What have we learned from Ra isotopes about the natural iron fertilization offshore from the Crozet and Kerguelen islands ?

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A large phytoplankton bloom occurs anually downstream of the Crozet and the Kerguelen islands despite their location in the largest high-nutrient, low-chlorophyll area of the global ocean. Whereas low iron concentrations in waters of the Southern Ocean usually limit the phytoplankton development, the input of iron released by the shallow sediments deposited onto the margins allows the phytoplankton to grow downstream of these islands.

Here, we summarize our findings on the mechanisms of the natural iron fertilization deduced from radium (Ra) isotopes in the framework of the KEOPS project. Combining Ra isotopes (^{223}Ra, $T_{1/2}$=11.4 d; ^{224}Ra, $T_{1/2}$=3.66 d; ^{228}Ra, $T_{1/2}$=5.75 y) and physical methods (surface drifters and lagrangian model derived from altimetry data), we provide information on the origin of the iron fertilization and on the timescales of the transfer of sediment-derived inputs towards offshore waters. In addition, we investigated the ^{226}Ra ($T_{1/2}$=1600 y) and barium (Ba) distributions offshore from the Crozet and Kerguelen islands, with the aim to provide additional constraints on the circulation patterns in this area. In particular, we observed temporal changes in the dissolved ^{226}Ra/Ba ratios that will be discussed. Among potential hypothesis, one can invoke i) changes in the circulation patterns or ii) the impact of biological processes on the dissolved Ra and Ba concentrations.