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TECHNOGENIC SOILS IN ZIELONA GÓRA

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Zielona Góra is a medium-sized city in the Polish-German border region (Fig. 1), located on the historical military route Berlin-Wrocław. The history of Zielona Góra as an urban area began probably in the 13th century. The first information about the city foundation comes from 1222 (Schmidt 1922, 1928), but the very first Slavic settlement was probably founded even in the 10th century (Garbacz 2003). The settlement was formed on the right bank of the Złota Łącza stream, near a hill, later called the Brick Height. The first document marked as ‘territorio Grunenbergense’ dates from 1302. The city rights were probably granted in 1312 (Schmidt 1922; Ribbeck 1929). During the Middle Ages, Zielona Góra was surrounded by a wall, first a wooden palisade, followed by a stone and brick wall. It was demolished in the 18th and 19th centuries (only small fragments of the brick wall are visible today). By the end of the 18th century, it was a typical small town (8 000 inhabitants), based on agriculture and craft. Intensive industrialization processes took place in the 19th and early 20th century. The main factories in the city were connected with food processing, textiles and metal industry. At the beginning of

World War II, Zielona Góra was populated by 30 000 inhabitants, living over a relative small area. A large increase in the area and the population size has been observed since the mid-20th century, especially in the late 20th century.

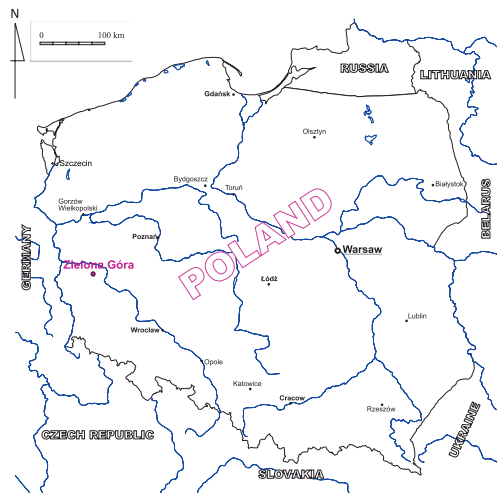


Fig. 1. Location of Zielona Góra

World War II, Zielona Góra was populated by 30 000 inhabitants, living over a relative small area. A large increase in the area and the population size has been observed since the mid-20th century, especially in the late 20th century.

In Polish, Czech and German, the city's name means a 'green mountain'. Vineyards were present in Zielona Góra almost throughout the entire history of the city – the first plantation was probably established in 1150 (Czyżniewski 2010). It is the only urban area in Poland based on the tradition of wine production. Nowadays, the city is known mostly for this tradition.

The population of the city, as of March 31st 2013, was 119 051 inhabitants. Zielona Góra covers an area of 5 864 ha. It is located on two geomorphological structures: glacier end-moraine (moraine belt) and moraine upland. The moraine belt in the southern part of the city is characterised by large differences in a relative height, exceeding 150 m (the highest point – Wilkanow Height – 221 m a.s.l.; 51°54'55.17" N 15°27'33.22" E). The northern part of the city is located within the moraine upland (70–100 m a.s.l.). The land cover in the city is not typical for modern agglomerations. A total area of 2 667 ha in Zielona Góra is covered by forests dominated by Scots pine (*Pinus sylvestris* L.). Climatic conditions are characterised by the following indices (2011): average annual air temperature 9.7°C, total annual precipitation 576 mm, average wind velocity 3.2 m·s⁻¹, insolation 1 937 h, average cloudiness in octants 4.7 (data source: Institute of Meteorology and Water Management 2012).

The origin of surface feature transformation in the area of Zielona Góra goes back to the 13th century with the highest intensity in the 19th and 20th centuries. Human activity generates huge changes in the types of area development. First of all, the vineyards and orchards have been transformed into the residential areas, first with multi-family housing, later with detached houses. The second, very important spatial factor consisted in surrounding the industrial ring (the historical one located outside the city) by the residential areas. Morphological changes in the city were caused by, among others, preparation of levelled surfaces for houses (making the 'platforms' on the moraine slopes), construction of roads, streets and channels etc. An interesting form of human activity in the city area consisted in channelling the streams into the pipes laid under the city.

