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Sedimentological discontinuties as chances for enhancing process-based palaeo-environmental reconstruction

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Morpho-stratigraphic approaches in the field of palaeoenvironmental reconstruction are time consuming, have a low temporal resolution and the problem of equifinality in terms of processes or simply the reputation of fuzziness. Nevertheless, investigations of seemingly continuous archives such as lake sediments are more effective if climate driven catchment signals are considered. Lake level data sets provide valuable indices for modelling the palaeoclimatic history and feedback-mechanisms on regional, supra-regional or even hemispherical scales. However, they are frequently used without considering the role of sediment trapping, signal buffering and random events (tectonic, mass-movements, etc.) along related sediment cascades. Moreover, dating inversions, record gaps and unlikely high or low SARs are considered as archive-internal disturbances or simply measurement errors which have to be smoothed by increasingly sophisticated tools of statistics or simply eliminated. This poster examines the value of such discontinuities and random events within continuous lake record for deciphering catchment-wide feedbacks/responses and their related processes.
Our first example shows the influence of lake level changes and permafrost uplift on the reservoir effect of Lake Heihai, Northern Tibetan Plateau. A drop in lake level induced the reworking of sediment sequences, which is not identifiable by disturbances of the stratighraphy. This problem only becomes apparent, if several on-shore sediment records and at least two lake cores are compared. Several lake records from Hala Lake, Qilian Mountains, northeastern Tibetan Plateau confirm highly diverse stratigraphies and sediment properties, thus underpinning the necessity of data comparison from different locations (within the lake) for a reliable reconstruction of climate-driven hydrological variations within a lake-catchment system.
A third example from a large endorheic foreland basin of the Tibetan Plateau (Ejina Basin also known as Gaxun Nur B.) shows that only a large set of well dated sediment records with overlapping time frame lead to an understanding of the underlying sedimentation processes. The information of sedimentation variance derived from a cored sediment record is punctual. Only the spatial relation and geomorphological context provide insights into a larger set of interrelated processes and thus ensure spatially reliable reconstructions of climate-induced hydrography.
Finally we show that a single record without considering the geomorphological process ensemble will provide less resolution or greater fuzziness than a geomorphological archive. Only the combination of more than one core from a “final” sink, an unbiased analyses of different proxy sets and at least a well dated morphostratigraphy may lead to a reliable process-based reconstruction of palaeo-environmental (-climate) variance.