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Data Article

Petrology dataset of Pliocene-Pleistocene sediments in northeastern Slovenia

Podatki o petrologiji pliocensko-pleistocenskih sedimentov severovzhodne Slovenije

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Ključne besede: petrografska analiza, litološka analiza klastov, provenienca klastov, pliocensko-pleistocenski sedimenti

Abstract

This is a dataset of petrological analysis of Pliocene-Pleistocene fluvial sediments from 14 gravely samples from the Slovenj Gradec, Nazarje, Celje and Drava-Ptuj Basin (northeastern Slovenia), collected for clast lithological analysis. The petrological analysis includes description of 155 thin sections of metamorphic, volcanic, volcaniclastic, clastic and carbonate rocks. This dataset provides grounds for determining the provenance of these gravel deposits, revealing possible resedimentation processes, and serves as a tool for drainage network interpretation in the Pliocene-Pleistocene.

Izvleček

V članku predstavljamo podatke o petrološki analizi rečnih pliocensko-pleistocenskih sedimentov iz 14 prodnatih vzorcev iz slovenjgraškega, nazarskega, celjskega in dravsko-ptujskega bazena (severovzhodna Slovenija), ki so bili vzorčeni za namen litološke analize klastov. Petrološka analiza obsega opise 155 zbruskov metamorfnih, vulkanskih, vulkanoklastičnih, klastičnih in karbonatnih kamnin. Ti podatki predstavljajo temelj za določitev provenience obravnavanih prodnatih sedimentov, razkrivajo morebitno resedimentacijo ter so pomembni za interpretacijo razvoja rečne mreže v pliocenu in pleistocenu.

Background

This dataset was collected to perform clast lithological analysis of Pliocene-Pleistocene fluvial sediments in the frame of research published in Mencin Gale (2021). The dataset present in this article contributes to understanding the provenance of gravelly sediments deposited in Slovenj Gradec, Nazarje, Celje and Drava-Ptuj Basins using clast lithological analysis. This method provides grounds for determining the source of gravel. Moreover, it serves as a tool for determination of possible re-sedimentation (e.g. from Miocene conglomerates) and drainage evolution.

Clast lithological analysis is traditionally performed at the macroscopic level (Bridgland et al., 2012), with efficacy and statistical validity being its primary strengths (Bridgland, 1986; Walden, 2004; Gale and Hoare, 2011). However, it has been discovered that conducting petrographic analysis on thin sections of selected clasts significantly enhances the quality and spatial resolution of provenance analysis (Mencin Gale, 2021; Mencin Gale et al., 2019a, 2019b, 2024). This approach provides more accurate information about the composition and source formations of the studied sediments.

Detailed results and interpretations of this methodology were already published in several publications: Mencin Gale (2021), Mencin Gale et al. (2019a, 2019b, 2024). Moreover, the selected sections frow where the samples were taken were in detail discussed in Mencin Gale et al., (2019a, 2019b, 2024).

