

Supplementary file for:
“Monthly element/Ca trends and inter chamber variability in two planktic Foraminifera
species: *Globigerinoides ruber albus* and *Turborotalita clarkei* from a hypersaline
oligotrophic sea”

Noy Levy, Adi Torfstein, Ralf Schiebel, Natalie Chernihovsky, Klaus Peter Jochum, Ulrike
Weis, Brigitte Stoll, Gerald H. Haug

Tables:

Table S1: RSD (relative standard deviation; %) for each element and respective isotope measured using LA-ICP-MS, calculated based on the measurements of the reference material MACS-3 and NIST-612 (Jochum et al., 2019).

Table S2: Spearman correlation matrix p-values for element-Ca ratio means of *G. ruber albus*, *T. clarkei* ‘big’ and *T. clarkei* ‘encrusted’. Mg/Ca, Sr/Ca, B/Ca, Na/Ca, Al/Ca and Fe/Ca units are mmol/mol; Ti/Ca, Mn/Ca, Co/Ca, Ba/Ca, Nd/Ca, Pb/Ca and Th/Ca units are $\mu\text{mol/mol}$; and U/Ca units is nmol/mol.

Table S3: p-values for element-Ca ratio standard deviation of *G. ruber albus*, *T. clarkei* ‘big’ and *T. clarkei* ‘encrusted’. Mg/Ca, Sr/Ca, B/Ca, Na/Ca, Al/Ca and Fe/Ca are mmol/mol; Ti/Ca, Mn/Ca, Co/Ca, Ba/Ca, Nd/Ca, Pb/Ca and Th/Ca are $\mu\text{mol/mol}$; and U/Ca is nmol/mol.

Table S4: Single chamber LA-ICP-MS measured element-Ca ratios, specimen means and standard deviations for *G. ruber albus*, *T. clarkei* ‘big’ and *T. clarkei* ‘encrusted’.

Figures:

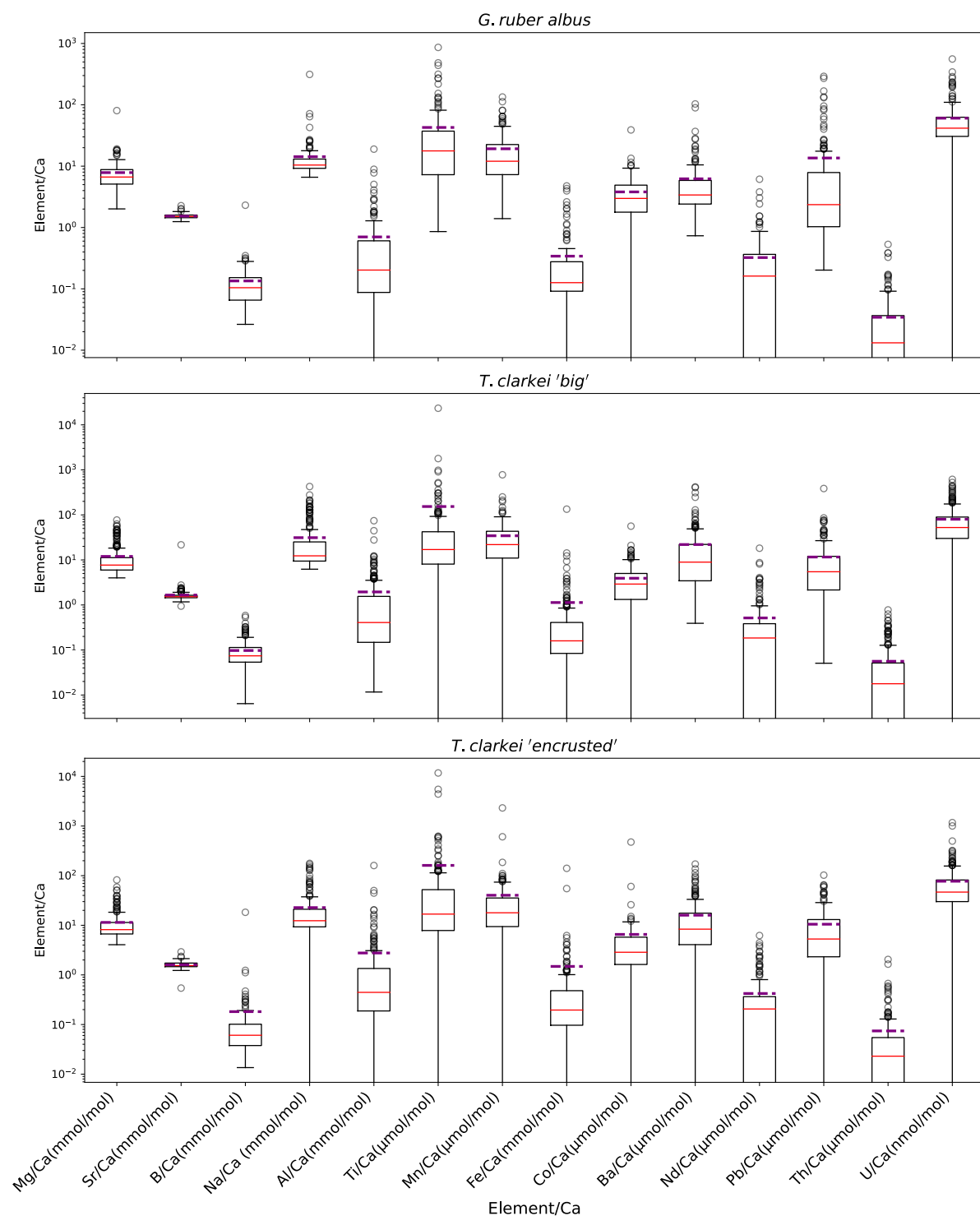


Figure S1: Range, Median (red line), Mean values (dashed purple line), of the calcium-normalized element ratios of *G. ruber albus*, *T. clarkei* 'big' and *T. clarkei* 'encrusted' shells, derived from sediment traps from the Gulf of Aqaba between June 2014 and June 2015. Y-axis in logarithmic scale.