The present state of urban soils is a result of different human activities: agricultural, urban and industrial. The areas covered with natural soils are still found within the city: (mainly Podzols and Brunic Arenosols, rarely Luvisols, Phaeozems, Gleysols and Histosols). Most of them are distinguished by major chemical transformations without changes in the morphology of soil Sites (Greinert 2003). Several different types of technogenic soils can be found in the city: urbisols, industrisols, garden soils, soils of parks and lawns, necrosols (relicts of several historical graveyards and cemeteries are to be found in the city centre), ekranosols and constructosols. The urban agricultural soils (mainly Phaeozems, Plaggic and Hortic Anthrosols) are used as allotment gardens. A large arable land (475 ha vs. residential area of 630 ha, industrial area of 236 ha) is a typical feature of Zielona Góra, next to a large forest area. Technosols are deeply transformed, including the enrichment with different construction and waste materials – a higher level of

enrichment in the subsoil compared to the topsoil is a typical situation (Greinert 2003; Greinert et al. 2013). Brick fragments, mortar, gravel and slag are most often found. Usually all the soil Sites are destroyed during the construction work. A low pH value of the topsoil (0–20 cm) – pH – 0.01M CaCl₂ of 3.2–4.5 – is a characteristic property of the forest soils outside the urban area. The analysis from Zielona Góra shows higher pH values in the forests – 4.3–5.3 (Greinert 2001) and significantly higher in the residential, traffic and industrial area – 6.4–8.3 (Greinert 2000, 2002, 2003). Considering the sandy texture and low content of organic carbon in the topsoil, the expected effect is a low content of elements in the soil, except for calcium (Greinert 2000, 2002, 2003; Greinert et al. 2013), and low EC values (0.1–0.3 mS·cm⁻¹) even on the roadsides (Greinert 2003, 2005; Greinert et al. 2013). A high concentration of Cu in several types of soil in the city is an interesting phenomenon connected with the presence of a vineyard in the past (the use of Bordeaux Mixture and slaked lime as a fungicide since 1882).

Site 1 – Horticultural Anthrosol



Location:

'Brick Height' Vineyard Park,
Zielona Góra,
western Poland

Coordinates:

51°56'15" N 15°30'43" E

Altitude: 142.5 m a.s.l.



Climate:

Average annual temperature: 9.2°C

Average annual precipitation: 591 mm

Land-use: vineyard-park (recreational)

Relief and lithology:

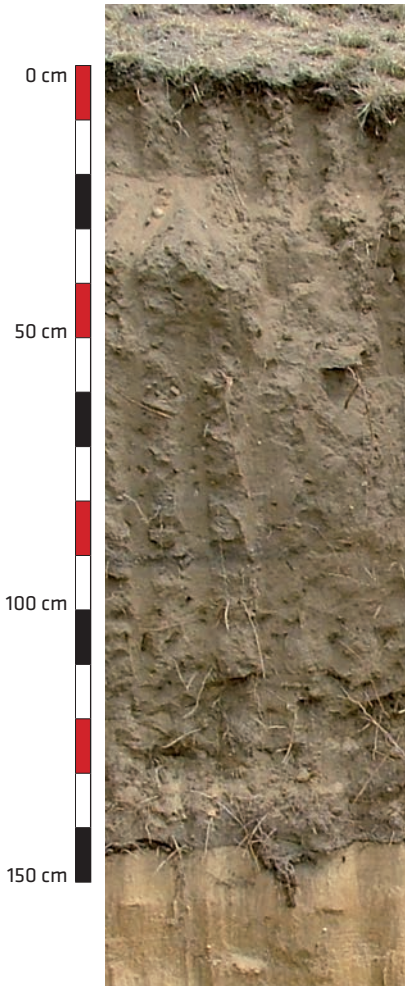
Major landform: height's slope

Slope position: the lower part of the slope,
elevation SW

Lithology: late Pleistocene (Vistulian,
Würm, Wisconsin) fluvio-glacial sands

Vegetation: vineyard, grass as the intercrop

Site 1 – Hortic Anthrosol



Morphology:

A1 – 0–5 cm: sand, very dark greyish brown, granular structure, slightly moist, clear boundary, very few artefacts (plastics, municipal wastes, glass; < 1%);

A2 – 5–145 cm: sand, dark olive grey, granular structure, slightly moist, sharp boundary, few artefacts (stones; < 1%).

