

1 **Supplementary materials for “REE geochemistry of conodont fossils from pelagic**
2 **deep-sea sedimentary rocks”**

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Table S1. Standard materials for the EPMA analysis

(a) Spot analysis

Measured element	Standard material	Characteristic X-ray	WDS
F	CaF	K α	LDEI
Na	NaAlSi ₃ O ₈	K α	TAPH
Mg	MgO	K α	TAPH
Al	Al ₂ O ₃	K α	TAPH
Si	CaSiO ₃	K α	PETJ
P	LaPO ₄	K α	PETJ
S	SrSO ₄	K α	PETJ
Cl	Na ₄ Al ₃ (SiO ₄) ₃ Cl	K α	PETJ
K	KAlSi ₃ O ₈	K α	PETJ
Ca	CaSiO ₃	K α	PETJ
Ti	TiO ₂	K α	PETJ
Mn	MnO	K α	LIFH
Fe	Fe ₂ O ₃	K α	LIFH
Sr	SrBaNb ₄ O ₁₂	L α	PETJ
Y	Y ₃ Al ₅ O ₁₂	L α	PETJ
La	LaPO ₄	L α	LIFH
Ce	CePO ₄	L α	LIFH
Pr	PrPO ₄	L β	LIFH
Nd	NdPO ₄	L β	LIFH
Pb	Pb, V, and Ge oxide	M α	PETJ
Th	ThO ₂	M α	PETJ
U	UO ₂	M β	PETJ

(b) Element mapping

Measured element	Standard material	Characteristic X-ray	WDS
F	CaF	K α	LDEI
Si	CaSiO ₃	K α	TAP
P	LaPO ₄	K α	PETJ
Ca	CaSiO ₃	K α	PETJ
Sr	SrBaNb ₄ O ₁₂	L α	TAP
Y	Y ₃ Al ₅ O ₁₂	L α	PETH
Nd	NdPO ₄	L β	LIFH
Th	ThO ₂	M α	PETJ

