



Finely laminated 4000 yr sediment record from Lake Bolatau (Bukovina, Romania) – implications for palaeolimnology and erosion history

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Geochemical and sedimentological analyses of lacustrine sediments are a valuable tool for understanding the dynamics of local and regional climate over various time scales. This study focuses on Lake Bolatau located at 1137 m a.s.l. in Obcina Ferdeului, one of the flysch nappes at to the Northern Romanian Carpathians. The lake was first mentioned in a scientific study in 1964, whereby the landslide dam origin was initially suggested, but there remained no evidence whatsoever of the age of the lake, albeit the first recorded historical reference to Lake Bolatau was in 1806 (Mindrescu et al. 2013).

From this currently eutrophic lake sediment two finely laminated lake sediment cores were extracted (winter 2013), of which one core was over 3 m long. Both cores were subsequently cut into 1 cm-long items of which we selected various batches of samples for specific analyses. Petrographic thin sections from the cores were examined under polarization microscope and BSE microscope.

An age-depth model for the Bolatau sediment record was established based on 8 AMS radiocarbon dates from terrestrial macrofossils and the double peaks (i.e. mid-1960s; global fallout maximum; 1986: Chernobyl accident) of the ^{137}Cs flux. The onset of the lacustrine sedimentation is estimated at ~ 4.6 ka cal BP. There was no abrupt change in the rate of sedimentation, after its onset however the geochemical and sedimentological properties of the sediments changed through time.

While vivanite or pyrite doesn't precipitate today XRD results indicated that there were several time intervals when environmental conditions were favorable for that. We identified syn-sedimentary and authigenic form of pyrite based on Wilkin et al. (1996). The presence of syn-sedimentary pyrite means that oxic-anoxic interface was often in the water column.

XRF results obtained from the upper 60 cm suggest that Fe actively migrated and precipitated in the organic matter rich layers due to the often anoxic environment. We regarded Ti as a conventional indicator of terrestrial input because Si has organic source too (diatoms). Based on their positive or negative correlation we established groups of trace elements of different origin. Geochemical changes mostly coincide with changes of the sediment structures. We observed seasonally altering detrital and organic layers in the thin sections; however, the microstructure of these layers often changed (e.g. chaotic or graded detrital laminae, diatom blooms, cross lamination, clay sheets, algal mats).

By employing several methods we attempted to document as accurately as possible the age and limnogeological evolution of Lake Bolatau in terms of the sedimentation changes or lack thereof, as well as to recognize abrupt certain changes in the local climate focusing on the last four millennia. As yet, based on the data acquired thus far, it has been established that Lake Bolatau may represent the oldest landslide-dammed lake in Romania, providing an important perspective on past environmental conditions in the Northern Romanian Carpathians via detailed lake sediment based study.

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References:

- Mindrescu et al. (2013) *Quat Int* 297:219
Wilkin et al. (1996) *Geochim. Cosmochim Acta* 60:3897