

# SOILS FOR FUTURE UNDER GLOBAL CHALLENGES

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## PLATINUM GROUP ELEMENTS AND RARE EARTH ELEMENTS IN URBAN PARK SOILS IN NOVI SAD, SERBIA

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### Introduction

In the framework of the Italian-Serbian program of bilateral cooperation funded by the Italian Ministry of the Foreign Affairs (MAECI), a research project with the aim to investigate the heavy metals distribution in urban soils in Rome and Novi Sad has been carried out. In particular, one task of the project was to study the behaviour of “new” pollutants released from car catalytic converters in selected top and bottom soils in two urban parks in Novi Sad. In order to get better overview the results for Novi Sad are compared with the results for Rome. The study of the anthropic pollution by a geochemical multi-element approach could be a useful tool overall in urban areas characterized by a high environmental complexity. Different catalysts honeycomb display typical Platinum Group Elements (PGE) and Rare Earth Elements (REE) associations and concentration levels not common in soil and, at the end, in the “natural” environment. Characteristic fingerprint displayed by the REE permit us to reveal the presence of particles derived from car catalysts.

### Sampling and analysis

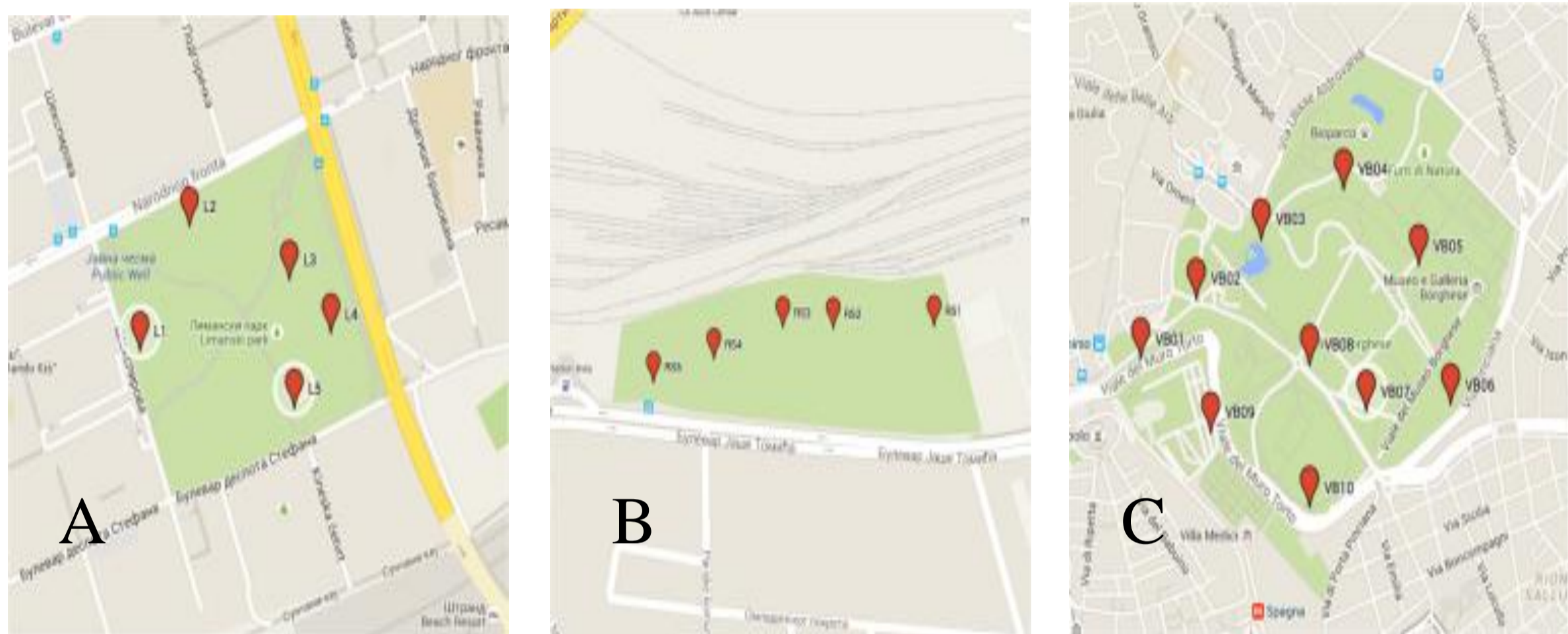


Figure 1. Sampling sites: A & B, Limanski and Zeleznicki parks, Novi Sad. C, Villa Borghese park, Rome

