Radium in the Arctic Ocean - the 2015 GEOTRACES missions

MICHIEL RUTGERS VAN DER LOEFF[1], LAUREN KIPP[2], DOROTHEA BAUCH[3], ALEXANDER N. CHARKIN[4]

[1]Alfred-Wegener Institut, Helmholtz Center for Polar and Marine Research, Bremerhaven Germany, mloeff@awi.de
[2]Woods Hole Oceanographic Institution, Woods Hole, USA, lkipp@whoi.edu
[3]GEOMAR Helmholtz Center for Ocean Research, Kiel Germany, dbauch@geomar.de
[4]Pacific Oceanological Institute (POI), Far Eastern Branch of Russian Academy of Sciences (FEBRAS), Vladivostok, Russia, charkin@poi.dvo.ru

The Arctic Ocean is a small ocean basin surrounded by wide and shallow shelves receiving large river inputs. The radium quartet are four tracers of contact with sediments that give information on transport processes ranging in time scale from days to hundreds of years.

^{228}Ra (5.8 y halflife) is a good tracer for surface water circulation. New 2015 GEOTRACES (sections GN01+GN04) ^{228}Ra data show the first full Barents Sea to Bering Strait transect with maximum activities in the Transpolar Drift. We compare the 2015 section in the central Arctic with earlier Polarstern sections in 1987/1991, 2007 and 2011 and discuss reasons for increases in maximum ^{228}Ra activities (Kipp et al., 2017).

The penetration of ^{228}Ra and its daughter ^{228}Th to waters of intermediate depths (up to about 1500m) shows the exchange of these waters with shelf and slope sediments on the time scale of ^{228}Ra decay.

Input from the seafloor causes an enrichment of ^{228}Ra and ^{226}Ra in bottom waters. In deep waters (>2000m) of the Eurasian and Makarov basins ^{226}Ra (1600 y halflife) accumulates to values around 16 dpm/100L or about twice the surface water concentration.

It has been argued that export production increases with decreasing ice cover in the Arctic (Arrigo et al., 2008). Natural radionuclides can help to quantify export production rates, but the fluxes found may depend on the time scale of the tracer used. The most commonly used tracer ^{234}Th/^{238}U (24 d halflife) has a memory much shorter than a season. The ^{210}Po/^{210}Pb (138 d; Roca-Martí et al., 2016) and ^{228}Th/^{228}Ra ratios (1.9 y) are alternatives on a full seasonal time scale.

Arrigo, K.R. et al., 2008. *Geophys. Res. Lett.* **35**, L19603
Kipp, L. et al., 2017. *ASLO 2017 OSM abstracts*
Roca-Martí, M. et al., 2016. *Journal of Geophysical Research: Oceans* **121**, 5030-5049