C – below 145 cm: sand, light yellow, loose, dry/slightly moist.

Comments:

Site 1 was located about 500 m from the Old Square, on the slope of the 'Brick Height' (part of the glacier end moraine), today developed as the Vineyard Park. It's a place probably close to the initial location of the town. From the 14th century till the end of the World War II productive vineyard.

Site 1 – Hortic Anthrosol

Selected soil properties

HORIZON	A1	A2	C	
DEPTH [cm]	0–5	5–145	> 145	
PARTICLE SIZE DISTRIBUTION				
ϕ [mm]		[%]		
>2	4.72	0.00	0.00	
2.0–1.0	18	21	35	
1.0–0.5	30	30	31	
0.5–0.25	27	27	17	
0.25–0.1	13	12	5	
0.1–0.05	7	3	7	
0.05–0.02	2	5	4	
0.02–0.002	3	2	1	
<0.002	0	0	0	
TEXTURE CLASS (USDA)	sand	sand	sand	
SOIL MATRIX	dry	5Y 4/1	5Y 5/1	2.5Y 8/3
COLOUR	wet	5Y 2.5/1	5Y 3/1	2.5Y 6/3
BULK DENSITY [g·cm⁻³]	1.42	1.51	1.62	
OC [%]	5.3	3.3	0.0	
N_t [%]	0.38	0.21	–	
C:N	14	16	–	
P_t [mg·kg⁻¹]	3 200	2 600	600	
pH	H ₂ O	6.5	6.8	6.8
	1M KCl	6.0	6.3	6.5
CaCO₃ [%]	0.5	0.3	0.0	
EC_{1:2} [mS·cm⁻¹]	0.28	0.24	0.06	
CEC [cmol·kg⁻¹]	22.8	20.6	2.0	
K_t [mg·kg⁻¹]	10 600	8 550	4 300	
Ca_t [mg·kg⁻¹]	26 000	22 000	2 800	

Site 1 – Hortic Anthrosol

Selected soil properties cont.

HORIZON	A1	A2	C
DEPTH [cm]	0-5	5-145	> 145
HEAVY METALS SOLUBLE IN AQUA REGIA			
Fe	9 430	8 400	5 760
Mn	341	290	187
Zn	143	123	46.4
Pb	57.0	43.0	17.5
Cd	0.52	0.30	0.20
Cu	192	138	29.4
Ni	10.0	8.7	6.4
Co	3.4	3.4	2.8
HEAVY METALS SOLUBLE IN 0.1M HCl			
Fe	219	617	878
Mn	237	232	166
Zn	53.6	50.1	12.9
Pb	23.2	21.5	15.8
Cd	0.32	0.18	0.09
Cu	94.4	80.2	19.5
Ni	3.0	2.6	1.7

Site 2 –Urbic Ekranic Technosol



Location:
Old Square,
Zielona Góra,
western Poland

Coordinates:
51°56'19" N 15°30'19" E

Altitude: 139.5 m a.s.l.

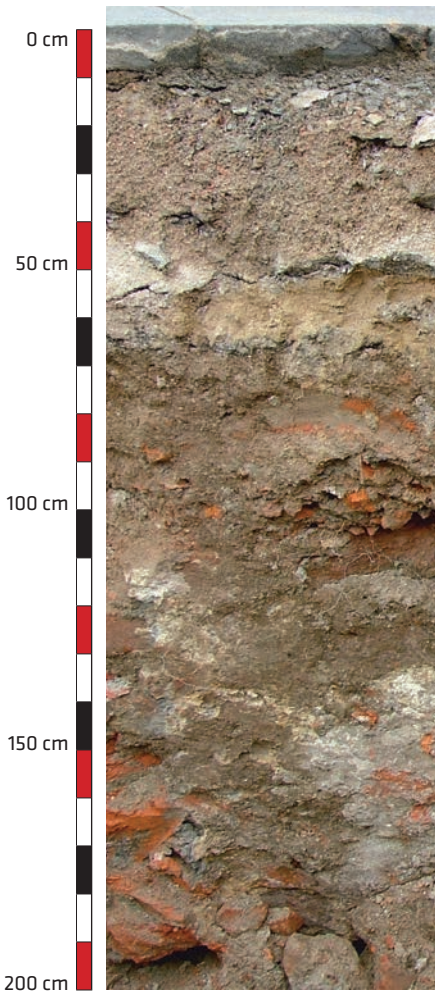


Climate:
Average annual temperature: 9.2°C
Average annual precipitation: 591 mm

Land-use: old town (commercial)