Sampling sites (Fig. 1. a, b, c) have been selected in the main central public parks in Rome and Novi Sad. In each city 10 top (0-5 cm) and 10 bottom (40-50 cm) soils were sampled. This work concerns only the top soil samples being the top layers more influenced by the anthropogenic activities. Samples were air dried at 40 °C and ground after being sieved to 2 mm. pH and pedological parameters have been obtained following the international procedures (Table 1).

Tab.1. Pedological data for Rome and Novi Sad Urban soils (T top soil)

Rome	pH	% Sand	% Silt	% Clay	USDA Textstural soil classification	Novi Sad	pH	% Sand	% Silt	% Clay	USDA Textstural soil classification
VB1T	7,7	50	43	7	LOAM - SANDY LOAM	NSL1T	7,9	95	3	2	LOAMY COARSE SAND
VB2T	7,9	54	49	7	SANDY LOAM	NSL2T	7,9	57	13	30	LOAM
VB3T	7,8	63	32	5	SANDY LOAM	NSL3T	7,8	59	14	26	LOAM
VB4T	7,7	32	55	13	SILT LOAM	NSL4T	8,1	96	2	2	LOAMY COARSE SAND
VB5T	8,0	41	46	13	LOAM	NSL5T	8,3	50	17	33	LOAMY CLAY
VB6T	7,7	60	36	4	SANDY LOAM	NSZ1T	7,9	96	2	2	LOAMY COARSE SAND
VB7T	7,4	32	51	17	SILT LOAM	NSZ2T	7,8	79	6	15	FINE SAND LOAM
VB8T	7,7	33	54	13	SILT LOAM	NSZ3T	7,8	87	4	9	LOAMY COARSE SAND
VB9T	7,7	50	43	7	LOAM - SANDY LOAM	NSZ4T	7,8	68	11	21	FINE SAND LOAM
VB10T	8,0	43	47	10	LOAM	NSZ5T	7,8	72	9	19	FINE SAND LOAM

Total elements determination in soils was obtained after microwave digestion with a mixture of 69% HNO<sub>3</sub>, 40% HF, 30% H<sub>2</sub>O<sub>2</sub> and 37% HCl in TFM vessels. The resulting solutions were analyzed by a Perkin-Elmer Elan 6100 ICP-MS spectrometer equipped with a cross-flow nebulizer.

