Phosphorus release from lake sediments: driving factors and mechanisms: A case study in Bay of Quinte (Ontario)

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Phosphorus (P) is the limiting macronutrient triggering toxic cyanobacteria and algal blooms in many lakes in Ontario. Releasing of reactive phosphorous (P), such as phosphate, from fresh water sediments represents a significant internal phosphorous source for many lakes. In shallow lakes where the external loading has been reduced but still with poor water quality, internal phosphorus loading may also prevent improvements in lake water quality. Bay of Quinte on the northeastern shore of Lake Ontario, Canada is chosen for the study. Three different basins of the Bay of Quinte are investigated, all of which have undergone distinct loading histories. The studied basins are Belleville (B), Hay Bay (HB), and Napanee (N). Sediments were sampled with cores and were cut in different depth layers: 0-1 cm,1-2cm, 2-4cm etc. during Aug 2013, Feb 2014, May 2014, July 2014, and Oct 2014. Sequential extraction procedure (Phosphorus Fractionation) is applied to estimate different P binding forms. The result indicates that aluminum and iron ratio data display a proof of redox dependent Fe(III) reduction process as the main mechanism for P-release from lake sediments. The effectiveness of the BD fraction step was also examined in a laboratory experiment by Reitzel et al. (2005) who determined that 96% of Fe-bound P was extracted by dithionite using amorphous Fe(OH)3(S). Therefore, P exchange across water-sediment interface is governed primarily by interaction with redox sensitive elements such as Fe and Mn. Molar ratio used as operational target for estimation of sediment P release potential and Al dosing of P-rich sediments to prevent P release under anoxic condition presented by Kopáček et al 2015, is also examined and tested with data from the study site.