

Supplemental material

ABYSSOURCE

ABYSSOURCE could be used to simulate the taphonomic environment of deep water and explore how early life forms, which related parameters and performance are shown in Table S1. ABYSSOURCE consists of three parts, including ① Console contains monitor, touch panel and input device; ② Controller consists of Programmable Logic Controller (SIEMENS SIMATIC S7-1500, Germany); ③ Simulator contains valves, pumps, sensors and chambers (Figure S1). ABYSSOURCE real-time data of factory acceptance test (30MPa, 200°C) displayed on the dashboard was shown in Figure S2; the real-time data of parameter setting (10MPa, 25°C) in this paper was shown in Figure S3.

Table S1 Parameters of ABYSSOURCE

Technical index	Working Range			Working Mode
Pressure	0-30±0.1 MPa			Auto-control
Temperature	0-200±1 °C			Auto-control
Sensor	150-200 °C	Open & Closed system	ORP: -1999~1999±1 mv pH: 0~13±0.02	On-line
	0-150 °C	Open system (unsealed Chamber)	ORP: -1999~1999±1 mv pH: 0~13±0.02 DO: 0~20±0.2 mg/L Sulfide: 0~10±0.1 mg/L	On-line & Manual
	0-150 °C	Closed system (sealed Chamber)	ORP: -1999~1999±1 mv pH: 0~13±0.02 DO: 0~20±0.2 mg/L Sulfide: 0~10±0.1 mg/L	Manual (experiment ended)

Morphologic preservation

According to the scoring index in the Method, the preservation scores of sample shrimps are detailed in Table S2.

Table S2 Preservation scores of selected characters

Sample Character	A	B	C	D	E	F	G	Character totals
Carapace-abdomen joint	100	100	100	100	50	100	100	650
Rostrum completeness	100	100	75	100	100	100	100	675
Carapace completeness	100	100	100	100	75	100	100	675
Abdomen completeness	100	75	100	50	25	100	100	550
Uropods-telson completeness	100	100	100	100	75	100	100	675
Appendages completeness	75	100	100	50	25	100	75	525
Sample totals	575	575	575	500	350	600	575	

Sample Character	H	I	J	K	L	M	N	Character totals
Carapace-abdomen joint	0	100	0	0	25	25	0	150
Rostrum completeness	25	100	75	25	0	25	25	275
Carapace completeness	50	100	50	50	25	25	25	325
Abdomen completeness	0	100	25	0	25	25	25	200
Uropods-telson completeness	75	100	50	0	25	25	0	275
Appendages completeness	0	75	25	0	25	0	0	125
Sample totals	150	575	225	75	125	125	75	

Chemical analysis

Decay of organism is crucial for generating changes of hydrochemical conditions in sediment. The changes generated by decay such as soluble protein or sulfide could be measured. Oxygen in the medium (water or experimental solution) was also measured²¹. The tracing data of soluble protein and sulfide in open condition are shown in the Figure S4. The chemical data tested after the experiment is shown in the Figure S5.