Note : WDS=Wavelength Dispersive X-ray Spectrometer

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Table S3

Major elemental concentration of conodont fossils from the Taho area

Sample ID	Section	Age	Lithology	Na ₂ O (wt%)	MgO (wt%)	Al ₂ O ₃ (wt%)	F (wt%)	Cl (wt%)	PbO (wt%)	SO ₃ (wt%)	P ₂ O ₅ (wt%)	Y ₂ O ₃ (wt%)	SiO (wt%)	SiO ₂ (wt%)	K ₂ O (wt%)	CaO (wt%)	TiO ₂ (wt%)	UO ₂ (wt%)	ThO ₂ (wt%)	La ₂ O ₃ (wt%)	Ce ₂ O ₃ (wt%)	Pr ₂ O ₃ (wt%)	Nd ₂ O ₃ (wt%)	MnO (wt%)	FeO (wt%)	Total (wt%)		
TC61_01	Taho	Early Triassic	Limestone	0.07	0.02	BDL	3.84	BDL	BDL	BDL	41.3	0.05	0.21	0.02	BDL	53.7	0.04	BDL	0.08	BDL	0.06	BDL	BDL	BDL	BDL	BDL	97.7	
TC61_02	Taho	Early Triassic	Limestone	0.13	0.02	BDL	3.56	0.01	BDL	0.06	41.3	BDL	0.18	BDL	BDL	53.9	BDL	BDL	BDL	BDL	BDL	BDL	0.05	BDL	BDL	BDL	97.9	
TC61_03	Taho	Early Triassic	Limestone	0.33	BDL	BDL	3.98	BDL	0.05	0.14	40.2	BDL	0.09	BDL	BDL	52.9	BDL	0.10	BDL	BDL	BDL	BDL	0.14	0.03	0.03	96.4		
TC61_04	Taho	Early Triassic	Limestone	0.28	0.06	0.03	3.91	0.01	0.09	0.05	40.7	BDL	0.23	BDL	BDL	53.4	BDL	BDL	0.05	BDL	0.12	0.08	0.05	BDL	BDL	BDL	97.4	
TC61_05	Taho	Early Triassic	Limestone	0.14	0.04	0.02	3.97	BDL	0.05	0.09	41.1	BDL	0.23	BDL	BDL	54.1	BDL	BDL	BDL	BDL	0.04	BDL	BDL	BDL	BDL	BDL	98.1	
TC61_06	Taho	Early Triassic	Limestone	0.34	0.08	BDL	3.84	0.01	BDL	0.04	40.8	BDL	0.06	BDL	BDL	53.8	BDL	BDL	0.08	0.03	BDL	0.12	BDL	0.04	BDL	BDL	97.7	
TC60_01	Taho	Early Triassic	Limestone	0.21	0.04	0.03	4.33	0.03	BDL	0.14	40.8	BDL	0.27	0.04	0.02	54.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	98.1	
TC60_02	Taho	Early Triassic	Limestone	0.12	BDL	BDL	4.19	0.03	0.10	0.08	41.7	BDL	0.19	BDL	BDL	54.4	BDL	0.09	BDL	BDL	0.08	BDL	BDL	0.02	BDL	BDL	99.3	
TC60_03	Taho	Early Triassic	Limestone	BDL	BDL	BDL	3.98	BDL	BDL	BDL	40.5	BDL	0.22	BDL	BDL	54.7	BDL	0.24	BDL	BDL	BDL	BDL	0.11	BDL	BDL	BDL	98.1	
TC60_04	Taho	Early Triassic	Limestone	BDL	BDL	BDL	3.75	0.01	0.07	0.05	41.0	BDL	0.28	BDL	BDL	54.6	BDL	BDL	BDL	BDL	0.03	0.10	BDL	BDL	BDL	BDL	98.3	
TC60_05	Taho	Early Triassic	Limestone	0.05	BDL	BDL	3.83	0.02	BDL	0.07	41.1	BDL	0.14	0.03	BDL	54.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	97.9	
TC60_06	Taho	Early Triassic	Limestone	BDL	BDL	BDL	3.79	0.01	BDL	0.07	41.1	0.06	0.19	0.02	BDL	54.8	BDL	BDL	0.10	0.04	BDL	BDL	0.13	BDL	BDL	BDL	98.7	
TC60_07	Taho	Early Triassic	Limestone	0.16	0.02	BDL	4.07	0.03	BDL	0.15	41.1	BDL	0.16	0.03	BDL	53.4	BDL	BDL	BDL	BDL	0.07	BDL	BDL	BDL	BDL	BDL	97.6	
TC60_08	Taho	Early Triassic	Limestone	0.17	0.03	BDL	3.98	0.02	BDL	0.09	41.1	BDL	0.23	0.03	BDL	54.2	BDL	0.09	0.12	BDL	BDL	0.13	BDL	0.03	0.05	98.6		
TC60_09	Taho	Early Triassic	Limestone	0.16	BDL	BDL	4.42	0.06	BDL	0.13	40.7	BDL	0.11	BDL	BDL	53.6	BDL	BDL	0.07	BDL	0.03	BDL	BDL	BDL	BDL	BDL	97.5	
TC60_10	Taho	Early Triassic	Limestone	0.17	0.03	BDL	4.33	0.02	BDL	0.05	40.2	BDL	0.20	0.04	BDL	53.6	BDL	BDL	BDL	0.05	BDL	BDL	BDL	BDL	BDL	BDL	97.0	
TC21_01	Taho	Early Triassic	Limestone	0.22	0.04	BDL	4.23	0.01	0.05	0.07	41.0	BDL	0.10	0.03	BDL	53.4	BDL	BDL	BDL	0.05	BDL	0.07	BDL	BDL	BDL	BDL	97.6	
TC21_02	Taho	Early Triassic	Limestone	0.08	BDL	BDL	3.94	0.03	BDL	0.09	40.4	BDL	0.06	BDL	BDL	54.0	BDL	BDL	0.09	BDL	BDL	BDL	0.07	BDL	0.06	97.2		
TC21_03	Taho	Early Triassic	Limestone	0.15	BDL	BDL	3.93	0.03	BDL	0.15	40.9	BDL	0.16	BDL	BDL	53.5	0.03	BDL	BDL	BDL	0.04	0.11	BDL	BDL	BDL	BDL	97.4	
TC21_04	Taho	Early Triassic	Limestone	0.22	BDL	BDL	4.18	0.05	BDL	0.10	40.0	BDL	0.20	BDL	BDL	54.0	BDL	BDL	BDL	BDL	0.07	BDL	BDL	BDL	BDL	BDL	97.2	
TC21_05	Taho	Early Triassic	Limestone	0.22	0.08	BDL	3.89	0.03	0.09	0.15	40.5	BDL	0.19	BDL	BDL	53.9	BDL	BDL	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.04	97.5
TC35_01	Taho	Early Triassic	Limestone	0.04	BDL	BDL	3.96	BDL	BDL	0.04	41.3	BDL	0.16	0.04	BDL	54.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	98.1	
TC35_02	Taho	Early Triassic	Limestone	0.03	0.03	BDL	3.79	0.02	BDL	0.05	41.6	BDL	0.23	0.04	BDL	53.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	98.1	
TC35_03	Taho	Early Triassic	Limestone	BDL	0.03	BDL	4.15	0.02	0.06	0.04	41.1	BDL	0.06	BDL	BDL	53.9	BDL	BDL	0.07	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	97.7
TC35_04	Taho	Early Triassic	Limestone	0.04	BDL	BDL	3.87	BDL	0.05	0.07	41.9	BDL	0.12	BDL	BDL	54.4	BDL	BDL	BDL	BDL	0.14	BDL	0.05	0.03	99.1			
TC35_05	Taho	Early Triassic	Limestone	0.13	0.04	BDL	3.78	0.02	BDL	0.18	40.5	BDL	0.23	BDL	BDL	53.8	BDL	BDL	BDL	BDL	0.06	0.07	0.08	0.04	0.05	97.5		
TC35_06	Taho	Early Triassic	Limestone	0.13	0.05	BDL	3.76	0.06	BDL	0.14	41.8	BDL	0.07	0.03	BDL	53.7	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL	BDL	BDL	98.2	
TC35_07	Taho	Early Triassic	Limestone	0.11	0.05	BDL	3.88	0.02	BDL	0.10	40.8	BDL	0.19	0.06	BDL	53.7	0.06	BDL	BDL	BDL	BDL	0.11	0.13	0.03	0.03	97.7		

