PO-218

Impact of Specific Surface Area on Hydrogeological Properties of Loess Deposits and Loess-Derived Soils in Eastern Croatia (ISSAH)-Pedological tasks within the project

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Introduction

Loess is a terrestrial sediment, formed by aeolian transport and deposition of silt-sized particles during Pleistocene glacial periods. Loess, loess-derived or loess-like materials cover significant areas of the Earth, being important for numerous human activities and scientific disciplines. Given that some of the most fertile soils are formed on loess, its importance for agriculture is especially high.

Much of continental Croatia - the main agricultural region of the country - is covered by loess(-derived) deposits. These deposits cover important regional aquifers, as semi-permeable layers through which atmospheric water infiltrates into groundwater. At the same time, loess deposits protect groundwater from contamination, which can be pronounced in agricultural areas.

Croatian loess(-derived) sediments and soils formed on them have not yet been investigated by an interdisciplinary approach that would involve hydrogeology, hydrology, agronomy, soil science and geology/sedimentology. Thus, the 5-year interdisciplinary scientific project ISSAH (lead researcher: Kosta Urumović, Ph.D.) had started in 2018. Main focus is on the specific surface area of particles in loess and loess-derived soils, as it is the property with the key effect on hydrogeological, geomechanical and pedophysical parameters. Project will yield a numerical model of groundwater-flow through the covering aquitard and water-bearing complex, helping the efficient use and protection of soils/groundwater in the area. Also, it will establish an interdisciplinary team able to tackle different and complex environmental issues, particularly in relation to the climate change.

Figure 1. The study sites (*Kanovci, Livade, Radoš*) in the Eastern Croatia

Study area

Study area is at the east of continental Croatia (**Fig. 1**), in which all important aquifers are loess-covered. Climate is semi-humid to semi-arid continental. Across the area, three representative locations were chosen for hydrogeological, meteorological and pedological research/monitoring. Each location is flat, found below 200 m asl, on loess(-derived) deposits. Two locations are grasslands and one is a vineyard (the Radoš location).

Pedological tasks

Pedological tasks performed so far comprised the following:

a) available literature on soils and soil-forming factors of the study area was analyzed, reviewed and synthesized;
b) on the three locations, soil reconnaissance/augering was performed and soil pits were opened (**Fig. 2**);
c) soil profiles were described, sampled by genetic horizons (disturbed samples + triplicate 100 cm^3 cores), and classified in line with the WRB-2014 system (**Fig. 2**)
d) three gravitational lysimeters were installed in each soil pit to collect soil water percolating through the rhizosphere;
e) on each location, soil temperature and moisture sensors were installed in topsoil and subsoil layers;
f) basic soil analyses were conducted (pH, organic matter and carbonate content, particle size distribution, density and total porosity, aggregate stability, etc.);
g) finally, soil water retention was determined using the sand-box apparatus (0-0.1 bar range) and the pressure extractors (0.1-15 bar range), with the differential soil porosity calculated according to the obtained water retention values – the results are presented in **Fig. 3.**

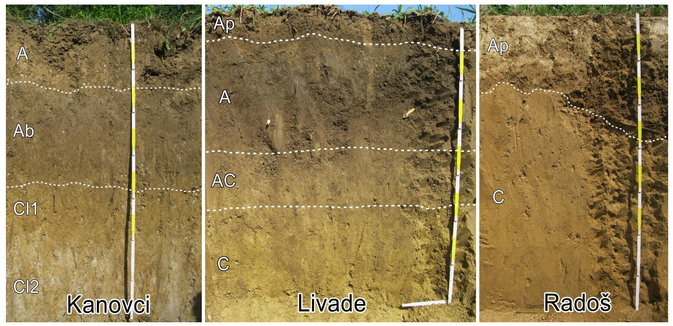

Figure 2. Soil profiles at the three studied sites: *Kanovci* - Calcic Kastanozem (Loamic, Novic, Transportic), *Livade* - Calcic Kastanozem (Loamic), *Radoš* - Hortic Anthrosol (Epiloamic, Endosiltic, Calcic)

Selected results

Based on the amounts of soil water content (SWC) retained at 0.00, 0.05, 0.33 and 15.00 bar and multiplied by the bulk densities of the corresponding soil horizons, the differential porosity was calculated, as the percentage of the bulk soil volume:

Fast-draining macropores (vol %) = SWC (0 bar) – SWC (0.05 bar)
Slow-draining macropores (vol %) = SWC (0.05 bar) – SWC (0.33 bar)
Non-draining macropores (vol %) = SWC (0.33 bar)

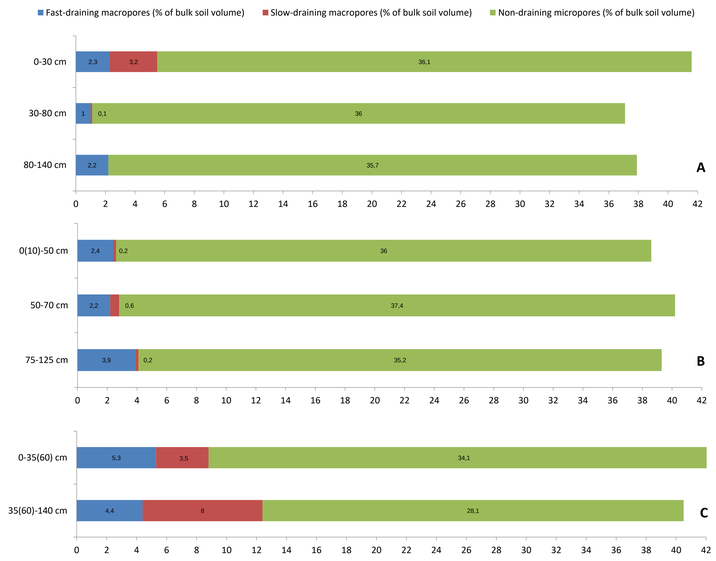

Figure 3. Differential porosity of the soil profiles at the studied sites *Kanovci*, (A) *Livade* (B), and *Radoš* (C)

Looking ahead…

The obtained results on soil water retention and differential porosity, along with those on the basic soil properties, will be complemented with the results on soil/sediment permeability for water, measured by automatic field infiltrometer and laboratory permeameter. Also, soil/sediment permeability and specific surface area will be calculated according to the geomechanical/mineralogical properties. Results of these calculations will be calibrated using test data to derive new water-flow functions specific for loess-like materials. The obtained data will be used to create the model of the water flow, both through the soils and the underlying material, using *Feflow* and *GMS* software packages.