Relief and lithology:
Major landform: plain
Lithology: late Pleistocene (Vistulian,
Würm, Wisconsin) fluvio-glacial sands
Vegetation: few *Acer saccharinum* L. trees
in isolated places

Site 2 – Urbic Ekranic Technosol



Morphology:

0–12 cm: *technic hard rock* – concrete slabs, grey, links filled with cement mortar.

C –12–50 cm: sand, light yellowish brown, loose, slightly moist, clear boundary.

IIC – 50–80 cm: sand, pale yellow, slightly moist, clear boundary.

IIIC – 80–120 cm: loamy sand, dark olive brown, slightly moist, gradual boundary, few artefacts (pieces of bricks; 30%).

IVC – 120–195 cm: sandy loam, dark brown, slightly moist, gradual boundary, artefacts (mortar, brick fragments; 30%).

VC – below 195 cm: brick construction dated back to the late Middle Ages, loam.

Comments:

Site 2 was located on area of the Old Square, a few meters from the town hall's wall. Soil site with residues of medieval times about 150–200 cm below the present surface (i.a. the foundations of ancient buildings and the furnace bread were found). Until the end of the seventies of 20th century vehicular traffic permitted.

Site 2 – Urbic Ekranic Technosol

Selected soil properties

HORIZON	C	IIC	IIIC	IVC	VC	
DEPTH [cm]	12-50	50-80	80-120	120-195	> 195	
PARTICLE SIZE DISTRIBUTION						
ϕ [mm]	[%]					
>2	3	1	8	15	87	
2.0-1.0	12	15	12	7	6	
1.0-0.5	24	28	24	25	16	
0.5-0.25	34	32	25	24	16	
0.25-0.1	21	19	11	12	11	
0.1-0.05	5	4	4	5	6	
0.05-0.02	3	2	8	6	16	
0.02-0.002	1	1	12	11	16	
<0.002	0	0	4	10	13	
TEXTURE CLASS (USDA)	sand	sand	loamy sand	sandy loam	loam	
SOIL MATRIX COLOUR	dry	2.5Y 6/3	2.5Y 7/3 2.5Y 8/1	5YR 5/2	7.5YR 5/2	7.5YR 5/1
	wet	2.5 4/3	2.5 5/4	5YR 4/1	7.5YR 3.5/2	7.5YR 4/1
BULK DENSITY [g·cm⁻³]	1.42	1.53	1.66	1.72	–	
OC [%]	0.1	0.0	0.3	0.1	0.0	
P_t [mg·kg⁻¹]	600	200	1100	1500	900	
pH	H ₂ O	7.5	7.1	7.2	7.1	6.9
	1M KCl	7.1	6.8	6.9	6.8	6.7
CaCO₃ [%]	2.1	0.6	1.3	4.2	0.9	
EC_{1:2} [mS·cm⁻¹]	0.25	0.25	0.24	0.21	0.24	
CEC [cmol·kg⁻¹]	5.7	2.6	12.4	15.4	18.1	
K_t [mg·kg⁻¹]	2 460	2 650	3 780	4 200	4 290	
Ca_t [mg·kg⁻¹]	32 000	5 800	17 100	42 000	8 900	

Site 2 – Urbic Ekranic Technosol

Selected soil properties cont.

HORIZON	C	IIC	IIIC	IVC	VC
DEPTH [cm]	12–50	50–80	80–120	120–195	> 195
HEAVY METALS SOLUBLE IN AQUA REGIA					
Fe	10 970	11 720	10 570	8 870	12 670
Mn	164	445	459	309	81
Zn	293	181	135	53.8	49.8
Pb	85.2	127	75.4	13.6	10.2
Cd	0.58	0.58	0.52	0.32	0.28
Cu	33.0	61.7	63.4	40.6	20.1
Ni	9.7	14.1	11.1	10.1	21.0
Co	2.9	4.9	4.9	3.8	4.5
HEAVY METALS SOLUBLE IN 0.1M HCl					
Fe	1 410	1 390	1 330	736	1 410
Mn	112	386	403	292	44
Zn	61.9	57.1	51.6	15.5	6.3
Pb	17.9	51.3	45.0	11.3	5.7
Cd	0.39	0.36	0.21	0.09	0.08
Cu	7.3	30.5	37.7	31.9	6.9
Ni	2.1	3.7	3.6	3.4	3.0