### Results

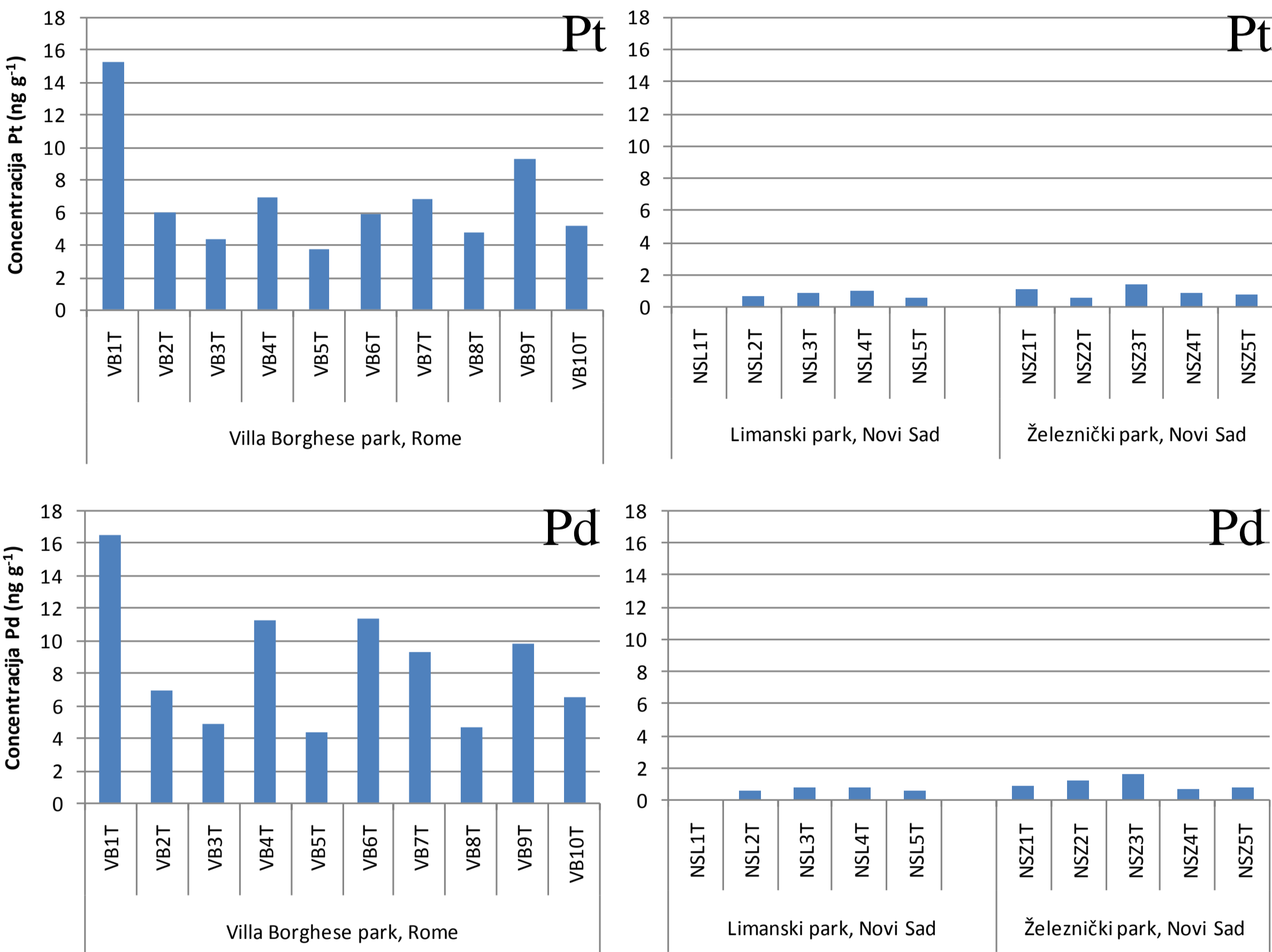
Tab. 2. Pt and Pd concentrations in top soils in Rome and Novi Sad (mean values given, concentration ranges in brackets)

	Rome	Novi Sad
	ng g <sup>-1</sup>	
Pt	6,82 (3,7-15,3)	0,89 (0,6-1,4)
Pd	8,52 (4,3-16,5)	0,85 (0,6-1,6)

