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Longevity and growth rates of Desmophyllum dianthus in the Marmara Sea and its potential as centennial scale geochemical deep-sea archive

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Living framework building cold-water corals have been observed at ambient temperatures of $\sim$13.9°C in the Ionian Sea, the Adriatic Sea, the Aegean Sea, as well as late Holocene solitary corals in the Eastern Mediterranean. These foreshadowed the discovery of living cold-water corals in 2007 in the Marmara Sea, where during submersible-dives (Le Nautile, RV Atalante, MARNAUT-expedition) large and abundant occurrences of the solitary deep-sea coral Desmophyllum dianthus were filmed and sampled along steep cliffs. These recently dead corals have been documented at depths of 900 to 1200 m, where temperatures of $\sim$14.5°C and fairly low dissolved oxygen concentrations of <1.27 ml/l prevail. Framework building cold-water corals like Lophelia pertusa and Madrepora oculata have not been observed in this low-oxygen environment. The individual solitary coral cones reach 15 cm in height with a calyx diameter of 7 cm. Their size rivals that of their Recent Atlantic cousins in the Northwest Atlantic (e.g. New England Seamounts), while most Recent D. dianthus in the Western and Eastern Mediterranean comprise much smaller corallites.

The age and growth rate of a 10 cm high D. dianthus specimen has been constrained by 6 U-series ages along the growth axis. The base of the coral dates back to $\sim$100 years, while the subsequently younger ages are evenly spaced, approaching present-day ($\sim$25 years). The calculated growth rate of 1 mm/yr resembles those obtained from North Atlantic corals, varying between 0.5 and 2.0 mm/yr. This quick growth rate allows us to test this coral as a potential high-resolution archive (sub-annual) for a wide variety of environmental and geochemical parameters, to track changes through time. Radiocarbon has been measured along the growth axes, to reveal past seawater concentrations of Δ^{14}C and the pattern of change of the anthropogenic bomb-spike. Likewise, boron isotopes (δ^{11}B), at known age intervals from the U-series based growth rate model, have been measured to track changes of pH. Using the 'lines technique', that is, applying a function of the linear regression of δ^{18}O and δ^{13}C of the skeletal aragonite, temperature reconstructions at six characteristic time slices across the last century is being attempted. In addition, neodymium (^{143}Nd/^{144}Nd) and strontium (^{87}Sr/^{86}Sr) isotopes have been measured to track changes in the Marmara watermasses.