Site 3 – Ekranic Episkeletic Technosol (Arenic)



Location:
Konstytucji 3 Maja Lane,
Zielona Góra,
western Poland

Coordinates:
51°56'12" N 15°30'33" E

Altitude:
118.0 m a.s.l.

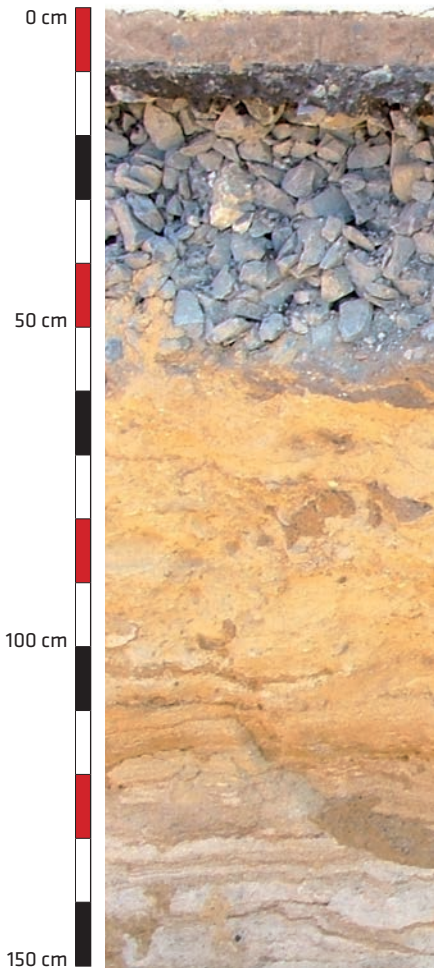


Climate:
Average annual temperature: 9.2°C
Average annual precipitation: 591 mm

Land-use: main city roadway

Relief and lithology:
Major landform: plain
Lithology: late Pleistocene (Vistulian,
Würm, Wisconsin) fluvio-glacial sands
Vegetation: lawn on median strip, single
trees about 50 m from the soil pit

Site 3 – Ekranic Technosol (Episkeletic, Arenic)



Morphology:

0–8 cm: *technic hard rock* – concrete slab s, grey, links filled with asphalt.

8–13 cm: *technic hard rock* – asphalt.

HTM1 – 13–38(55) cm: *technic hard rock* – road-material (breakstone); cement and silt admixtures (3%); greenish grey.

HTM2 – 38(55)–55(60) cm: human-transported material – sand with cement and silt (30%), greenish grey, gradual boundary..

C1 – 55(60)–120 cm: sand, yellow, loose, slightly moist, gradual boundary.

C2 – 120–150 cm: sand, white/pale yellow, loose, slightly moist.

Comments:

Site 3 was located within sidewalk along one of the most important roads of Zielona Góra (ro ute from Wrocław). The road borders from the south historical center of Zielona Góra.

Site 3 – Ekranic Technosol (Episkeletic, Arenic)

Selected soil properties

HORIZON		HTM1	HTM2	C1	C2
DEPTH [cm]		13–38(55)	38(55)–55(60)	55(60)–120	120–150
PARTICLE SIZE DISTRIBUTION					
ϕ [mm]		[%]			
>2		96	73	< 1	< 1
2.0–1.0		47	39	13	15
1.0–0.5		35	38	24	28
0.5–0.25		11	16	34	32
0.25–0.1		7	7	21	19
0.1–0.05		6	6	5	4
0.05–0.02		1	2	3	1
0.02–0.002		2	1	0	1
<0.002		0	0	0	0
TEXTURE CLASS (USDA)		sand	sand	sand	sand
SOIL MATRIX COLOUR	dry	5G 6/1	5G 6/1	5Y 8/6	2.5Y 8/1 2.5Y 7/3
	wet	5G 4/1	5G 3/1	2.5Y 5/6	2.5Y 7/2 2.5Y 4/3
BULK DENSITY [g·cm ⁻³]		–	–	1.55	1.59
OC [%]		0.04	0.03	–	–
P _t [mg·kg ⁻¹]		800	800	300	200
pH	H ₂ O	7.8	7.6	7.3	7.3
	1M KCl	7.3	7.1	6.9	6.9
CaCO ₃ [%]		2.1	1.6	0.5	0.0
EC _{1:2} [mS·cm ⁻¹]		0.20	0.10	0.07	0.07
CEC [cmol·kg ⁻¹]		11.7	11.7	8.9	3.9
K _t [mg·kg ⁻¹]		0.68	0.63	0.55	0.37
Ca _t [mg·kg ⁻¹]		1.90	1.52	0.48	0.16