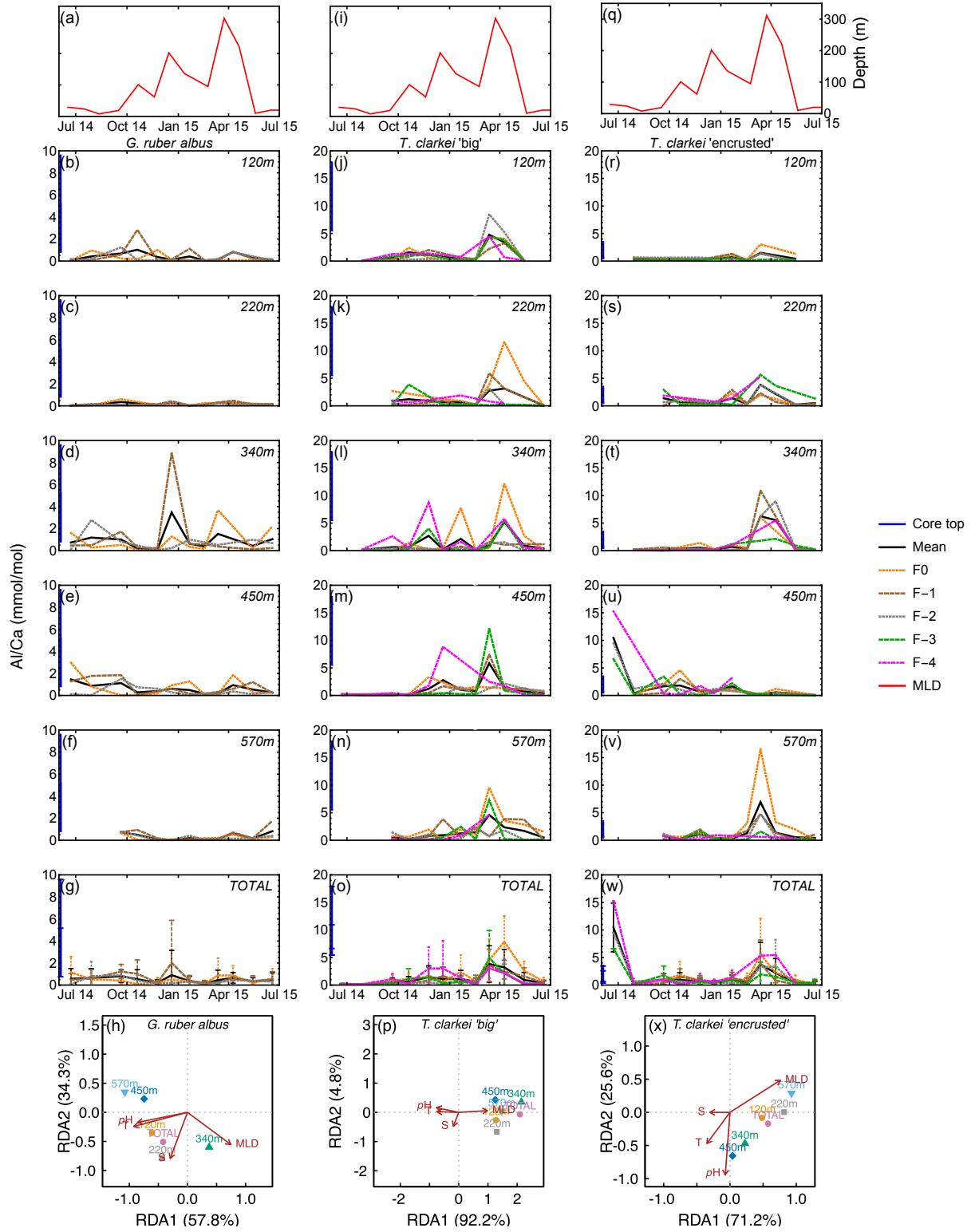


Figure S2: Time series of Al/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Al/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables.