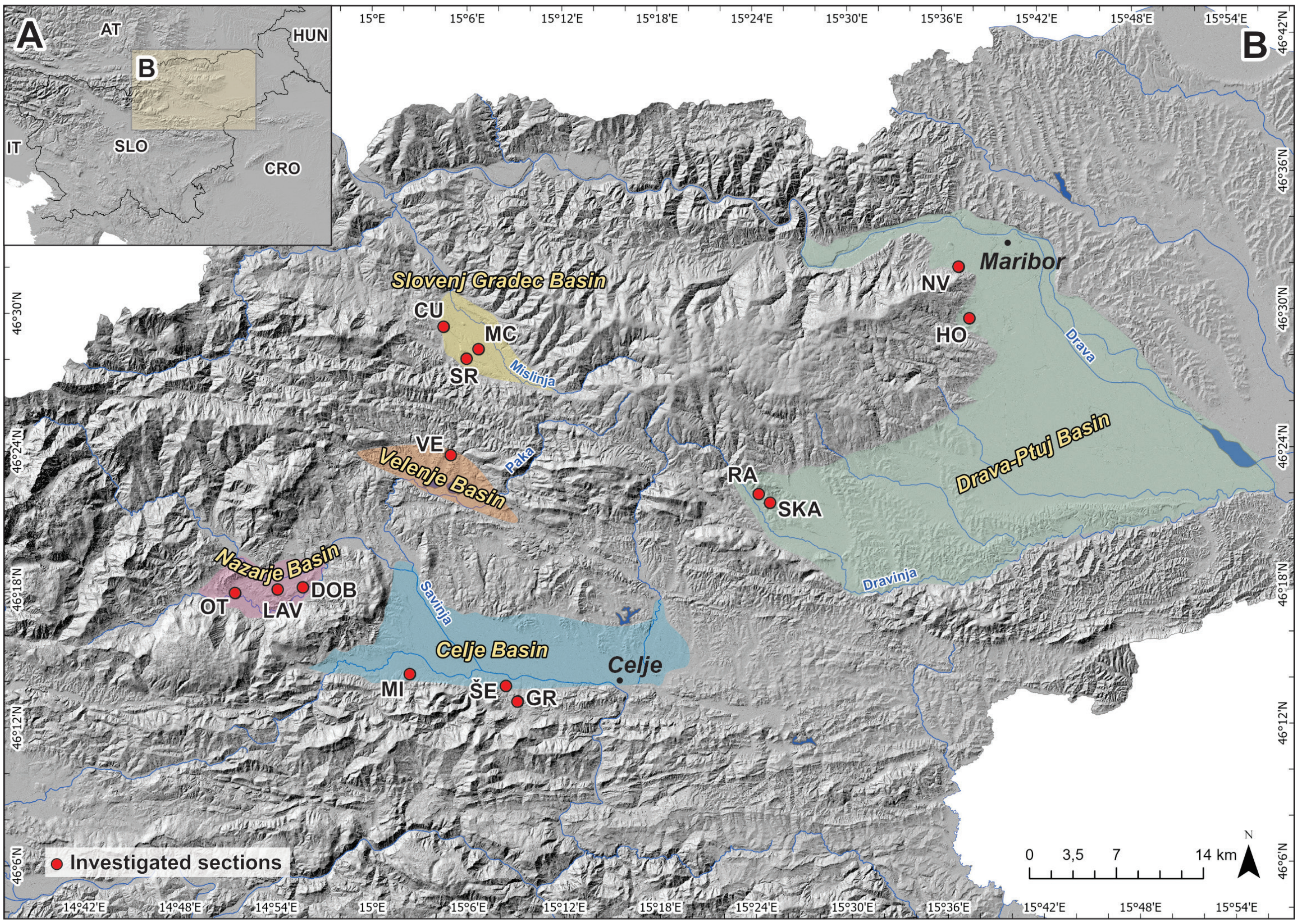

Fig. 1. Overview of the studied region. A: Map of Slovenia with marked investigated area. B: Locations of the selected basins and sections comprising the dataset presented in this paper. Basemap: shaded relief of the DEM (digital elevation model, Ministry of Environment & Spatial Planning, 2015).

Experimental design, materials, and methods

a) Gravel sampling

We selected 14 sections in Slovenj Gradec, Nazarje, Celje and Drava-Ptuj Basins for sedimentological analysis and sampling (Fig. 1). The sections were selected based on length and preservation of the clasts (avoiding weathered sections). The sections range from 1 to 14.3 m in length (Table 1). The most suitable outcrops were found on terrace risers or within areas incised by tributaries. Samples of gravel were collected from the sections, which were cleaned prior to sampling. Locations of the sections (x, y, z) were acquisited with hand-held GPS device Trimble and further managed in ArcGIS Pro (ESRI).

b) Clast lithological analysis (CLA)

Clast lithological analysis was adapted from guidelines by Walden (2004), Lindsey et al. (2007), and Gale and Hoare (2011). Sampling for gravel involved bulk sampling of the exposed surface to avoid biasing by selecting only the most obvious clasts. The Velunja section (VE; Velenje Basin) was logged and sampled with an abseiling technique and the rest of the sections were accessible from the ground. Dry-sieving was conducted in the field, with only a 1.5–6 cm fraction transported to the laboratory for further analysis. Clasts smaller than 1.5 cm are mostly too weathered to allow for reliable determination of lithology. Larger clasts also allow for better observation of the texture and bulk characteristics of the rock.

Each sample comprised 48–346 clasts, with precise counts provided in Table 1. A smaller number of counted clasts is due to the less available material for the analysis (e.g. smaller, conglomerated layers). Macroscopic examination and lithology-based grouping were followed by petrological analysis. In total 2.682 clasts were examined from which 155 were selected for detailed examination in thin sections: 14 clasts from the Slovenj Gradec Basin, 63 from the Nazarje Basin, 13 from the Celje Basin, 32 from the Drava-Ptuj Basin, and 33 from the Velenje Basin.

c) Microscopy for determination of source stratigraphic unit

We used optical polarizing microscope Opton Zeiss for microscopy in transmitted light with lenses with magnifications of 2.5×, 5×, 10×, 20×, 25×, 50×. A digital camera is attached to the microscope for production of microphotographs. Biotic components in carbonate and mixed carbonate-siliciclastic rocks, grain composition in clastic rocks, and mineral associations and mineral alterations in metamorphic, volcanic, and volcaniclastic rocks determined from thin sections crucial for the determination of source stratigraphic unit of each rock type.

