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Data Article

Paleoenvironmental multiproxy dataset of the Quaternary abandoned channel in Tövises bed, Great Hungarian Plain

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ABSTRACT

To obtain the multiproxy paleoenvironmental dataset from southeast Great Hungarian Plain (GHP), 345 sediment samples were collected at one cm intervals from the cores retrieved from Tovisies bed paleochannel, and six samples were analyzed for 14C dates. The obtained radiocarbon dates were calibrated to calendar ages using the IntCal20 calibration curve. Bayesian statistics within the R bacon 2.5.8 age-depth modeling package were used to establish the age-depth model and it represented the time frame for the entire dataset. The obtained polymodal grain size distribution (GSD) data was unmixed into four EMs using the AnalySize v.1.2.0 algorithm, employing the built-in General Weibull function which helped explain the dynamicity of the endmembers' sedimentation process. To understand the alluviation history, the endmember abundances were correlated with LOI55, LOI950, and magnetic susceptibility. The dataset presented in this article could be of potential reuse for studying the spatial-temporal environmental changes and in geoarchaeological research, providing insights into how human societies adapted to environmental shifts across the southeast GHP.

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Specifications Table

Subject	Earth and Planetary Sciences
Specific subject area	Earth-Surface Processes, Quaternary
Type of data	Tables and figures
How the data were acquired	The grain size data of the pretreated sediment core samples were obtained at one cm intervals using the Easysizer20 laser particle analyzer with a range of 0.1-500 µm, for 42 grain-size classes [1]. AMS dates from six samples [2] analyzed at INTERACT, Institute for Nuclear Research, Loránd Eötvös Research Network, Debrecen, Hungary were used for ^{14}C chronology.
Data format	Raw and Analyzed
Description of data collection	Six cores of undisturbed sediment were retrieved from paleochannel in Tövises bed in the southeast Great Hungarian Plain using a 5 cm diameter sealed liner tube Russian peat corer. Each core was subsampled on a one cm scale for a total of 345 samples.
Data source location	• Institution: University of Szeged • City/Town/Region: Szeged • Country: Hungary
Data accessibility	Repository name: Mendeley Data Data identification number: http://10.17632/fgjgv2ymxp.5 Direct URL to data: https://data.mendeley.com/datasets/fgjgv2ymxp/5
Related research article	Eltijani, A.; Molnár, D.; Makó, L.; Geiger, J.; Sümegi, P. Application of Parameterized Grain-Size Endmember Modeling in the Study of Quaternary Oxbow Lake Sedimentation: A Case Study of Tövises Bed Sediments in the Eastern Great Hungarian Plain. Quaternary 2022, 5, 44. https://doi.org/10.3390/quat5040044

Value of the Data

- An extensive multi-proxy analysis of Tövises bed paleochannel core samples in southeast, Great Hungarian Plain (GHP) comprising: Grain size distributions (GSDs), chronology, and magnetic susceptibility (MS) datasets.
- GSD dataset of these infills can be used to characterize the alluviation history of the abandoned channels
- The radiocarbon dates can be used for the age-depth model, therefore providing the time frame of the sedimentation and abandoned channel infill history.
- MS measurement is the sum of all individual susceptibility contributions from various magnetic mineral grains in a sediment sample, indicating changes in composition associated with paleoclimatic conditions affecting sedimentation processes by measuring magnetizable sediment contents.
- LOI data can be used as an indicator of organic matter and carbonate content in sediments, which can be linked to both climate and land-use changes.

1. Objective

The purpose of creating this dataset was to characterize the depositional processes by analyzing grain size characteristics, and sediment transportation, and identifying the depositional environment. The goal was to document the spatiotemporal patterns of past environmental and depositional processes across the GHP.

Moreover, this dataset was aimed at demonstrating the utility of abandoned channel-fill sequences as reliable indicators of sedimentological processes and paleofloods, by enhancing the comprehension of the internal evolution of the abandoned channel sedimentary sequences.

2. Data Description

The dataset is multiproxy data; it contains different measurements of sediments retrieved from the Tövises bed abandoned channel [3]. The first data file (Chronology.xlsx) contains the raw and calibrated 14C ages where six samples with corresponding depth in cm, covering the period from circa 515 ± 18 to 6926 ± 3, the 2σ calibrated ages, and the weighted mean age ranging from circa 532 to 7748 cal yr before present (BP). The second datafile (Grain-size.xlsx) contains the raw GSDs of 345 samples with grain sizes ranging from 0.1 – 500 µm. The grain size range of each sample was plotted against it is fractional abundance which showed polymodal distributions of six sub-modes ranging from 2.5 to 11 Φ (Fig. 1). A summary statistic of some of the GSDs is shown in Table 1 which includes the percentages of clay, silt, and sand and major statistical parameters.