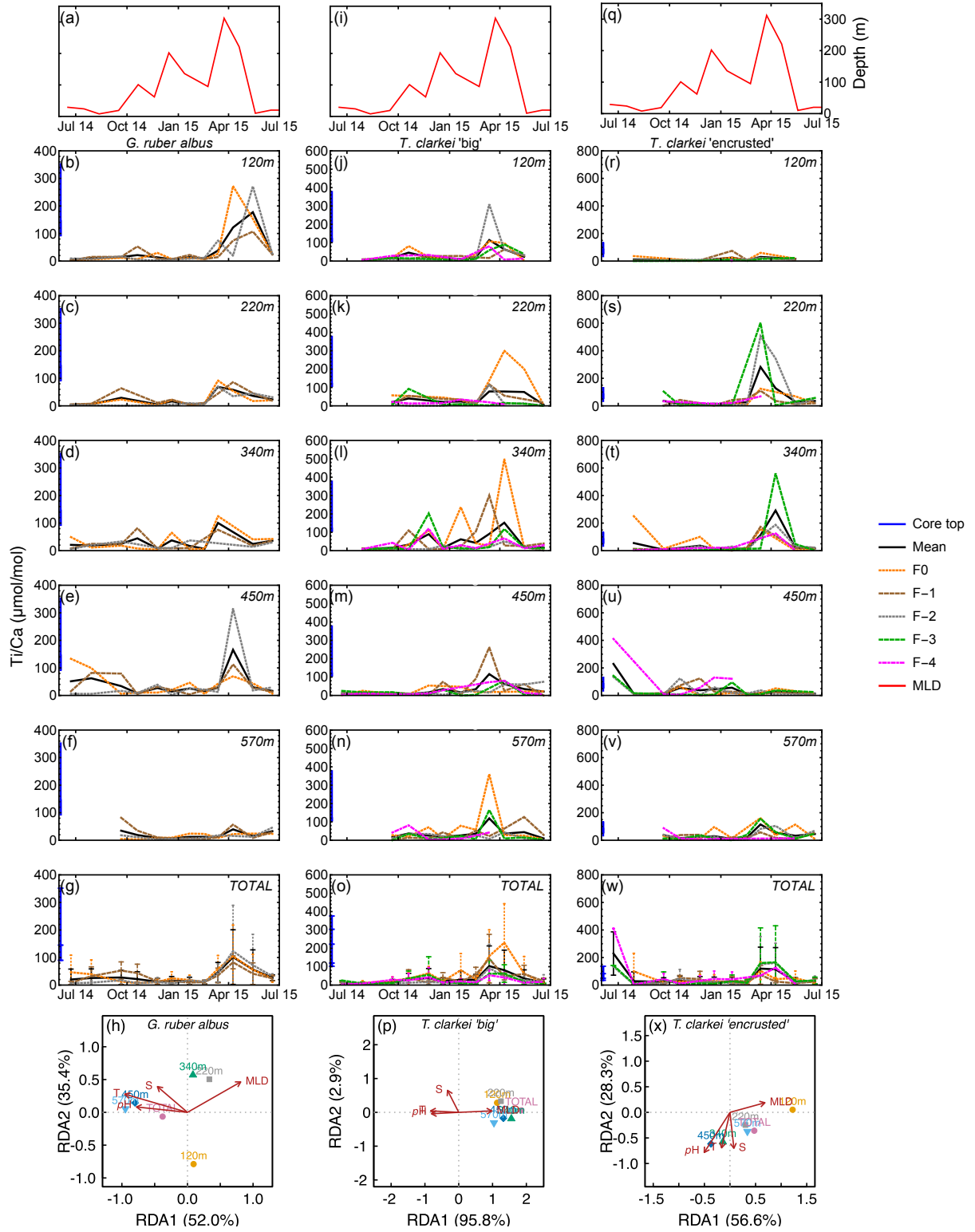


Figure S3: Time series of Ti/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Ti/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables.

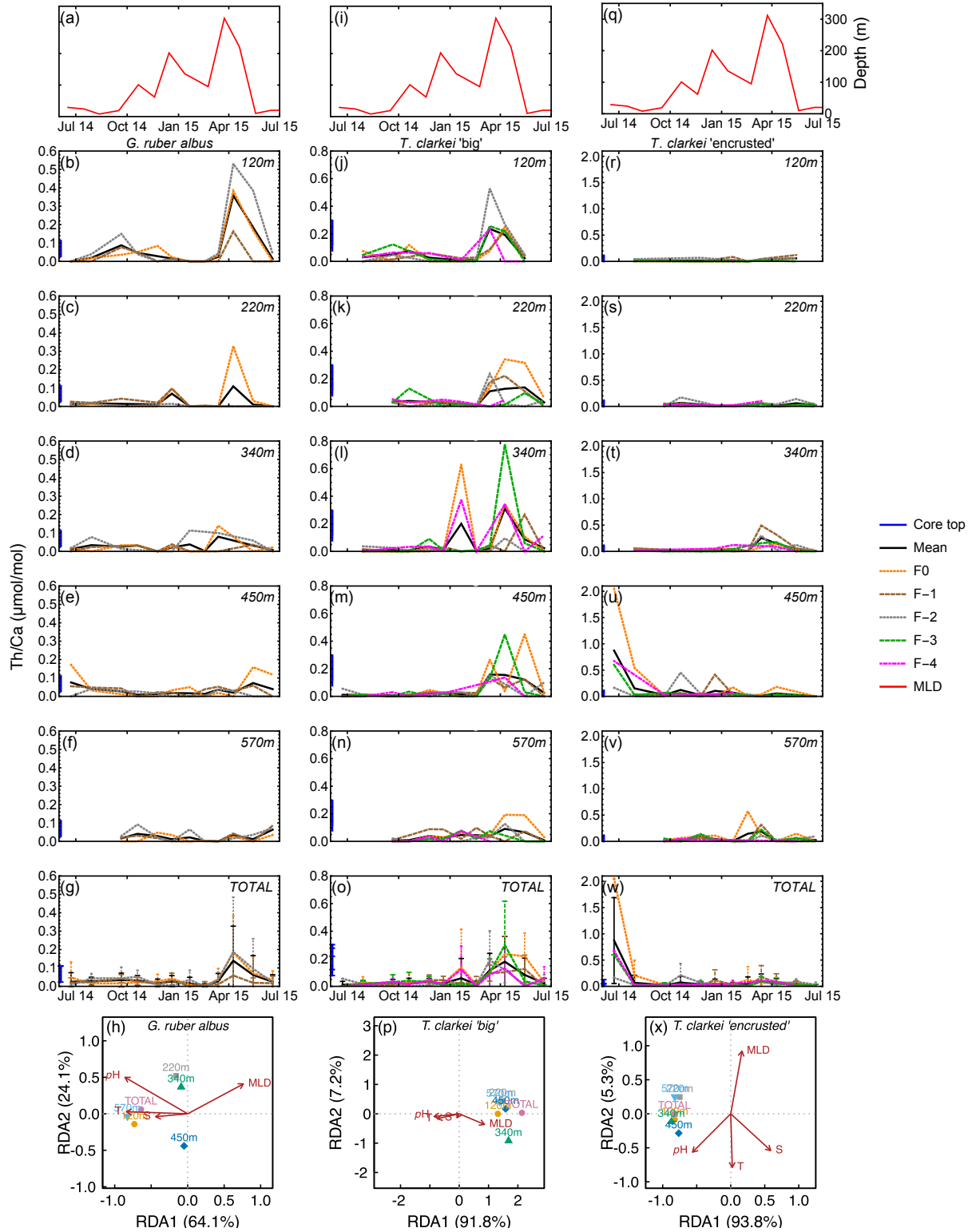


Figure S4: Time series of Th/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Th/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables. *G. ruber albus* display a peak during spring months accompanied with more ICV. *T. clarkei* 'big' show similar trends to *G. ruber albus* albite with higher ICV during spring. *T. clarkei* 'encrusted' exhibit spring-ICV in the upper water column while with depth, there are ICV throughout the year.

