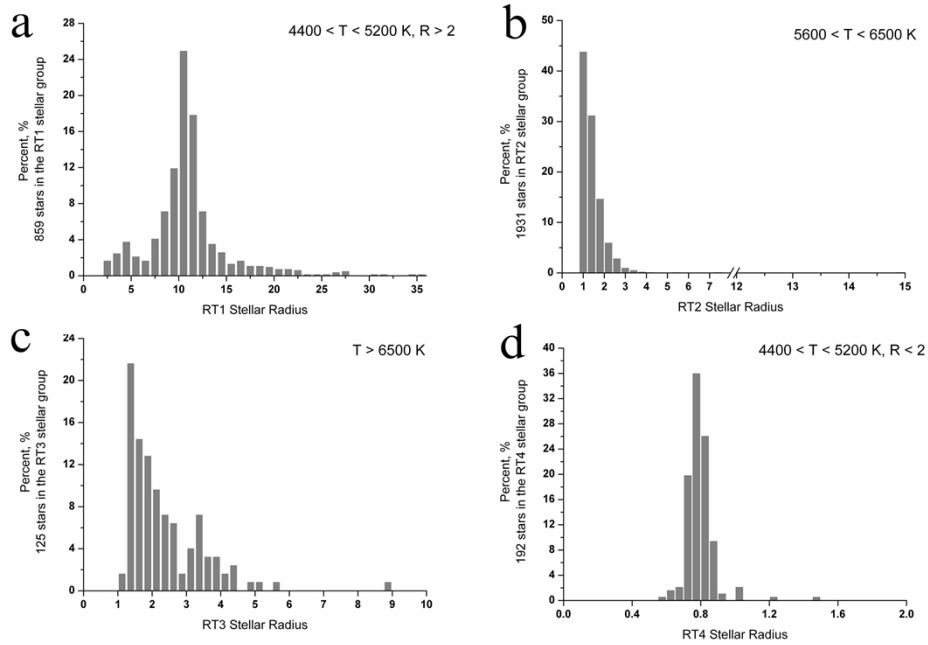
STable 5. The linear regression for RT4 stellar group.
Designations are similar to designations shown in STable 2.

RT4 stellar group (192 stars)											
4400 < T < 5200 K, $R_s < 2 R_k$ $ R > 0.12$ and $N > 10$											
N_e	Element	$10^4 \times$ bias	R	SD	N	N_e	Element	$10^4 \times$ bias	R	SD	N
1	Li	16.80	0.262	0.813	57	10	V II	-9.74	-0.431	0.288	80
2	N	6.72	0.295	0.252	53	11	Cr II	-2.99	-0.137	0.310	162
3	O	-3.79	-0.318	0.157	161	12	Zr	1.82	0.120	0.213	171
4	Si II	-5.89	-0.231	0.331	71	13	Zr II	-3.22	-0.155	0.300	153
5	S	-9.25	-0.366	0.335	192	Lanthanides					
6	K	-4.54	-0.303	0.214	11	14	Ce	-4.78	-0.422	0.200	10
7	Ca II	-17.30	-0.458	0.464	70	15	Pr II	-11.50	-0.548	0.236	79
8	Sc	-2.85	-0.178	0.223	177	16	Eu	4.23	0.305	0.200	65
9	V	-2.60	-0.154	0.233	190						

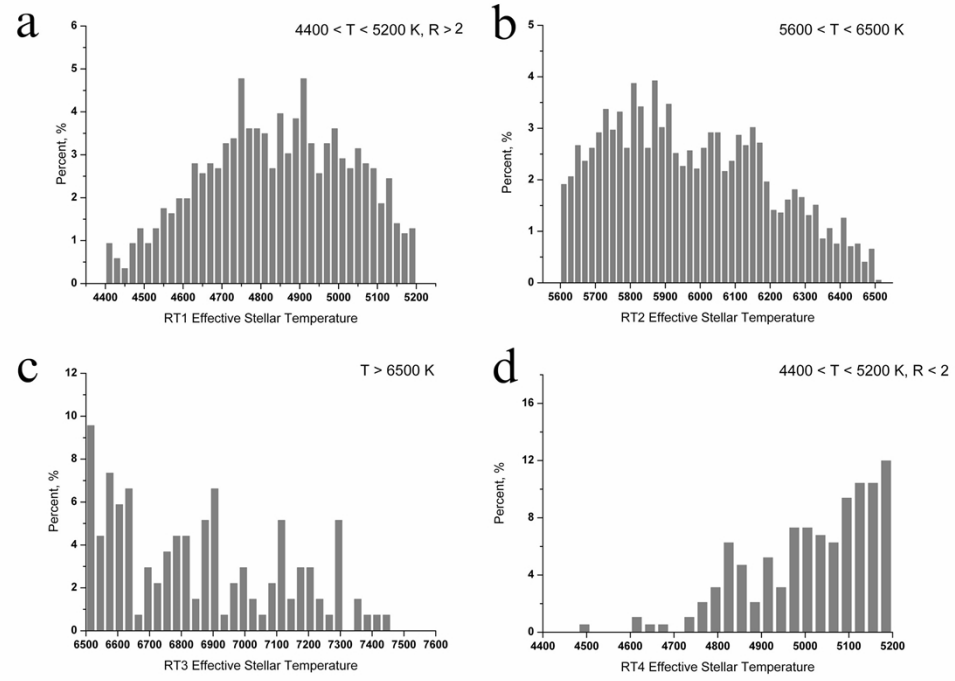
Supplementary Figures



SFigure1. The mass distributions of fission products produced in the thermal, fast, and high neutron fission yields of ^{232}Th (a) and ^{235}U (b). The thermal fission path of ^{232}Th is absent.



SFigure 2. The statistic distributions of the stellar radius (in R_p) for RT1 (a), RT2 (b), RT3 (c) and RT4 (d) stellar groups were presented.



SFigure 3. The statistic distributions of stellar effective temperature for RT1 (a), RT2 (b), RT3 (c), and RT4 (d) stellar groups were presented.