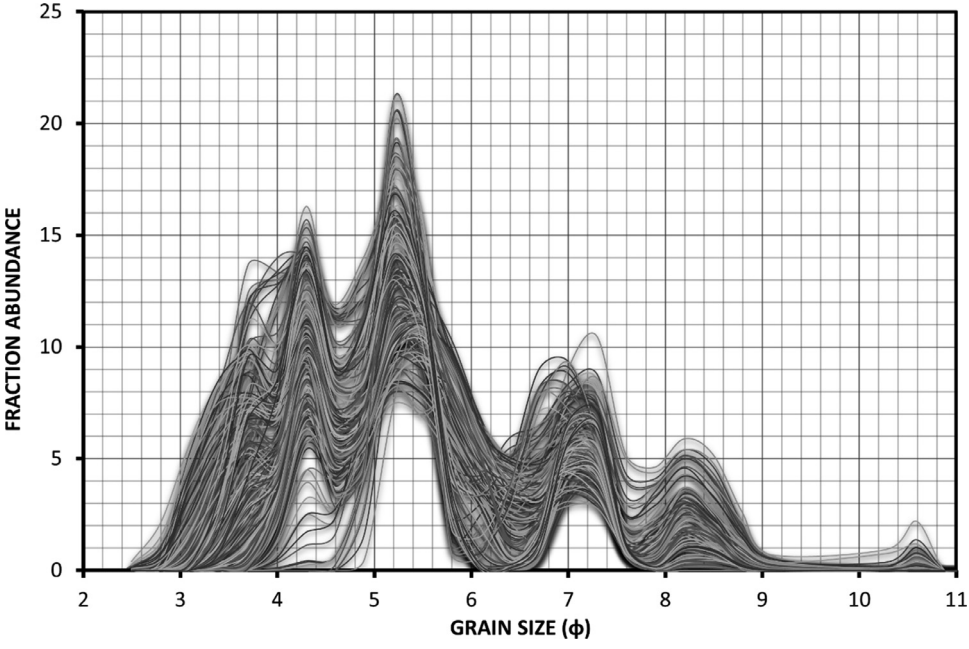

Fig. 1. GSD characteristics of the Tövises bed core. (a) Overlay plot of the GSDs of the 345 samples, illustrating the polymodality of Tövises bed sediments. Adapted from [2].

The third data file (Endmembers.xlsx) is for the EMs data; it contains three sheets: the GSDs sheets are the clean GSDs with size ranges from 0.12 – 176 µm and is used as the input for the endmember modeling, the EMs_stats sheet contains the statistical summary of the obtained four EMs (Clay, silt and sand ratios, mean drain size, sorting, skewness, and kurtosis), and the EMs_Abundance sheet which contains the fractional abundance of the four EMs. The fourth data file (Magnetic_Loss-on-ignition.xlsx) contains LOI55, LOI950 and Magnetic succeptibility data.

Table 1
The different grain size fraction abundances (%) with the basic statical parameters of selected samples.

Sample	Clay (%)	Silt (%)	Sand (%)	Mean (phi)	Sorting (phi)	Skewness (Sk)	Kurtosis (K)
1	0.03	77.62	22.35	4.69	0.98	0.24	1.19
2	0.00	82.51	17.49	4.78	0.95	0.22	1.22
3	0.00	84.73	15.27	4.81	0.94	0.20	1.26
4	0.00	83.26	16.74	4.79	0.95	0.21	1.23
5	0.00	83.88	16.12	4.79	0.94	0.22	1.24
6	0.00	90.91	9.09	4.95	0.92	0.16	1.31
7	0.00	83.26	16.74	4.79	0.95	0.22	1.22
8	0.00	91.29	8.71	4.97	0.92	0.16	1.32
9	0.00	89.78	10.22	4.94	0.93	0.17	1.30
10	0.02	94.73	5.25	5.05	0.88	0.15	1.32
11	0.49	94.21	5.30	5.13	0.92	0.16	1.26
12	0.54	93.14	6.32	5.15	0.95	0.15	1.26
13	1.74	94.14	4.12	5.64	1.19	0.29	1.27
14	0.51	92.60	6.89	5.20	0.99	0.15	1.23
15	1.19	95.00	3.81	5.62	1.18	0.30	1.26
16	1.26	89.17	9.57	5.48	1.22	0.25	1.19
17	1.01	95.62	3.38	5.58	1.17	0.31	1.26
18	1.53	95.38	3.09	5.64	1.17	0.30	1.29
19	2.40	92.51	5.09	5.66	1.21	0.25	1.11
20	1.05	96.22	2.72	5.63	1.16	0.32	1.27