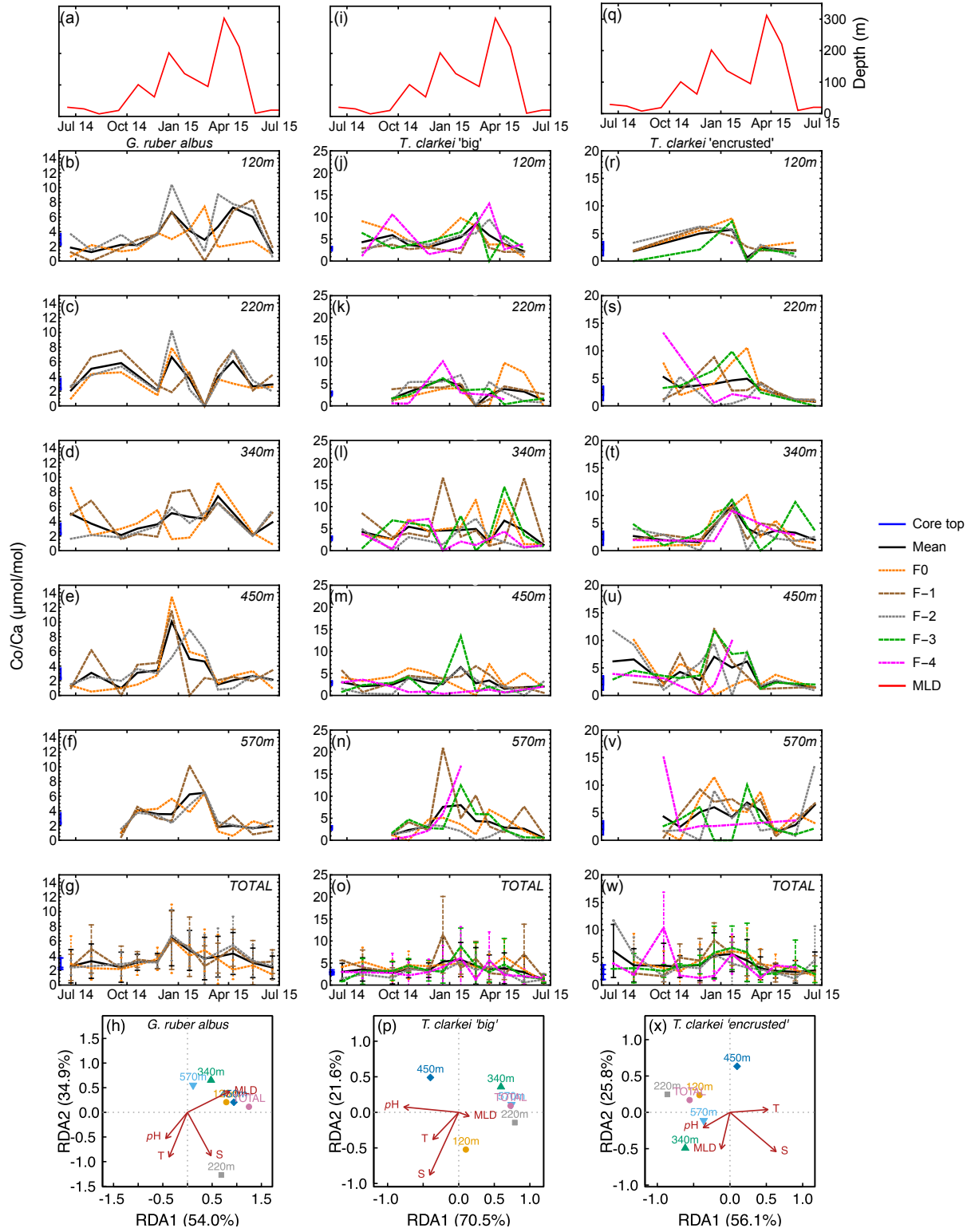


Figure S5: Time series of Co/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Co/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables.