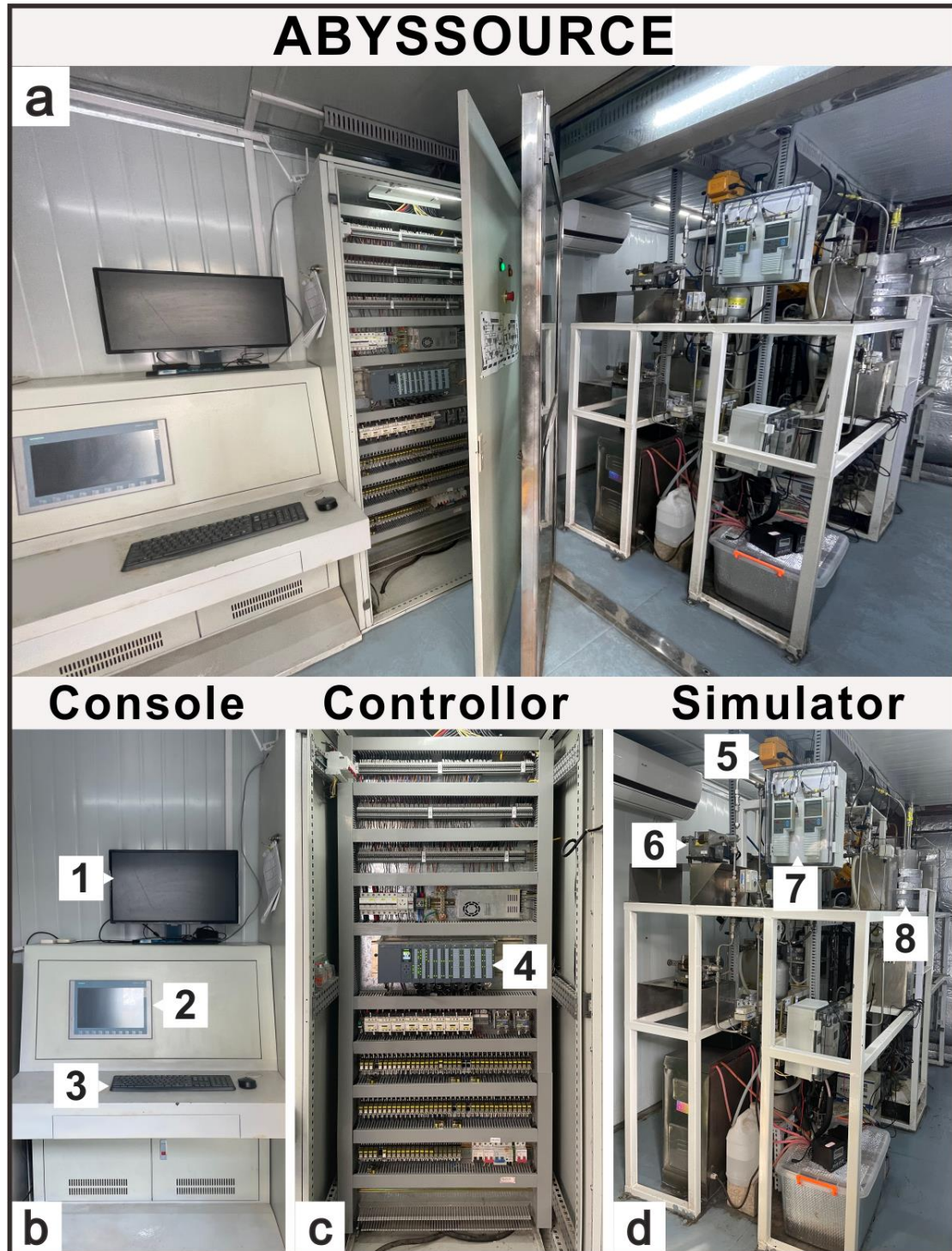


Figure S1. ABYSSOURCE Composition The figure shows the equipment appearance and its three components. a, ABYSSOURCE. b, Console of ABYSSOURCE (1, monitor; 2, touch panel; 3, input device). c, Controller of ABYSSOURCE (4, SIEMENS S7-1500). d, Simulator of ABYSSOURCE (5, valve; 6, pump; 7, sensor and 8, chamber)

