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Growth rate of deep-sea Scleractinian corals (Madrepora oculata, Lophelia pertusa) inferred from 210Pb-226Ra chronology

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Deep-sea corals are found in all ocean basins within a range of temperature between 3°C and 12°C ($\sim$ 50 to 4000 m), and allow investigations into past climate and ocean circulation changes in intermediate and deep-sea water masses. Moreover, scleractinian corals have an aragonitic skeleton which can be precisely dated using 230Th/U and 14C techniques. But over the last century these methods can be tricky to apply to establish a precise chronology. Within the framework of the European FP7 EPOCA project, we used 210Pb-226Ra chronology to describe the age and growth rate of two post-modern scleractinian deep-sea corals (Lophelia pertusa and Madrepora oculata) collected in the North Atlantic waters (Rost Reef, Norwegian margin). This 210Pb-226Ra radiometric method had never been applied to these two main contributors to deep-sea reef building. The 226Ra activities were determined using Ge-detectors at the Modane underground laboratory (LSM); 210Pb detection was accomplished by alpha-spectrometric determination due to its low activity.

210Pb and 226Ra were not incorporated by the same way into the deep-sea corals. This is due to the different chemical behaviors of Ra and Pb in the aquatic environment. Pb isotopes readily scavenge onto particles, whereas Ra isotopes are soluble in seawater. Since the 226Ra was incorporated from the seawater it was not in secular equilibrium with its daughter the 210Pb. Thus, when (210Pb/226Ra) ratio was more than 1 in deep-sea coral, the use of the excess method with initial 226Ra in secular equilibrium with 210Pb can not be applied. Therefore, to describe the temporal variation of 210Pb we have to take into account the decrease of 210Pb initially incorporated to the skeleton and, the ingrowth of 210Pb from 226Ra.

Since 226Ra activities in these two cleaned corals were fairly constant, then assuming constant uptake of 210Pb with time the 210Pb-226Ra chronology can be applied to calculate linear growth rate. For the specimen of Madrepora oculata (45.5 cm), a constant linear growth rate was estimated at 2.6 polyp.yr-1 or 15 mm.yr-1 with an age of 31 years. For the Lophelia pertusa (80 cm) traces elements revealed a high level of contamination of Mn-oxides for the oldest part but for the upper 15 cm a linear growth rate was estimated at 0.4 polyp.yr-1 or 8.5 mm.yr-1. Such type of information is essential in the development and assessment of these species as archives to study seasonal, interannual and decadal paleoclimate changes.