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Interactive comment on “Explosive demographic expansion by dreissenid bivalves as a possible result of astronomical forcing” by M. Harzhauser et al.

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Review Explosive demographic expansion by dreissenid bivalves as a possible result of astronomical forcing.

This is an interesting paper that should be published anyhow. It places booms and busts of a dreissenid population in the wide perspective of periodicity. The introduction starts with the recent expansions of dreissenid bivalves in Europe and North America. It should be noted here that the Quagga mussel (*Dreissena rostriformis bugensis*) is not only spreading in East and Central Europe but also in Western Europe (Bij de Vaate et al., 2013; Matthews et al., 2014).

C6171

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The core of the paper is dealing with the occurrence of shells of an extinct dreissenid *Sinucongeria primiformis* in a drilled core representing 8000 yrs of sedimentation of offshore clays in Lake Pannon deposited in the Miocene. The analysis showed periods of colonization, peak densities and disappearance of the bivalve in the profile, which could be related to solar cycles. Lack of oxygen on the sediment bottom where the dreissenids form mats should play a role as indicated by the presence of pyrite. The cycles appear to control regional wind patterns causing more or less water mixing of the lake. Ostracods show also such a pattern etc.

There are two problems with such study a) first only one drilling core was studied so we are not sure that this pattern occurred over the whole of Lake Pannon in the same periods or is local at that side of the lake for example by wind exposure in that part of the lake. I think that a drop in atmospheric pressure can also cause lack of oxygen at larger depth in particular when organic matter is accumulating in the lake. Wind exposure can mix the water column but can also cause that organic matter is transported to other parts of the lake. In contrast the water can remain stagnant at certain periods. Accumulation of organic matter can cause anoxic conditions with development of toxic compounds such as H₂S which can be washed out all oxygen at low air pressure and cause mass mortality (e.g. Magni et al., 2008 and literature therein). Pyrite can also be formed by the dead bodies of the bivalves. b) the sediments seems to be from an offshore environment. Is any estimation of the depth of the lake here possible. Perhaps also the water table fluctuated periodically causing at shallow depth more oxygen availability also by higher influence of the wind and a lack in oxygen in the case of increased depth also related to the development of stratification (thermocline with epi- and hypolimnion) in the lake. Wind can also cause suspended clay particles in the water which can clog the gills of the bivalves. I miss such a discussion in the paper. Are there also periods in the profile related to organic matter?

A. bij de Vaate, G. van der Velde, R.S.E.W. Leuven & K.C.M. Heiler 2013. Spread of the Quagga Mussel (*Dreissena rostriformis bugensis*) in Western Europe. Chapter 6

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In: T. Nalepa & D.W. Schloesser (eds.). Quagga and Zebra mussels: Biology, impacts and control. CRC Press, Boca Raton, FL. 2nd ed. p. 83-92 (815 pp.).

P. Magni, S. Rajagopal, G. van der Velde, G. Fenzi, J. Kassenberg, S. Vizzini, A. Mazzola & G. Giordani 2008. Sediment features, macrozoobenthic assemblages and trophic relationships ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analysis) following a dystrophic event with anoxia and sulphide development in the Santa Giusta lagoon (western Sardinia, Italy). Mar. Pollut. Bull. 57: 125-136.

J. Matthews, G. van der Velde, A. bij de Vaate, F.P.L. Collas, K.R. Koopman & R.S.E.W. Leuven 2014. Rapid range extension of the invasive quagga mussel in relation to zebra mussel presence in The Netherlands and Western Europe. Biol. Invasions (online).

This paper is suitable for publication in Biogeosciences as it is well-written, to the point and generating novel perspectives on the wax and wane of dreissenid species which are known for their mass invasions.

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C6173