Note: BDL—below detection limit

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Table S5

Rare earth element concentrations of conodonts from Tabo Limestone

Sample ID	Age	Y 2SE (ppm)	La 2SE (ppm)	Ce 2SE (ppm)	Pr 2SE (ppm)	Nd 2SE (ppm)	Sm 2SE (ppm)	Eu 2SE (ppm)	Gd 2SE (ppm)	Tb 2SE (ppm)	Dy 2SE (ppm)	Ho 2SE (ppm)	Er 2SE (ppm)	Tm 2SE (ppm)	Yb 2SE (ppm)	Lu 2SE (ppm)	ΣREE 2SE (ppm)	Ce/Ce* 2SE	Y/Ho 2SE																		
TC42_2	Lower Triassic	36	5	21	3	29	4	5.6	1.0	25	4	5	2	0.8	0.2	4.4	1.3	0.68	0.17	2.3	0.5	0.39	0.07	1.5	0.4	0.24	0.09	0.7	0.3	0.10	0.06	133	9	0.61	0.11	91	4
TC60_1	Lower Triassic	6.2	0.6	6.1	0.6	7.1	0.6	1.4	0.1	5.2	0.6	0.9	0.2	0.18	0.07	0.5	0.2	0.06	0.02	0.4	0.1	0.09	0.03	0.21	0.06	0.03	0.01	BDL	-	0.02	0.01	28.4	1.3	0.57	0.06	66	10
TC60_2	Lower Triassic	12	2	14	3	21	6	2.9	0.5	12	2	1.3	0.5	0.50	0.15	2.2	0.7	0.26	0.10	1.3	0.5	0.26	0.08	0.6	0.3	0.08	0.03	0.5	0.3	0.03	0.02	68	7	0.7	0.2	45	6
TC35_01	Lower Triassic	20	3	53	13	90	59	14	3	47	5	6.8	1.2	1.1	0.2	5.1	1.7	0.7	0.2	2.5	0.8	0.39	0.11	1.09	0.15	0.13	0.07	0.8	0.3	0.09	0.04	243	60	0.7	0.5	52	11
TC35_02	Lower Triassic	10.3	0.9	11	2	17.9	1.9	4.4	0.4	19	2	2.8	0.3	0.55	0.13	2.2	0.4	0.22	0.05	1.0	0.2	0.15	0.05	0.48	0.14	0.03	0.02	0.5	0.1	0.03	0.02	70	4	0.60	0.08	70	8

Note: BDL=below detection limit

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Table S6

Y/Ho and Ce/Ce* of siliceous sediments

Name	Y/Ho	2SD	Ce/Ce*	2SD
N4	33	12	1.2	0.16
N3	24	10	1.4	0.19
N2	29	4	1.54	0.13
N1	36	13	1.5	0.4
R3	28	6	2.4	0.3
R2	31	5	1.6	0.5
R1	27	6	1.3	0.3
O1	30	6	1.3	0.19
C4	21	4	1.6	0.5
C3	29	6	1.2	0.15
C2	28	5	1.1	0.3
C1	30	6	1.03	0.2
M5	25	6	1.0	0.2
M4	30	7	0.9	0.3
M3	32	5	1.1	0.2
M2	25	9	1.1	0.2
M1.5	26	6	1.0	0.8
M1	23	7	1.1	0.4
Mj17_1	30	4	0.92	0.2
Mj10	25	2	0.97	0.12
Mj9	26	2	0.97	0.09
Mj8_2	28	4	0.9	0.13
Mj8	24	8	0.9	0.2
Mj7	23	12	1.0	0.10
Mj6	33	13	0.99	0.10
Mj5	26	2	0.9	0.16
Mj4	29	5	1.0	0.16
Mj3	28	3	0.9	0.17
Mj2	29	5	0.87	0.11
Mj1	30	3	0.9	0.2
MjL3	31	4	1.0	0.18
MjL2	35	4	1.1	0.11
MjL1	25	4	0.9	0.3

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