Data description

All described and deposited data are analyzed data. They are represented in several figures, tables and shapefile.

Fig. 1 shows locality map of the sections. Fig. 2–5 show selected photographs of 35 thin sections in the Slovenj Gradec (5), Nazarje (10), Celje (8) and Drava-Ptuj Basin (12), respectively.

Figure 1: Locations of the sections where samples for clast lithological analysis were collected.

Figure 2: Microfacies of clasts in the Pliocene-Pleistocene sediments from the Slovenj Gradec Basin in cross-polarized light. Corresponding thin sections descriptions are presented in Table 2. Abbreviations: Qtz – quartz, Mc – microcline, Pl – plagioclase, Ep – epidote, Am – amphibole, Chl – chlorite, Bt – biotite, Ms – muscovite, Grt – garnet

Figure 3: Microfacies of clasts in the Pliocene-Pleistocene sediments from the Nazarje Basin in plain- (A, B, C, D, G, H, I, J, K, L) and cross-polarized light (E, F). Corresponding thin sections descriptions are presented in Table 3. Abbreviations: H – hyaloclasts, Lmt – laumontite, Chl – chlorite, Sme – smectite, Zeo – zeolite, Pl – plagioclase, PmL – pumice lapilli, VRF – volcanic rock fragment, Fsp – feldspar, Aug – augite, Qtz – quartz, Bt – biotite, Hbl – hornblende, M – glassy groundmass, Px – pyroxene, RF – rock fragment.

Figure 4: Microfacies of clasts in the Pliocene-Pleistocene sediments in the Celje Basin in plain- (B, C, D, E, F, G, I) and cross-polarized light (A, H). Corresponding thin sections descriptions are presented in Table 4. Abbreviations: Qtz – quartz, Ms - muscovite, CG – crystal grains, y-GS – y-shaped glass shards, VRF – volcanic lithic fragment, Fsp – feldspar, M – tuffaceous matrix, Bt – biotite, g – glassy groundmass, RF – rock fragment, Tur – tourmaline, Tur(a) - authigenic tourmaline

Figure 5: Microfacies of clasts in the Pliocene-Pleistocene sediments in the Drava-Ptuj Basin in cross- (A, B, D, G, H, I) and plain-polarized light (C, E, F, J, K, L, M, N, O). Corresponding thin sections descriptions are presented in Table 5. Abbreviations: Qtz – quartz, Qtz(m) – microcrystalline quartz, Hbl – hornblende, Ep – epidote, Grt – garnet, Ms – muscovite, Ser – sericite, Chl – chlorite, Chl(a) – altered chloride, Op – opaque mineral, WGS – welded glass shards, Cl – collapsed lapilli.

Locality map of sections in Shapefile (Shapefile 1) contains following attribute: type of shapefile, section (full name), name of the section (abbreviations), section type, reference, where the results and interpretation are published, author of the mapping and year of mapping. Shapefile contains 14 data points.

Shapefile 1: Location map of sections

Table 1 contain dataset with listed sections in each basin; section names after village name; sections' lengths in meters; CLA (clast lithological analysis) sample; depth of collected clast lithological samples; number of counted clasts per sample; number of thin sections per sampling area; coordinates of the sections in EPSG Coordinate Reference System Code (code: 3794); cross-reference for petrographical data (Tables 2-5 and publications) and related research article in which results and discussions were presented. Tables 2–5 contain petrographical dataset of analyzed thin sections from the Slovenj Gradec, Nazarje, Celje and Drava-Ptuj Basins, respectively, including lithogroup, lithotype, thin section descriptions and provenance attribution. Thin sections are marked with abbreviation of the section and a consecutive number. Lithogroup marks general rock classification. Lithotype represents basic rock determination. Brief petrographic description contains information about rock structure, texture, mineralogical composition, alteration, weathering, cementation, microfossils, diagenesis and, where applicable, resemblance with a certain thin section. Provenance was determined according to petrographic descriptions and compared with published data and maps of the geological units (Mencin Gale et al., 2019a, 2019b, 2024; Mencin Gale, 2021, and references therein).

Table 1: Sections dataset

Table 2: Petrography Slovenj Gradec Basin

Table 3: Petrography Nazarje Basin

Table 4: Petrography Celje Basin

Table 5: Petrography Drava-Ptuj Basin

Data format

Figure 1–5: Raster image (.jpeg format)
Shapefile 1: ESRI shapefile, point features (.shp format)
Table 1–5: Microsoft Excel file (.xlsx format)

Data accessibility

The analyzed data and metadata are open access data and has been deposited in DiRROS repository. License: CC-BY 4.0. Data and metadata are accessible using the link:

Repository name: DiRROS

Direct URL to data: https://dirros.openscience.si/IzpisGradiva.php?id=19042&lang=slv

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