Tracing Anthropogenic Osmium in Tokyo Bay using the Osmium Isotopic Composition of Macroalgae

A.D. SPROSON[1], D. SELBY[1] AND K. SUZUKI[2]

[1]Department of Earth Sciences, Durham University, Science Labs, Durham, DH1 3LE, UK (a.d.sproson@durham.ac.uk, david.selby@durham.ac.uk)

[2] Research and Development Center for Submarine Resources, JAMSTEC, Yokosuka 237-0061, Japan (katz@jamstec.go.jp)

The present-day open ocean seawater $^{187}Os/^{188}Os$ value of ~1.06 is seen to reflect the balance between unradiogenic mantle derived osmium (Os) and radiogenic continental Os [1]. However, Os released by anthropogenic activities has been detected in coastal sediments, lakes, estuaries, rain and snow from sources such as sewage sludge, catalytic convertors, smelting, fossil fuel burning and use as a staining reagent, thereby impacting the global Os budget [2][3].

Despite over two decades of research, contemporary Os inputs into the ocean are believed to be underestimated by a factor of ~3, leading to discrepancies in oceanic Os residence times estimated from mass balance calculations [4]. This, in part, is due to the problems associated with directly measuring ultra-low concentrations of Os in seawater [5][6]. Recently, it has been proposed that the $^{187}Os/^{188}Os$ of macroalgae (seaweed) reflects that of the seawater in which it lives [7]. This suggests macroalgae can act as a proxy for the Os isotopic composition of seawater.

We present Os isotope data for macroalgae collected from Tokyo Bay. Macroalgae close to central Tokyo exhibits unradiogenic $^{187}Os/^{188}Os$ values as low as 0.45, in agreement with published sediment data [8]. As you move away from central Tokyo $^{187}Os/^{188}Os$ values become more radiogenic, reaching values as high as 0.86 at the tip of the Boso peninsula. We propose macroalgae is recording the influence of anthropogenic processes on the Os budget of Tokyo Bay. Therefore, macroalgae could become a useful pollution indicator and tracer of continental Os inputs.

[1] Peucker-Ehrenbrink & Ravizza (2000) *Terra Nova* **12**, 205-219. [2] Chen *et al.* (2009) *PNAS* **106**, 7724-8. [3] Turekian *et al.* (2007*) Geochim. et Cosmochim. Acta* **71**, 4135-4140. [4] Oxburgh (2001) *G³* **2**, 1525-2027. [5] Gannoun & Burton (2014) *JAAS* **29**, 2330-2342. [6] Chen & Sharma (2009) *Anal. Chem.* **81**, 5400-5406. [7] Racionero-Gómez *et al.* (2016) *Geochim. et Cosmochim. Acta,* Submitted. [8] Zheng *et al.* (2014) *Applied Geochemistry* **40**, 82-88.