3. Experimental Design, Materials and Methods

Following core retrieval, the subsampling of the sediments was on one cm intervals, resulting in a total of 345 samples with a depth resolution of 345 cm. Six samples were analyzed for ^{14}C date at the International Radiocarbon AMS Competence and Training Center (INTERACT), Institute for Nuclear Research, Loránd Eötvös Research Network, Debrecen, Hungary. The obtained radiocarbon dates were calibrated to calendar ages using the IntCal20 calibration curve in CALIB 8.1. Age-depth model [2] was based on Bayesian statistics within the R Bacon 2.5.8 age-depth modeling package conducted in R language version 4.1.3. [4] Bayesian statistics approach is flexible and allows variations in sediment accumulation rate from zero to high sedimentation rates [5]. In contrast to standard linear regression models, this approach leads to more realistic uncertainty estimates, by combining numerical ages with prior knowledge of the accumulation rates and its variability [6].

The laboratory procedures for sample treatment were conducted following the methodology described in [7], which involved drying the samples at 55 °C, followed by treatment with 30 mL of $Na_2P_6O_{18}$ solution and subsequent ultrasonic bath dispersion of the particles. The samples were analyzed for their grain size distribution (GSDs) using laser diffraction with the Easysizer20 laser particle analyzer (OMEC). The GSDs were measured at one-cm intervals for 42 grain-size classes ranging from 0.1 to 500 µm [8]. The instrument has a measuring range of 0.1 to 500 µm with a repeatability error of less than 3% and uses 54 built-in detectors based on the Mie scattering.

The measured GSDs were unmixed using the AnalySize v.1.2.0 EMM algorithm [9], utilizing The General Weibull function, which produced four endmembers (unimodal endmembers "EM1-4") (Fig. 2); the optimal number of EMs was determined using the determination coefficient (R^2) and the angular deviation (θ) between the EMs and the GSDs. This approach ensures accurate fitting results and avoids data over-fitting. The General Weibull function was used to explain the dynamicity of the EMs sedimentation process by considering the geological background of the GSD, resulting in the greater statistical and physical significance of the EMM [2].

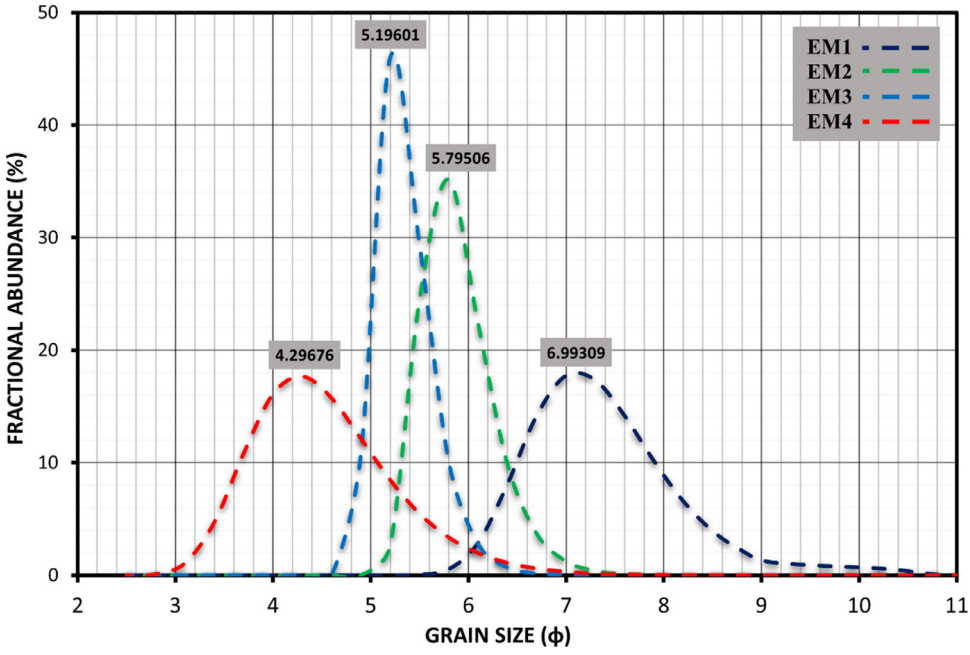

Fig. 2. Representation of the four endmembers (EMs) resulting from the statistical unmixing of the original grain size distribution (GSDs). Adapted from [2].

Ethics Statements

This dataset did not involve human subjects or animal experiments nor was it obtained from social media platforms and therefore does not contend with any ethical issue.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Dataset of quaternary abandoned channel in Tövises bed, Great Hungarian Plain (Original data) (Mendeley Data).

CRediT Author Statement

Abdelrhim Eltijani: Data curation, Conceptualization, Methodology, Visualization, Investigation, Writing – original draft; **Dávid Molnár:** Supervision, Writing – review & editing; **János Geiger:** Software, Writing – review & editing.

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