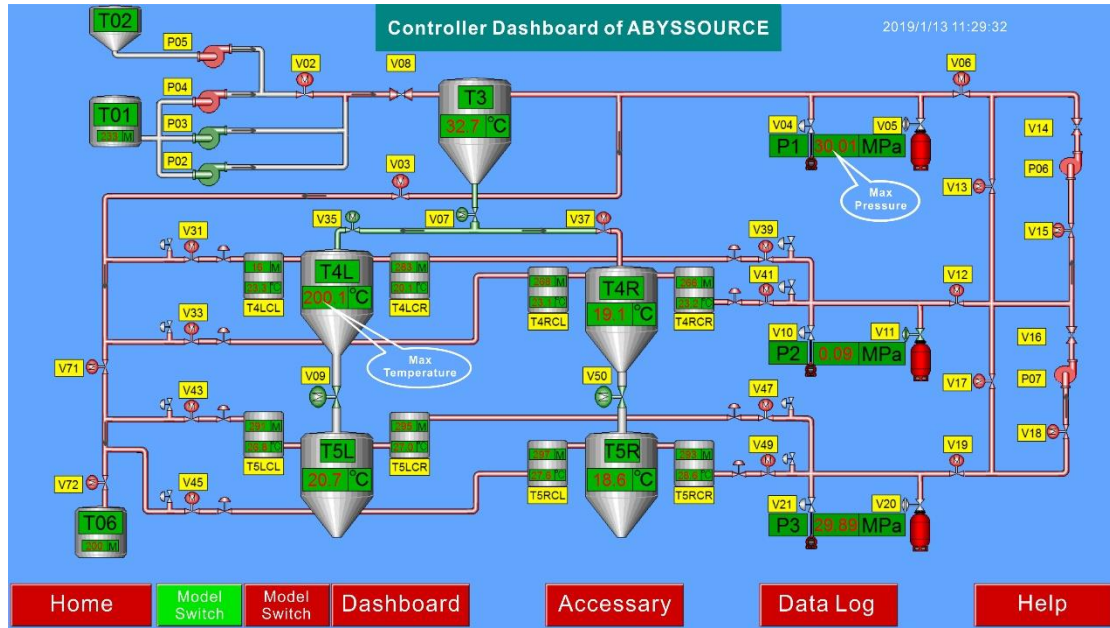


Figure S2. Console snapshot-1 The figure shows the factory acceptance test of ABYSSOURCE, including the verification and validation under 30MPa and 200°C use Chamber T4L.

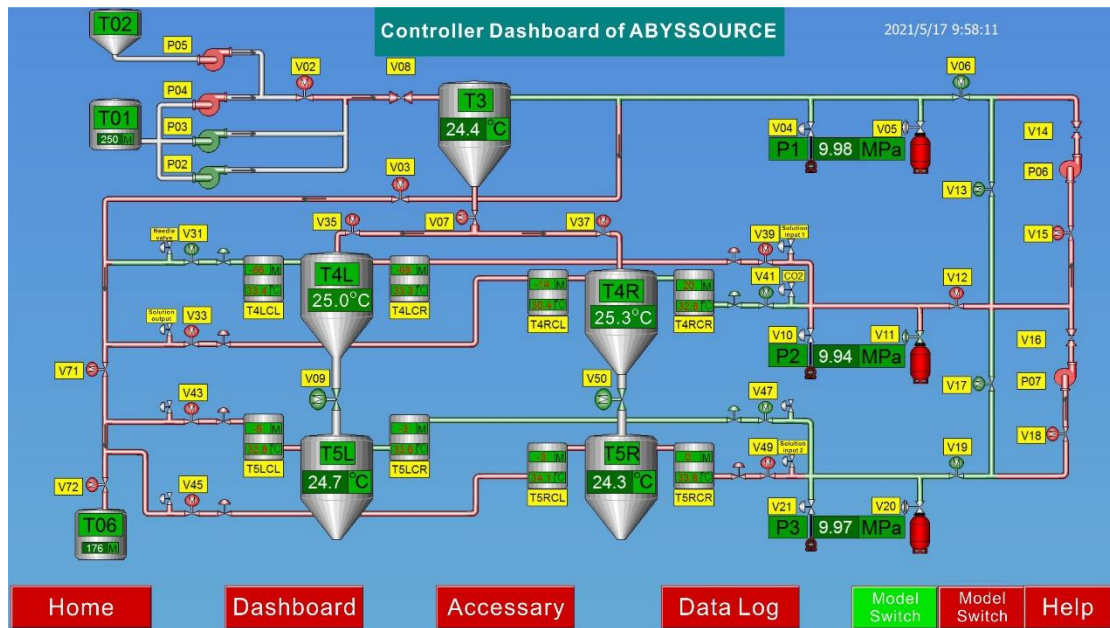


Figure S3. Console snapshot-2 The figure shows the real-time data of experiment in this paper. The pressure had been set to 10.0 MPa and the temperature had been set to 25.0 °C. The bias was about ± 0.05 MPa and ± 1.0 °C. T4L is Chamber A with medium exchangeable (open system), T4R is Chamber B under sealed (closed system).

