The PhD thesis of Mgr. Kateřina Kopalová deals with the taxonomy, ecology and biogeography of terrestrial and aquatic (inland) diatoms of two islands in the Maritime Antarctic Region. To date, this region remains underexplored from the point of view of non-marine diatoms, and Mgr. Kopalová’s thesis represents the first significant and rigorous account of their taxonomy and ecology.

In general, the thesis consists of two types of chapters: taxonomic ones and ecological ones. The quality of the taxonomic chapters is outstanding. All descriptions are state-of-the-art: they are rigorous, detailed and standardized, and the taxa are always extensively compared with similar taxa from the Antarctic and elsewhere. It is great to see that many type and/or original materials have been investigated: this is crucial for solving and anchoring species identities in order to prevent potential future taxonomic drift and confusion. The photographic illustrations always cover the whole range of (observed) morphological variation within the taxa, and the quality of the light and electron microscopic images is very high. In addition to the quality, the amount of floristic and taxonomic work that has been done is also impressive. The taxonomic chapters are exemplary for diatom taxonomists everywhere.

The ecological chapters contain descriptive analyses of community structure in relation to environmental variation in the study areas, with remarks on the biogeography of the diatoms observed. These chapters follow a rather ‘classic’ approach, with similarity and cluster analyses, followed by ordination analyses. The overall multivariate statistical approach and treatment is good, although I have a few minor remarks, suggestions and questions (see below). The overall analyses presented in the discussion, which place the results of the present analyses in a wider ‘Antarctic’ context, are good but could have been discussed in more detail (see also my questions below).

Overall, this is a very fine piece of work, which fills an important gap in our knowledge of the taxonomy, ecology and biogeography of non-marine diatoms in the (Sub)Antarctic, and will form the base-line and reference for future studies on lacustrine, stream and terrestrial microalgae in the Maritime Antarctic for years to come. The thesis is definitely suitable for defense and fulfills all the criteria necessary for obtaining the PhD degree.

Below, I list some general remarks on individual chapters. Note that I think all these chapters are very interesting and scientifically sound; these remarks are mainly suggestions to keep in mind for future research and analyses. At the end, I have listed a list of general and more detailed questions for the PhD candidate. In general, I have no remarks on the taxonomic chapters (2-4, appendices 1-5).

There is some inconsistency between the titles of chapter 5 in the contents list and the chapter itself (and the final manuscript title).

The introduction presents an overview of what diatoms are, the study regions and diatom research in these regions. It contains most important information, but lacks some detail here and there. For example, it would have been nice to have a more in depth discussion of the current status of different opinions on diatom classification and phylogeny (e.g. Medlin & Kaczmarska 2004, Theriot et al. 2010, Brown & Sorhannus 2010, Adl et al. 2012). Some important details are lacking (e.g. it should have been pointed out that sperm production (Fig. 1.2) only occurs in the centrics, not in the pennates. Also note that the Chromalveolata concept has now been abandoned in favor of the SAR concept (Stramenopiles, Alveolates & Rhizaria, cf. Archibald 2009, Adl et al. 2012).

It would also have been nice to provide detailed maps of the study regions and the sampling localities in the introduction, including a list of all the samples and sampling localities. For example, some South Shetland Islands listed in the text (p. 25-26) I cannot find in the map (Fig. 1.4). I realize...
these are provided in the separate chapters, but it would be good to have an overview in the Introduction.

In Chapter 5, it would have been good to also perform a PCA (in which the environmental variables could be introduced as supplementary – passive - variables). The same goes for the epilithon lake data set in Chapter 6. This would reveal if any major gradients in species composition have been missed [e.g. gradients related to variables which have not (or cannot be, e.g. biotic interactions) measured], and may therefore explain the rather low amount of variance captured by the direct ordination axes, and the rather low correlation values between the axes and the environmental variables. Also not that there is some confusion between the inter- and intra-set correlations in chapters 5 and 6 (p. 145, 173): if you show direct ordinations then you should give the intra-set, not the inter-set correlations (which are the correlations between the environmental variables and the corresponding indirect ordination axes). Note that this may also explain the lower correlation values.

