

Text S1

BENTHIC CHAMBER EXPERIMENT IN THE GULF OF AQABA

In the paper we suggest that sediment resuspension by marine groundfish enhances DSi fluxes from bottom sediments and that neglecting fish-induced DSi fluxes may lead to severe underestimation of the "real" DSi fluxes from the seafloor. The manuscript describes enhanced opal dissolution following simulated resuspension experiments conducted on Saanich Inlet sediments (Fig. 3). In order to examine the generality of this observation we conducted an *in situ* simulated resuspension in a benthic chamber deployed in the Gulf of Aqaba, Red Sea, where groundfish constantly resuspend the sediment ((Yahel et al. 2002); SVideo 4). The simulation was conducted in shallow, sandy sediments overlain with warm (23°C) oligotrophic waters, a fundamentally different oceanographic setting than Saanich Inlet.

Description of the simulated resuspension experiment

An opaque cylindrical benthic chamber (internal volume 5.45 L, cross section area 278 cm²) was deployed on a sandy seafloor at a depth of 10 m in the northern tip of the Gulf of Aqaba (29°32' N 34°58' E). SCUBA divers gently inserted the chamber into the bottom sediment. Care was taken not to resuspend the sediments during the process. The lid of the chamber was closed after an overnight acclimation period. The overlying waters inside the chamber were continuously stirred with a magnetic stirrer throughout the 32 h long experiment. Eight hours after the lid was closed we resuspended sediments inside the chamber with a jet of water from a 100 ml syringe (injection lasted 2-3 sec). Six water samples (in duplicates), were taken from the chamber with 60 ml plastic syringes: three samples during the 8 hr period before the simulated resuspension, and three more (0.2 hr, 15.5 hr and 23.7 hr) following the simulated resuspension event. Ambient bottom water was sampled in each dive to correct for the difference in DSi between the sampled water from the chamber and the ambient seawater that replaced it. The dimensions of the small pit formed by the water jet were measured at the end of the experiment to estimate the volume of the sediments resuspended during the simulation.

Results and discussion

The DSi flux from undisturbed sediment during the 8 h before the simulated resuspension was $90 \mu\text{mol m}^{-2} \text{d}^{-1}$ (Fig S3). Twelve minutes after the resuspension event, DSi in the chamber increased by $0.7 \mu\text{mol}$, mainly due to porewater mixing (see below). After this initial stage, DSi was released from the sediments due to diffusion from the undisturbed sediments and due to enhanced dissolution of the opal particles that were resuspended during the event. The opal dissolution rate in the chamber increased 5 fold from $0.11 \mu\text{mol h}^{-1}$ to $0.51 \mu\text{mol h}^{-1}$ (Fig. S3). We can therefore calculate that During the 24h following the resuspension event some $12.2 \mu\text{mol}$ of DSi were released into the benthic chamber, only $2.6 \mu\text{mol}$ of it were related to molecular diffusion and infaunal bioirrigation; $\sim 9.6 \mu\text{mol}$ DSi were released as a result of the resuspension of a $\sim 17 \text{cm}^2$ patch of sediment with the water jet.. The volume of sediments that were resuspended during the event (see above) was estimated to be $\text{ca.} 35 \text{cm}^3$. This volume is similar to the volumes of feeding pits formed by the local goatfish that inhabit the study site (see SVideo 4). Accordingly, we estimate that a single resuspension event of a similar size conducted once a day in an area of 1m^2 would increase the DSi flux from the sediment by about 10 %. It should be noted however that goat fish are capable of resuspending bottom sediments at much greater frequency (Yahel et al. 2002). The generality of the fish induced DSi flux is further corroborated by experiments conducted in the Kattegat, at the Baltic Sea outlet (Tengberg et al. 2003)

REFERENCES

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