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Supplement of

Ocean alkalinity enhancement approaches and the predictability of runaway precipitation processes: results of an experimental study to determine critical alkalinity ranges for safe and sustainable application scenarios

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Figure S1: Experimental setup, flow-through incubation boxes, Espeland Marine Biological Station (Bergen, Norway), background Raunefjord

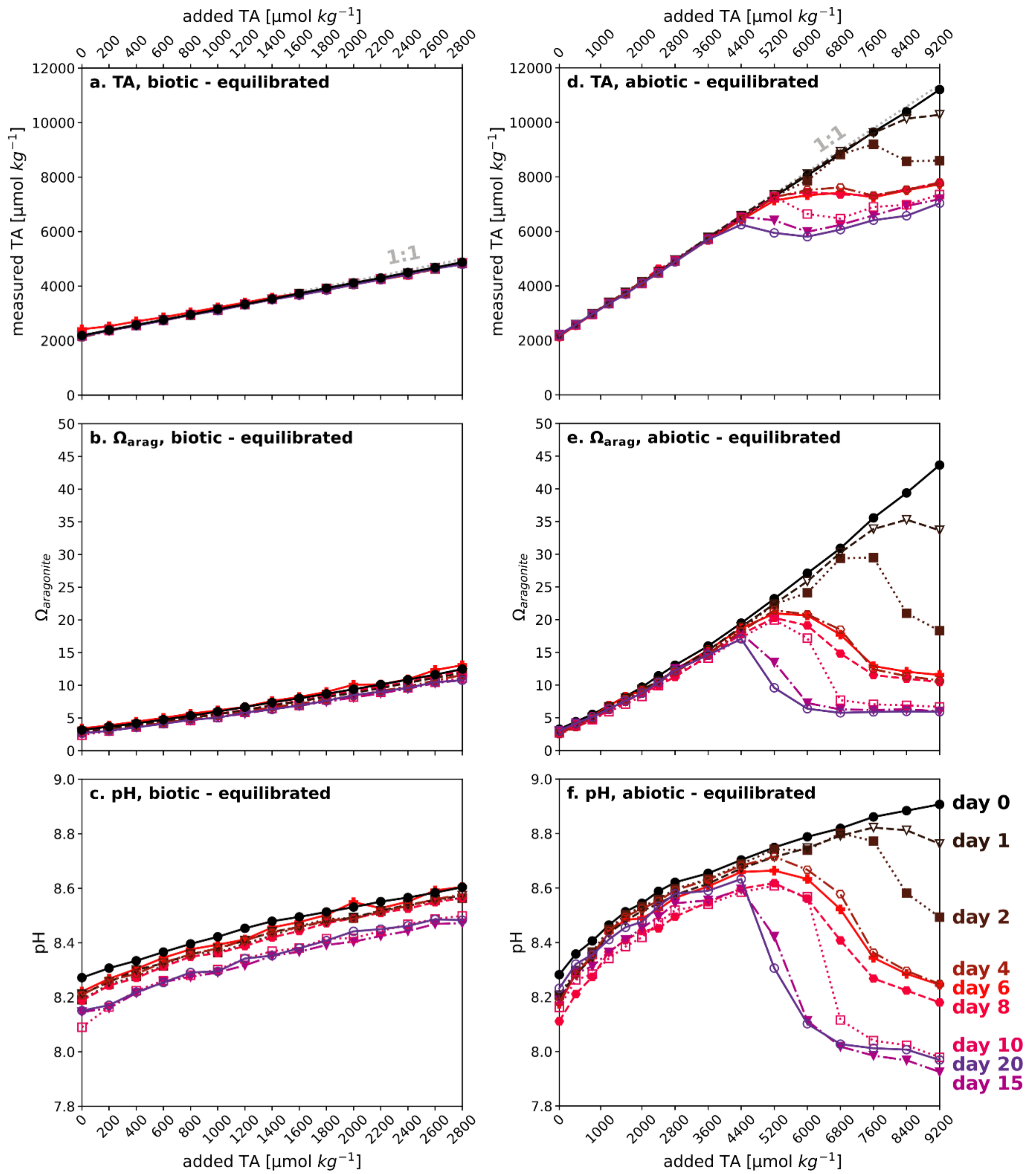

Figure S2: Comprehensive datasets for the CO_2-equilibrated treatments; TA, $\Omega_{aragonite}$ and pH evolution, complementary to Fig. 2, with each graph representing a specific sampling day