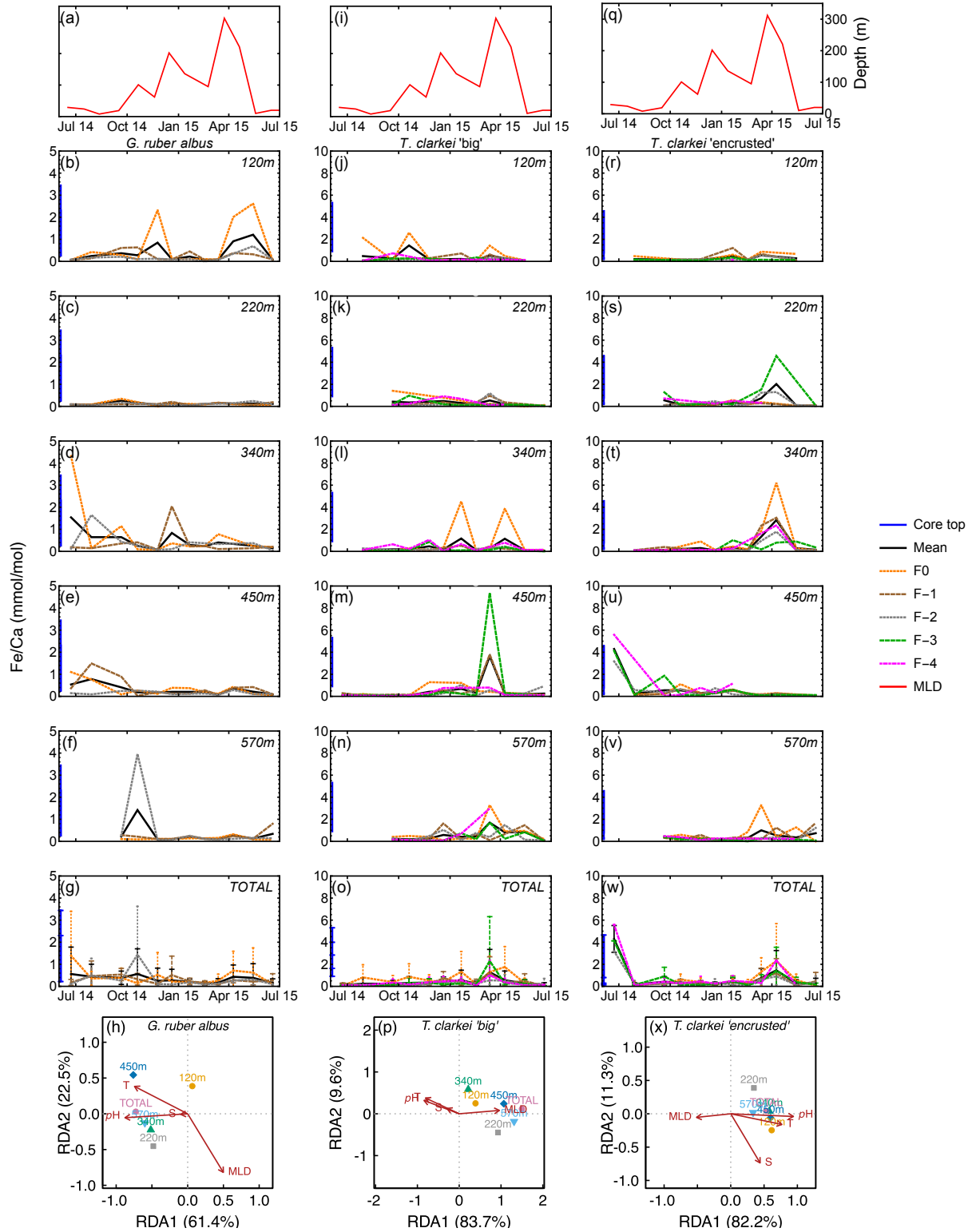


Figure S6: Time series of Fe/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Fe/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables.

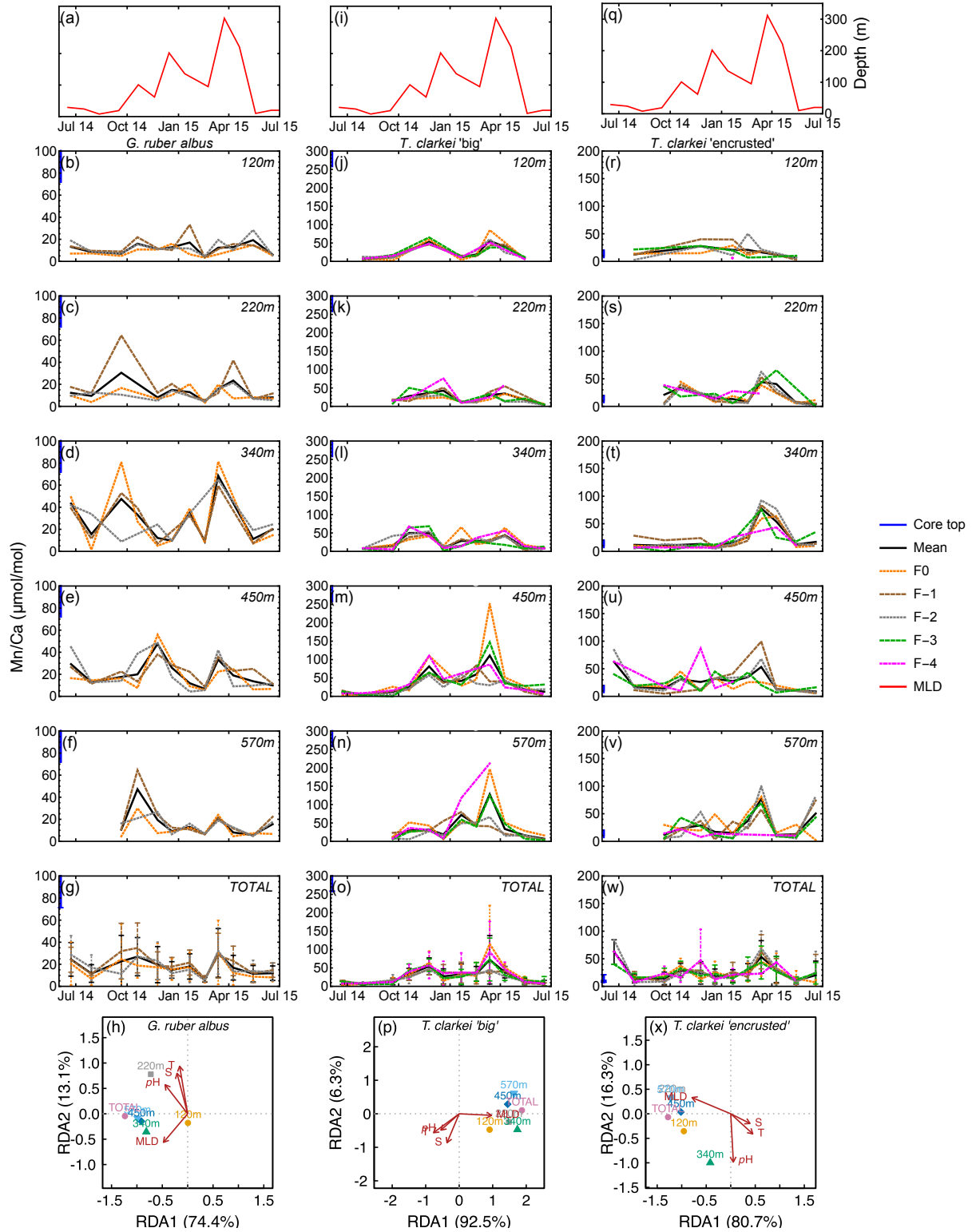


Figure S7: Time series of Mn/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Mn/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables. No obvious trends in *G. ruber albus* between chambers and depths. *T. clarkei* types show more systematic trends between chambers and higher values compared to *G. ruber albus*. Both types of *T. clarkei* show water-column mixing excursions.

