Modelling deformation and horizontal sectioning of lake sediments

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# Methods

Table 1. Sources of core photos that contained digitized layers used in this study.

|  |  |  |
| --- | --- | --- |
| Photo ID | Layers Digitized | Reference |
| crevice\_lake | 12 | Rosenbaum et al. 2010 |
| ds\_unpubl1 | 1 | Dunnington and Spooner (unpublished data) |
| ds\_unpubl2 | 2 | Dunnington and Spooner (unpublished data) |
| ds\_unpubl3 | 1 | Dunnington and Spooner (unpublished data) |
| ds\_unpubl4 | 1 | Dunnington and Spooner (unpublished data) |
| longlake\_pc1 | 1 | White 2012 |
| menounos\_cheak1 | 8 | Menounos and Clague 2008 |
| menounos\_cheak2 | 8 | Menounos and Clague 2008 |
| suzielake\_1 | 4 | Spooner et al. 1997 |
| suzielake\_2 | 9 | Spooner et al. 1997 |
| whistler\_gc4 | 1 | Dunnington 2015 |
| whistler\_gc8 | 1 | Dunnington 2015 |

## Deformation model

We modeled horizontal sections with height *H* and diameter *D* as a 3-dimensional raster grid with a cell size of 0.005 mm (Figure 1). For each cell *i*, an original depth *d0i* was calculated with reasonable minimum, maximum, and mean parameters obtained from digitized strata. Density histograms were then obtained to estimate the contribution of each original depth *d0* to the slice. For each slice, *d*=0 refers to the middle of the slice. We produced these models for *D*=6 cm, as this represents the barrel width of our Glew (1989) gravity corer. Compression was not modelled using this method, although modification of this model would make including compression possible.

## Effect on paleolimnological data

To model the concentration (mass fraction) we would obtain by sectioning and homogenizing a sample with variable concentration and density, we need to calculate total mass of the target substance divided by the mass of the slice. With a 3-dimensional raster grid using *n* cells, this value can be written as a sum of the product of concentration (), density (), and volume (*V*) divided by the sum of the product of *V* and (1).

We can remove *Vi* from the summation in both the numerator and denominator because the cell size is constant for each *i*, and write and as functions of *d0i*.

Equation (2) in combination with our deformation model allows for modelling the effect of sectioning, homogenization, and deformation given high-resoution un-altered data. We used fictional generated data to test our deformation model inspired by 1 mm resolution XRF core scanner data (Guyard et al. 2007; Brunschön, Haberzettl, and Behling 2010; Kylander et al. 2011), and a linear dry density gradient from 0.1 to 0.5 g/cm3. Generated data was transformed and smoothed

# Discussion

Any other literature out there? Haven't yet checked...

# Conclusions

There is a limit to how small extrusion intervals can get based on deformation. For minor deformation, even small extrusion intervals are ok.

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