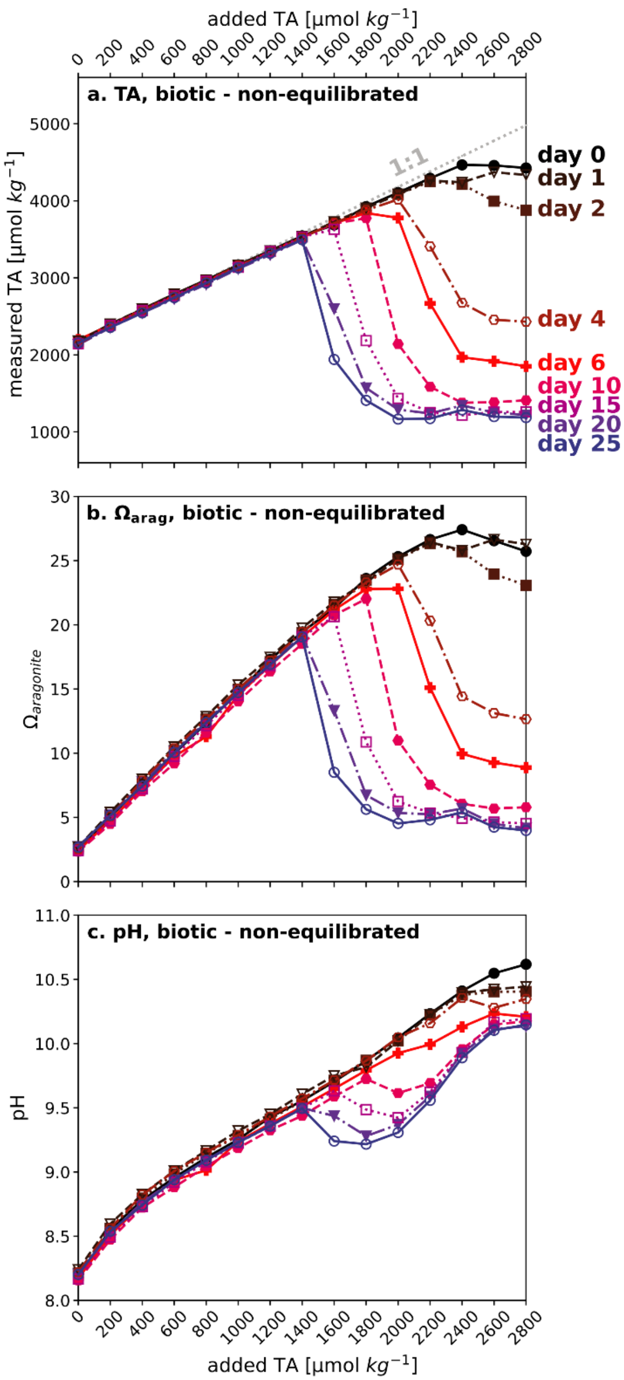

Figure S3: Comprehensive datasets for abiotic non-CO_2-equilibrated treatments; TA, $\Omega_{aragonite}$ and pH evolution, complementary to Fig. 3, with each graph representing a specific sampling day

