Compositional data analysis of sedimentological, mineralogical and geochemical data for the evaluation of Austrian loess and loess loam deposits

Heinz Reitner¹, Christian Benold¹, Peter Filzmoser², Maria Heinrich³, Gerhard Hobiger¹, Can Mert², Julia Rabeder¹, Jürgen M. Reitner¹, and Ingeborg Wimmer-Frey¹

¹Geological Survey of Austria, 1030 Vienna, Austria (heinz.reitner@geologie.ac.at)
²Research Unit Computational Statistics - Institute of Statistics and Mathematical Methods in Economics, Vienna University of Technology, 1060 Vienna, Austria
³Marxergasse 37/5, 1030 Vienna, Austria

Austrian loess and loess loam deposits represent an important source of raw materials for the heavy clay industry for centuries. Building material quality of loess and loess loam deposits and their suitability for different applications is significantly influenced by their heterogeneous properties. These depend on the geology of the source area, climatic conditions, geomorphological location, stratigraphic position, intensity of weathering and redeposition potential. The description of occurrences, properties and availability of these raw materials is therefore an important prerequisite to meet the industrial quality requirements. A large number of different sub-datasets exist at the Geological Survey of Austria, which comprise grain-size analysis, bulk rock composition, clay mineralogy, and geochemistry data of loess and loess loam. Within our project, these individual data sets underwent a thorough examination and have been merged into a coherent database to enable the joint regional and statistical analysis of the data. By applying a log-ratio approach the compositional nature of the analysis data has been taken into account for multivariate statistical methods. Within our study we focused on the classic Austrian loess regions in the Northern Alpine foreland areas of Upper and Lower Austria and in the Vienna Basin. By transferring the results of the statistical analysis to a Geographic Information System (GIS) these served as the fundamental basis for our categorization of the loess and loess loam occurrences. Taking into account previously published approaches based on soil profile classifications as well as trends and patterns derived from the analysis data, we finally were able to delineate different districts of brick raw materials deposits. These will be made publically accessible to the industry and interested parties as part of the web application of the Austrian Interactive Raw Material Information System IRIS-Online.