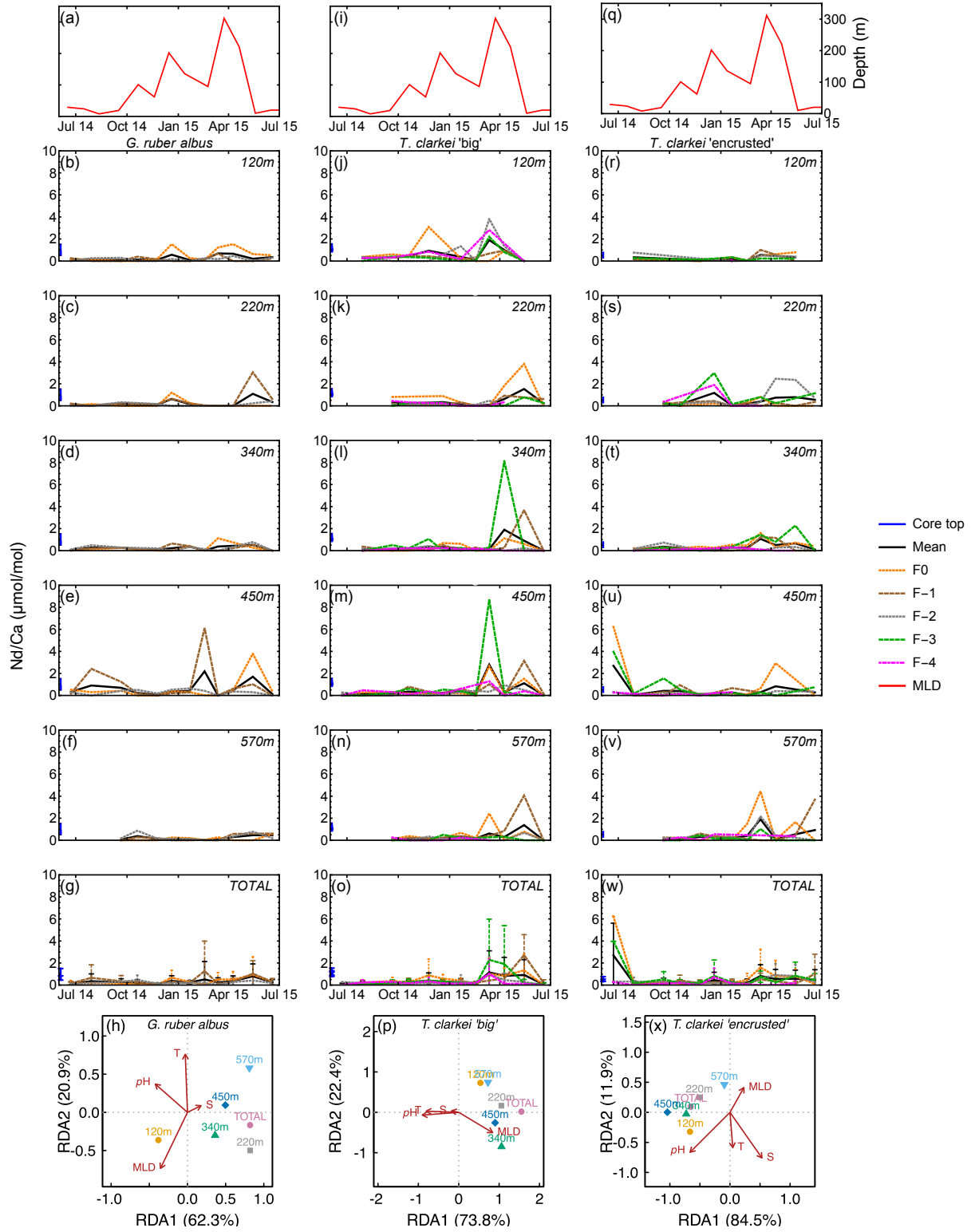


Figure S8: Time series of Nd/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Nd/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables.