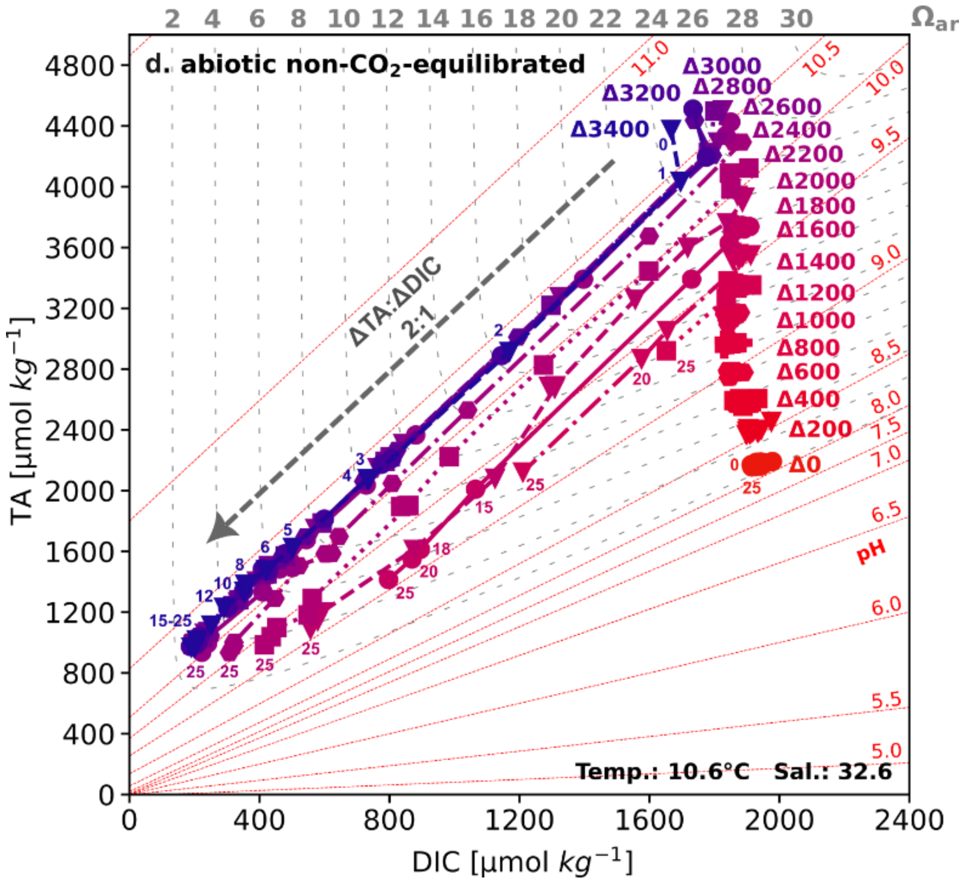

Figure S4: TA:DIC diagram complementary to Fig. 4e showing the whole gradient from ΔTA0-3400 µmol kg^{-1}, a selection of data points is labeled with their corresponding sampling day