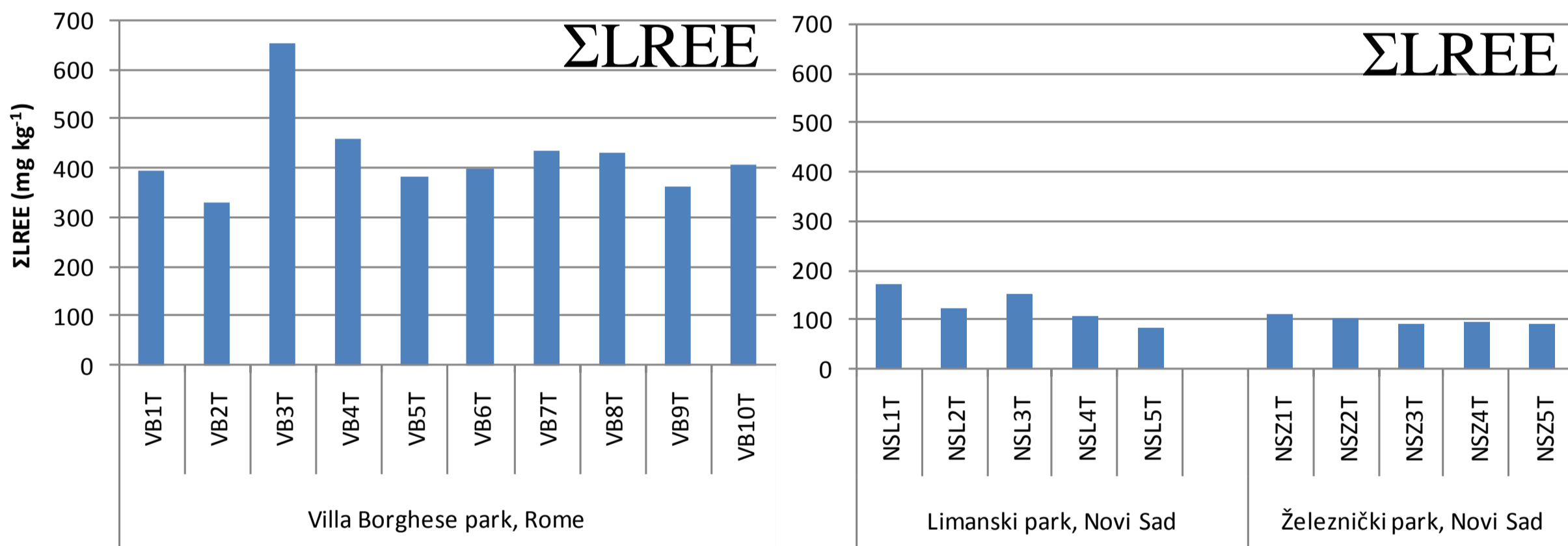


Tab. 3. REE concentrations in top soils in Rome and Novi Sad (mean values given, concentration ranges in brackets)

	Rome	Novi Sad
	ng g <sup>-1</sup>	
La	116,1 (97,9-172)	26,91 (21,2-35,8)
Ce	204,4 (162-326)	56,0 (74,0-42,0)
Nd	92,1 (62-140)	23,9 (12,0-54,0)
Sm	12,36 (9,9-18,0)	4,34 (3,3-7,5)
Eu	2,38 (1,5-3,1)	0,81 (0,5-1,2)
Σ LREE	427	112



Graf. 1. Concentrations of Pt and Pd in top soils in Rome and Novi Sad



Graf. 2. Sum of concentrations of light-group rare earth elements (ΣLREE) in top soils in Rome and Novi Sad

### Conclusion

In Serbia car catalyst introduction is relatively recent respect to other European Countries and these preliminary data show that, among PGE, Pt and Pd concentration levels are 0.89 and 0.85 ng/g respectively, resulting still lower or very close to the typical geochemical background for these elements in natural soils and rocks. Then, the presented data can be used as useful reference values to assess their accumulation trend in Serbian urban soils.

Concerning REE that are usually contained in high percentages in the catalyst honeycomb and released with PGE via car fumes, their average concentrations result lower in Novi Sad top soils (ΣLREE 112 mg/kg) than in Rome (ΣLREE 427 mg/kg), where catalysts were introduced in the early 90s and soil parent material is mainly derived from volcanic rocks. However, the REE distribution patterns result very similar in both cities as well as the HREE concentration levels.

These preliminary data show that the urban environment is continuously exposed to new pollutants in relation to changes of the *anthropic* activity. Environmental safeguard requires proper and innovative tools to check and study the fate of these potential pollutants overall in relation to potential negative effects on population.

#### ACKNOWLEDGEMENTS

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