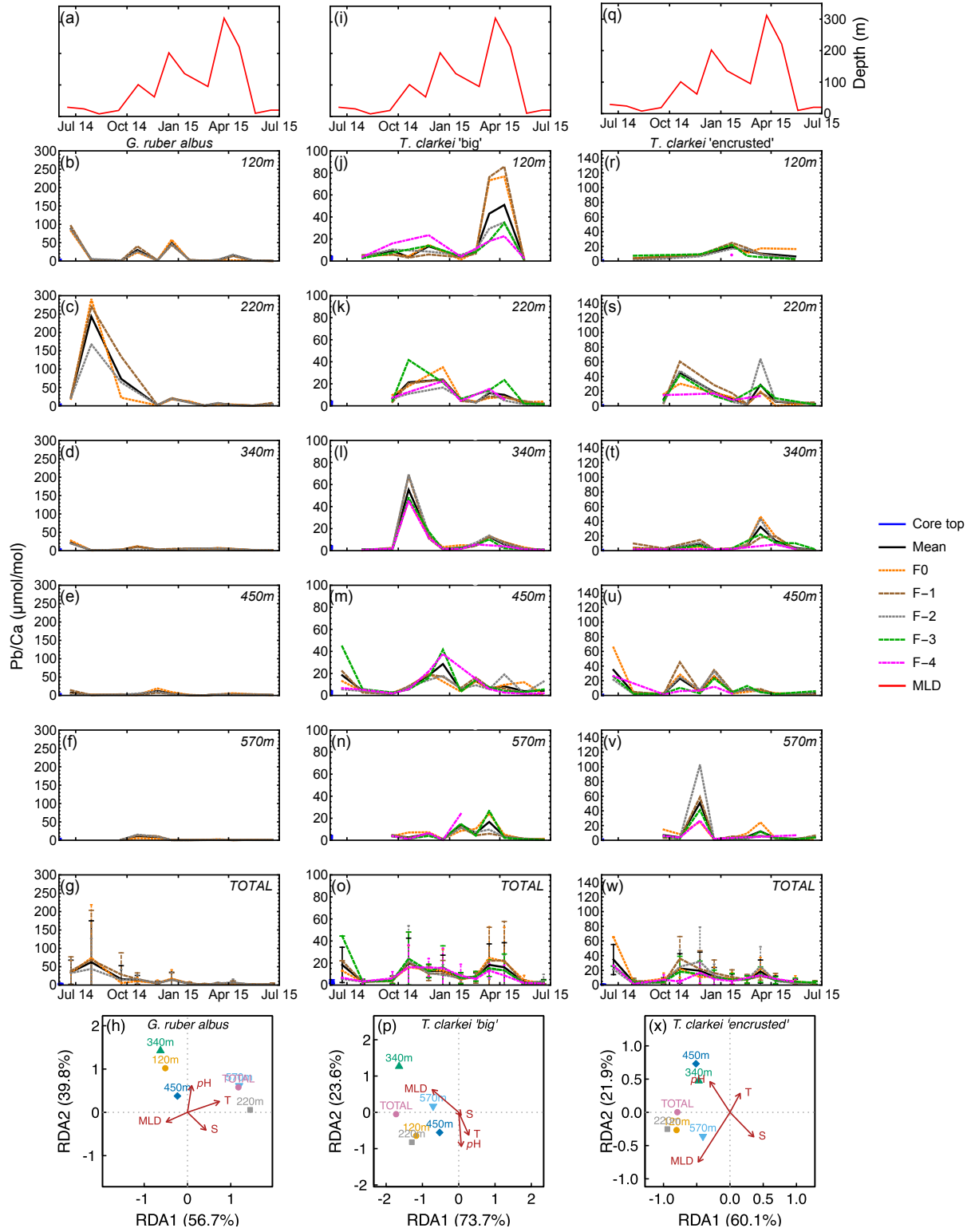


Figure S9: Time series of Pb/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). Pb/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables. Almost no ICV in *G. ruber albus* (except in 340 m during August). Similar trends in both *T. clarkei* phenotypes albite with peaks in different months and depths.