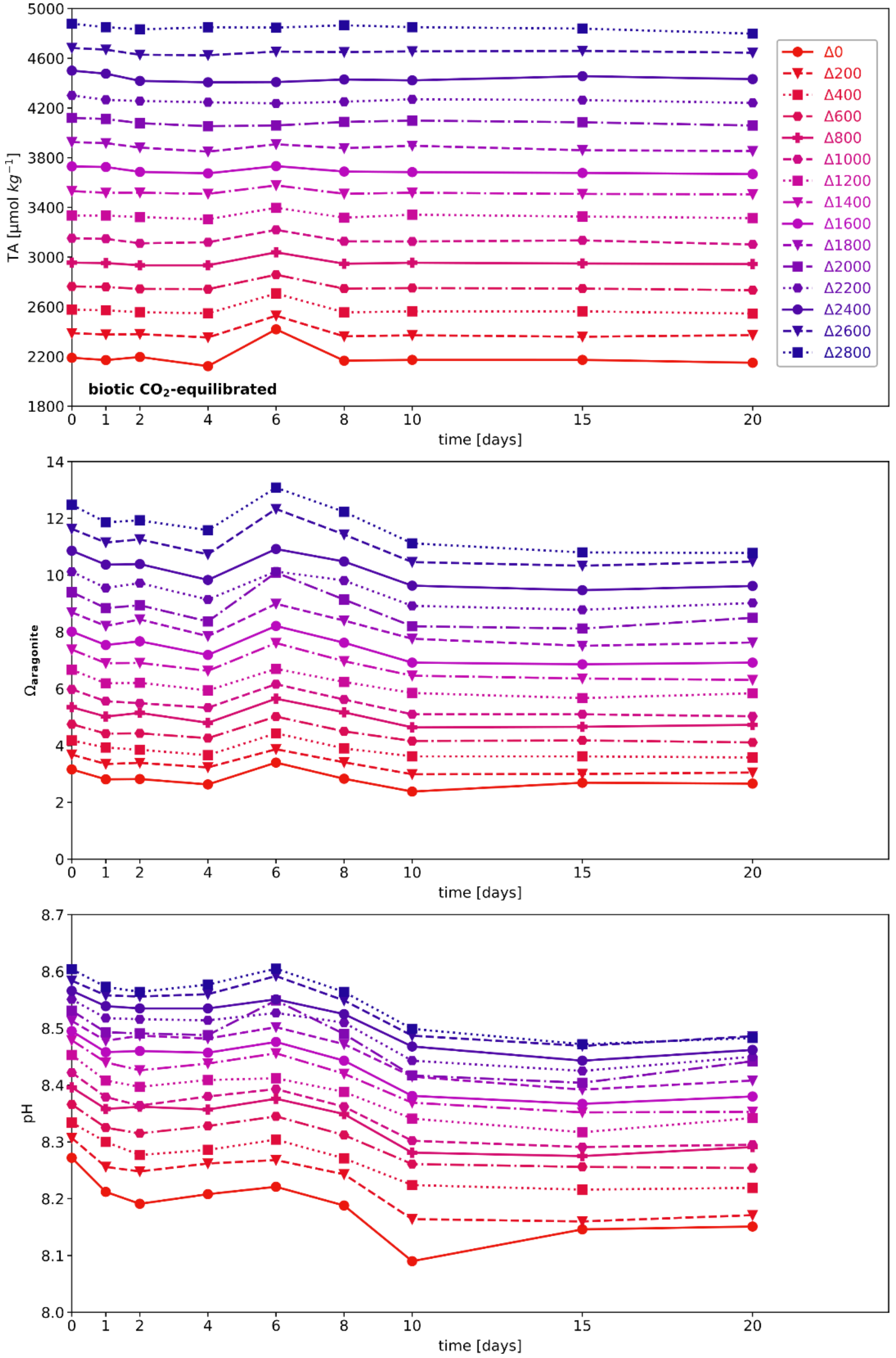

Figure S5: Temporal development of TA, pH and $\Omega_{aragonite}$ in the biotic CO_2-equilibrated experiment; Sal. ~32.6, biotic: Temp. ~12-15 °C

