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Bringing light into the darkness – Chernozem evolution in Central Germany clarified by single-grain luminescence data

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Chernozems are among the most productive soils in the world, as they unite several favorable factors such as high fertility, favorable pH, a granular structure and high moisture retention capacity. Because of that they are typically characterized by a high agrarian value and often provide long records of intensive human land-use that reach back several millennia. However, despite their high relevance for soil sciences and geoarchaeology, many important aspects regarding chernozem formation – e.g. the question whether natural or human factors were more important - are still poorly understood (Eckmeier et al., 2007). One important drawback in this context is the lack of powerful methods to get grip on timing and rates of chernozem evolution.

Recently it has been suggested that the nexus of soil mixing and soil evolution can be clarified through single-grain luminescence analyses (Reimann et al., 2017). In this study we apply the suggested protocol for the first time to two chernozem profiles in Central Germany that were buried by the Late Bronze Age burial mound Bornhöck ca. 3.8 ka ago. Our goals are (i) to test the newly developed luminescence methodology, and if successful, (ii) to date the start of chernozem formation and degradation and (iii) to quantify soil formation rates through time.

First results suggest that chernozem formation of the two profiles started most likely in the early Holocene and ceased between ca. 5.5 and 5.0 ka ago. Furthermore, our data demonstrate that chernozem formation was characterized by very intensive vertical soil mixing, most likely related to intensive bioturbation. In a next step we will calculate corresponding biological soil mixing rates to further detail chernozem evolution. Already at this stage of research, however, we can confidently conclude that we are able to trace key processes of chernozem formation through the analyses of single-grain luminescence data.

References:

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