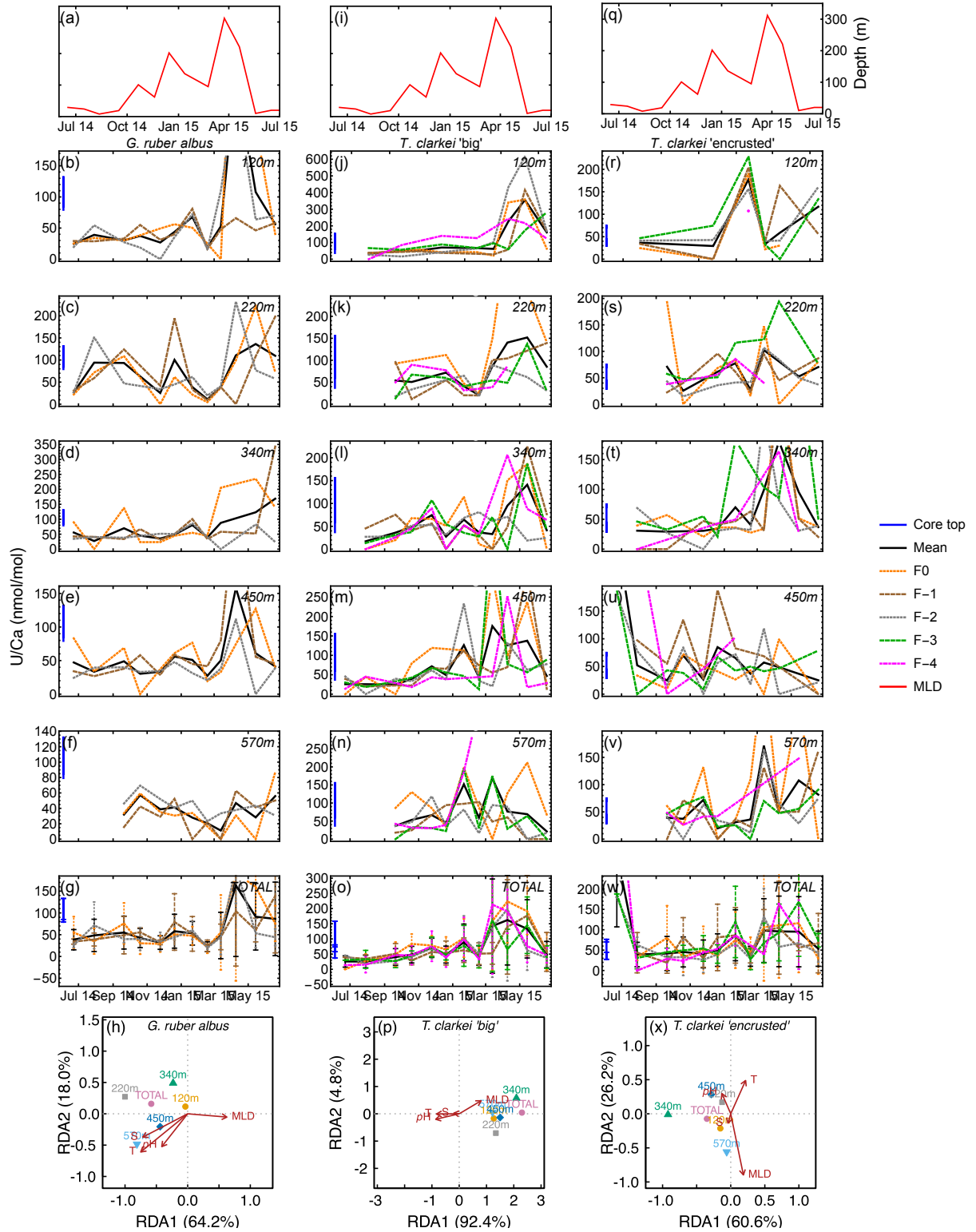


Figure S10: Time series of U/Ca values measured from the shells of *G. ruber albus* (b-f), *T. clarkei* 'big' (j-n) and *T. clarkei* 'encrusted' (r-v), derived from sediment traps located at different water depths (120-570 m). U/Ca of core top are marked by a blue bar along the left y-axes. Top panels a, i, and q show the depth (meters below surface layer) of the mixed layer depth (MLD). Panels g, o, and w represent the average values of all depths for each chamber for each species. Panels h, p and x show the redundancy analysis (RDA) per species for each water depth with MLD depth, temperature, salinity and pH as explanatory variables. *T. clarkei* 'big' exhibit higher values in the upper water column in the spring compared to *G. ruber albus* and *T. clarkei* 'encrusted' as well as to other water depths.

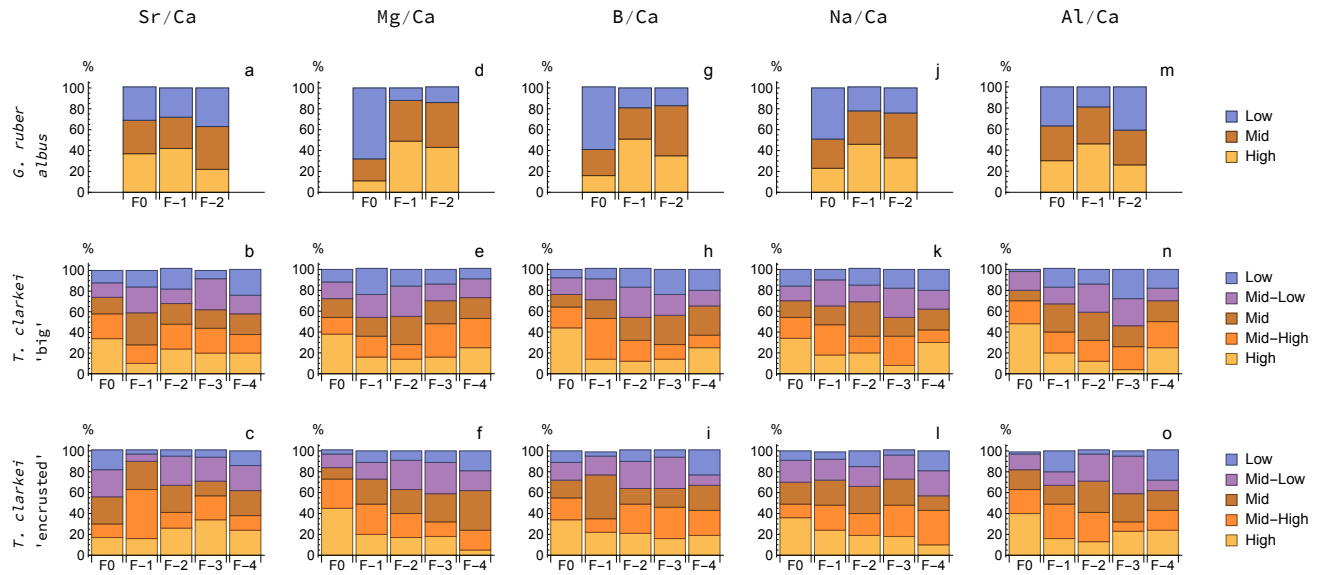


Figure S11: Frequency distribution of calcium-normalized element ratios in individual chambers of planktic foraminifera shells, categorized by the relative ranking of each chamber's value within the same shell: highest, second highest, middle, second lowest, and lowest. For example, Mg/Ca in ~65% of the *G. ruber albus* specimens (d) was lower in the F0 chamber than in the other two preceding chambers in the final whorl; similarly, about 50% of the specimens of *T. clarkei* 'big' display the highest Al/Ca values in F0 (n).

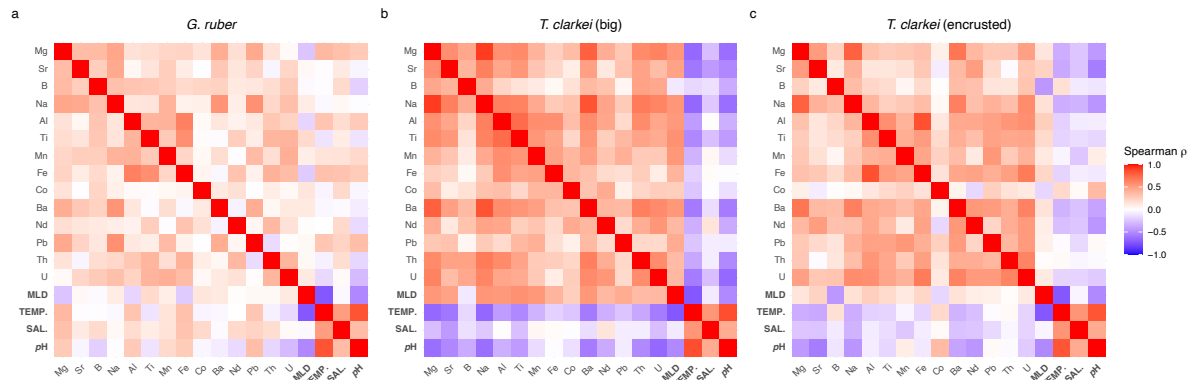


Figure S12: Spearman correlation matrix of the different trace element-Ca normalized abundances standard deviation in *G. ruber albus* (a), *T. clarkei* "big" (b) and, *T. clarkei* "encrusted" (c).