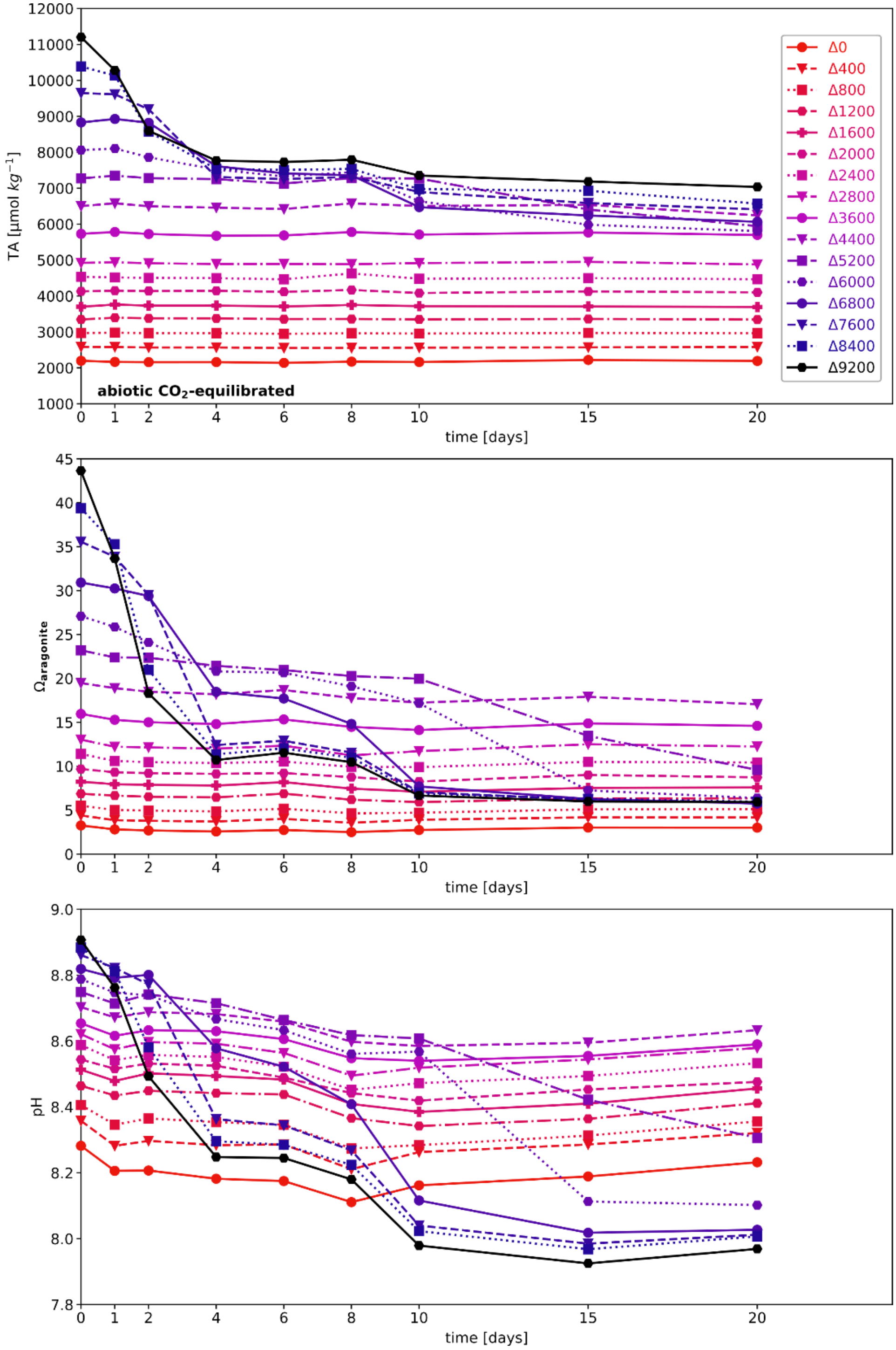

Figure S6: Temporal development of TA, pH and $\Omega_{aragonite}$ in the abiotic CO_2-equilibrated experiment; Sal. ~32.6, biotic: Temp. ~12-16 °C