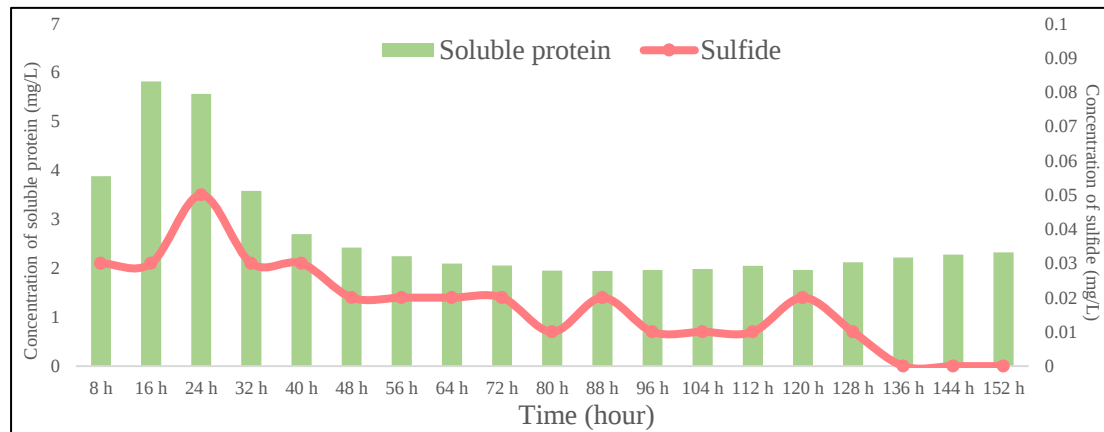


Figure S4. Tracing data of out flow from Chamber A (open condition).

Concentration of soluble protein and sulfide were tested every 8 h. After 48 hours of decay, they tended to be stable. The peak of sulfide lagged behind that of soluble protein.

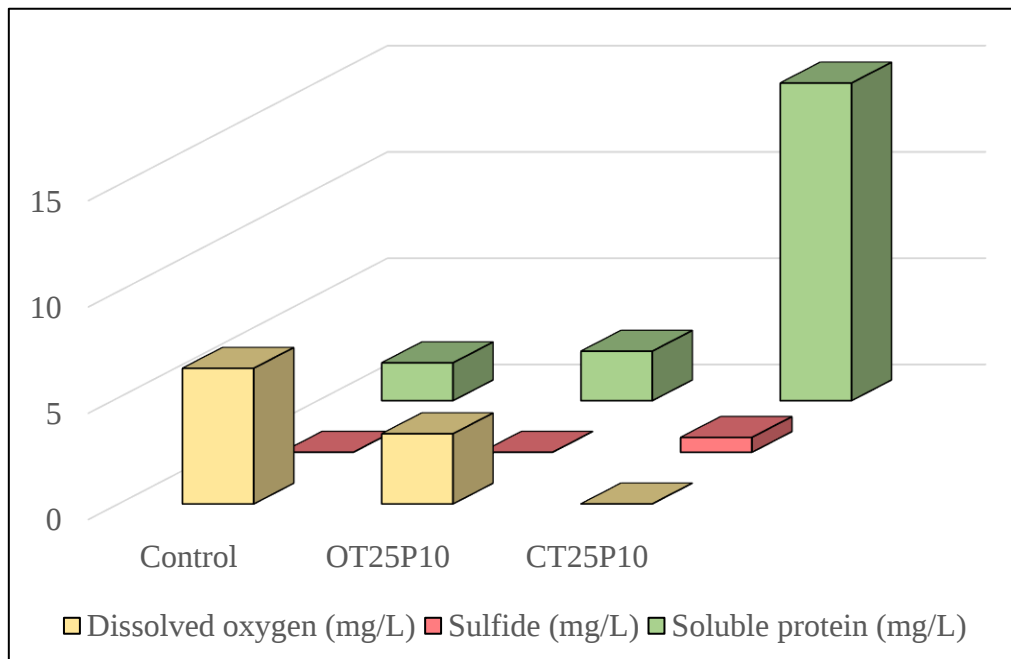


Figure S5. Chemical change of the medium. This figure showed the chemical differences of Control (river fresh-water), OT25T10 and CT25P10 (medium from Chamber A and Chamber B). The maximum concentration of soluble protein and sulfide appeared in CT25P10, which contained little or no dissolved oxygen.