In chapter 6, I wonder why you used CCA for the final reduced data set (Fig. 6.5). I can accept you find a large length of gradient (p. 167) in the entire James Ross Island (JRI) data set, but I doubt that you still have an underlying unimodal response in the restricted data set. I am sure that a PCA would be more appropriate. On p. 175, did you check for the independent contribution of conductivity (i.e. after partialling out the effect of other variables by introducing them as covariables)?

In chapter 7 (p. 202), you mention species-accumulation curves but these are not shown. I think it is also a missed opportunity that you did not plot the (moss) moisture types (p. 198) in your PCA diagram (p. 206). This would have shown whether there is a link between variation in community structure and this environmental factor. On p. 210, you contrast salinity and conductivity as important factors in Continental vs Maritime Antarctica. Surely, this concerns the same factors? Also, you state that the PCA axis 1 represents a biotic axis. I think this is a bit of an unfortunate statement, as I think you mean biotic stress induced by salinity and nutrients. So basically these are abiotic variables.

General questions

- On the basis of your taxonomic revisions, you find some striking biogeographical patterns in the Antarctic region. Would you expect to find some of your species in Arctic and alpine regions worldwide, if their diatom floras would also be subjected to a similar rigorous taxonomic analysis? Or in other words, do you think some of your species may, at the moment, simply be overlooked elsewhere?
- Do you think the level of endemism in marine Antarctic species is also high?
- You explain the presence of continental Antarctic diatoms on JRI by invoking aerial transport. However, throughout the manuscript you state that dispersal in diatoms is much more limited than previously thought. Could the presence of these diatoms be explained by other mechanisms?
- You find striking differences between the diatom communities of island groups west and east of the Antarctic Peninsula. Could you summarize the factors that would cause this difference?
- In general, do you have any idea of the fraction of diatoms that were alive in your samples? Could the inclusion of (washed in) dead valves affect your ecological findings?
- Do you expect to find other diatoms in the deeper parts of the lakes (where disturbance by seasonal ice formation should be much lower)? Note that in East Antarctica, lake depth is an important factor structuring the diatom communities.

More detailed questions
On p. 22, you state that the ‘Principal factors ... are the physical and chemical characteristics of their habitat’. Is this actually what you find?

On p. 24, you mention a study by Terauds et al. (2012) who defined 15 regions in the Antarctic. How do these regions relate to the three-subregion concept (Convey 2011)?

I was wondering how the seepage areas relate to the streams on JRI (p. 97). Are they connected to one another?

On p. 104 you mention some diatoms show a typical Maritime Antarctic distribution. However, they also occur in other regions. What is their definition as a typical Maritime Antarctic diatom based on?

On p. 133 you refer to a study in which 190 diatom taxa were found on Hurd Peninsula. Taking into account that they used a broader taxonomic species concept, how do you explain the difference in species number between Byers and Hurd Peninsula?

On p. 149, you state that pH is not an important factor (as it would not show a strong gradient). However, pH is selected as an important and significant factor by the forward selection procedure (also take into account that this is measured on a log scale). So what makes you state that only salinity and nutrients influence diatom species composition?

On p. 151 (Byers data set), you state that in the Antarctic region streams seem to be less determining for diatom community structuring. It is actually hard to see if you do or do not find differences between the streams and lakes in LIV Island as the streams are not indicated in the graphs provided (as far as I can see). However, on JRI, you find a clear distinction between streams/seepage areas and lakes. Do you have an explanation for this observation (i.e. the discrepancy between LIV and JRI)?

You use a unimodal model (CA) for JRI, and a linear model (PCA) for LIV. This would suggest that species turnover (beta diversity) is much higher on JRI. Can you explain this?

In the general discussion, you use a linear model (p. 231, PCA) for the whole Antarctic data set. However, for the JRI data alone you used a unimodal model. It would therefore be surprising that the whole data set would show a linear underlying response?

Why is the analysis of the JRI lakes restricted to only the epilithon samples? Are these different from epipelon samples?

On p. 234-235, it would be nice to have seen a more detailed discussion of these graphs. What are the SA areas that show a degree of overlap with CA (or do these separate along a third axis)? Are LIV and JRI the only MA samples included in this data set?

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Gent, September 5th 2013