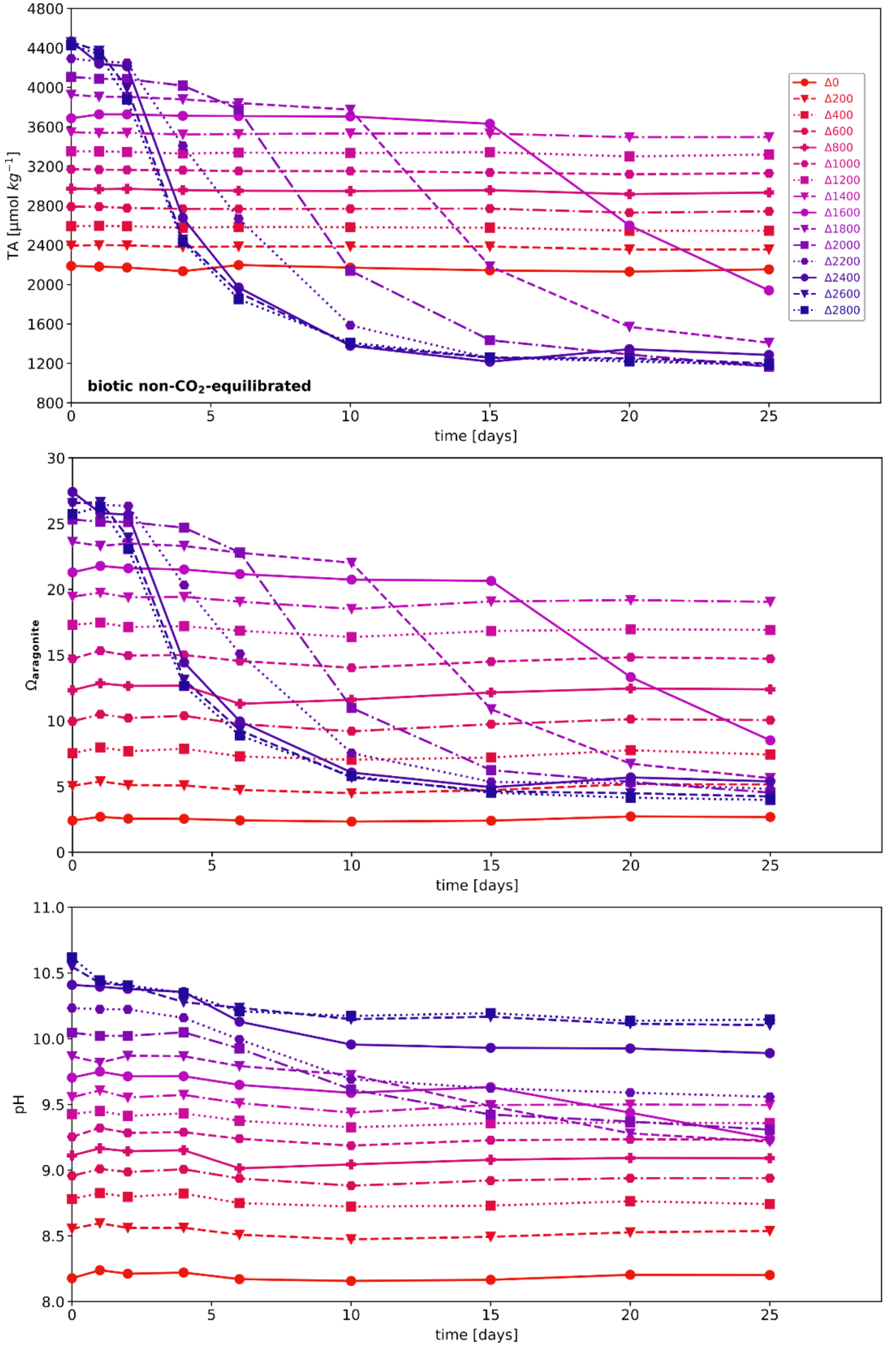

Figure S7: Temporal development of TA, pH and $\Omega_{aragonite}$ in the biotic non-CO_2-equilibrated experiment; Sal. ~32.6, biotic: Temp. ~10-11°C

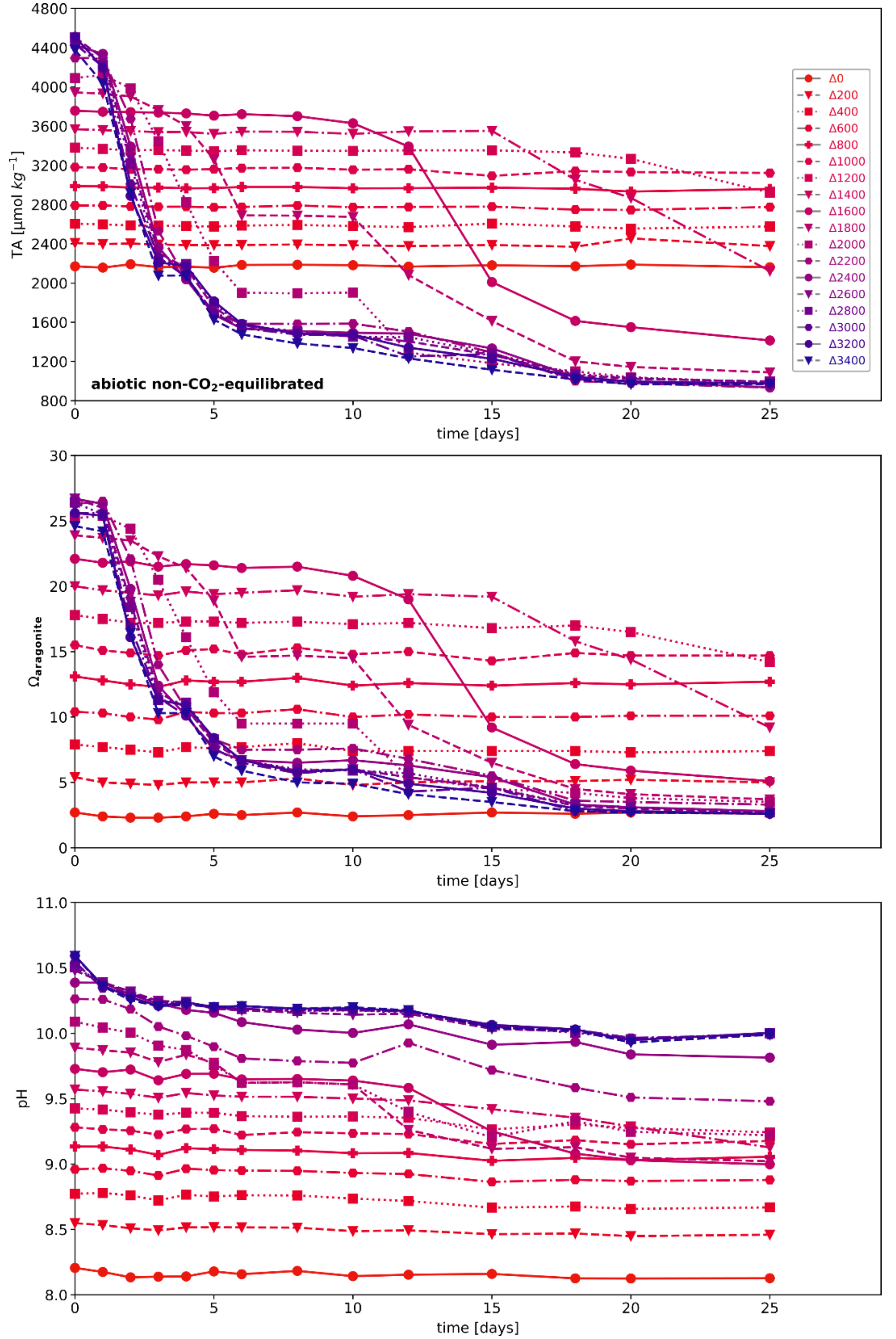

Figure S8: Temporal development of TA, pH and $\Omega_{aragonite}$ in the abiotic non-CO_2-equilibrated experiment; Sal. ~32.6, biotic: Temp. ~11-13 °C

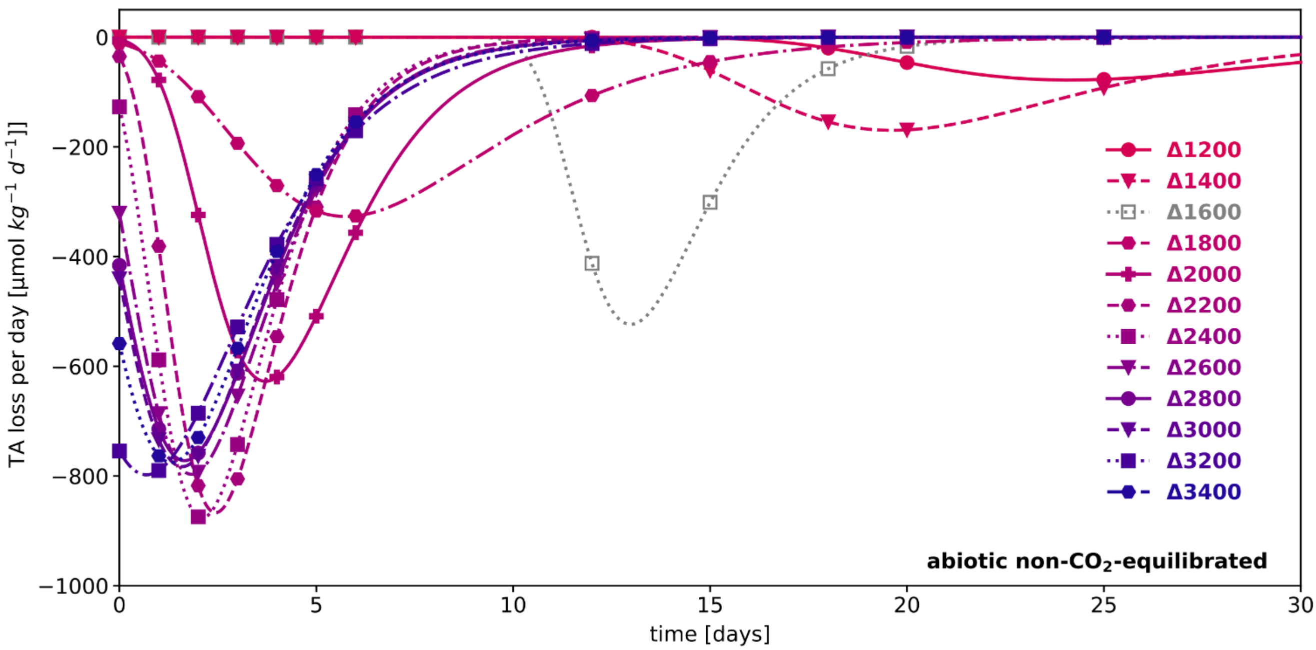

Figure S9: TA loss rates per day in the abiotic non-CO_2-equilibrated experiment, showing precipitation processes; rates were calculated based on differentiating functions determined by a sigmoidal curve fit model of the temporal development of TA; due to missing data points, rates for treatment level Δ1600 could not be determined properly, also see description of outliers below

Table S1: Shift of values in control treatments (ΔTA0), comparison of start and end values for each experiment

Seawater conditions	CO_2 state to atmosphere	TA [µmol kg^{-1}]	DIC [µmol kg^{-1}]	pH	pCO_2 [µatm]	$\Omega_{aragonite}$	Runtime [days]	Temperature range [°C]
abiotic	Eq.	-3.96	22.10	-0.050	30.44	-0.25	20	12-16
	Non-eq.	-9.24	9.11	-0.080	59.32	-0.14	20	11-13
biotic	Eq.	-39.97	12.03	-0.120	77.08	-0.50	25	12-15
	Non-eq.	-34.39	-62.20	0.024	-21.32	0.27	25	10-11

Outliers

As described in the Methods section, each TA treatment was divided into three individual bottles. These bottles were sampled at defined time intervals. For the CO_2-equilibrated abiotic experiment a complete set of bottles (sampling days 4, 6 and 8), exhibited stable parameters at the same level throughout the experiment (see Fig. 2d, 4b, and 6a). In contrast, the set with the related sampling days 10, 15, and 20, continued the process of runaway precipitation uniformly. A similar phenomenon was observed in the abiotic non-CO_2-equilibrated experiment. Again, bottles sampled on days 6, 8, and 10 exhibited no significant changes, while bottles sampled on days 15, 20, and 25 showed continued precipitation. Despite thorough examination and multiple repetitive measurements on-site, no explanation for this behavior could be determined. The temporal alignment of both incidents (occurring between June 24th and June 28th, 2022) suggests that an environmental factor, such as water temperature, sunlight intensity, or a specific aspect of the sampling procedure might have affected related bottles. Errors during the measurements were excluded by numerous iterations with check standards. Furthermore, the simultaneous impact on pH and TA indicates that the measured values were accurate.