Site 3 – Ekranic Technosol (Episkeletic, Arenic)

Selected soil properties cont.

HORIZON	HTM1	HTM2	C1	C2
DEPTH [cm]	13–38(55)	38(55)–55(60)	55(60)–120	120–150
HEAVY METALS SOLUBLE IN AQUA REGIA				
Fe	4 480	2 870	1 030	1 790
Mn	165	123	152	132
Zn	85.0	16.4	11.6	7.0
Pb	35.8	7.2	1.9	1.0
Cd	0.4	0.2	0.1	0.2
Cu	15.4	8.1	23.1	15.1
Ni	4.8	3.2	10.2	2.4
Co	2.2	2.6	1.4	1.1
HEAVY METALS SOLUBLE IN 0.1M HCl				
Fe	1 580	1 050	571	510
Mn	129	70	77	78
Zn	6.9	7.0	3.2	2.5
Pb	11.3	1.6	0.7	0.7
Cd	0.1	0.1	n.d.	n.d.
Cu	4.4	4.4	10.9	2.8
Ni	2.2	2.2	1.8	1.1

Site 4 – Ekranic Technosol (Humic, Arenic)



Location:

Dąbrowskiego St.,
Zielona Góra,
western Poland

Coordinates:

51°56'53" N 15°29'35" E

Altitude:

118.0 m a.s.l.



Climate:

Average annual temperature: 9.2°C
Average annual precipitation: 591 mm

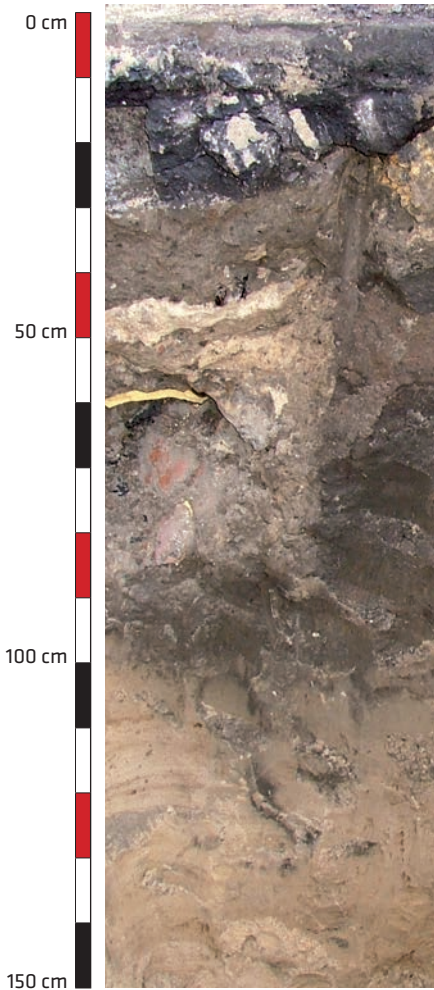
Land-use: local city roadway

Relief and lithology:

Major land form: plain
Lithology: late Pleistocene (Vistulian,
Würm, Wisconsin) fluvio-glacial sands

Vegetation: none

Site 4 – Ekranic Technosol (Humic, Arenic)



Morphology:

0-10 cm: *technic hard rock* – asphalt surface.

10-20(28) cm: *technic hard rock* – uneven layer made of asphalt and different construction wastes, clear boundary.

AuBu - 20(28)-55(85) cm: sand with different technogenic admixtures uneven filled (5-50%), greyish brown, slightly moist, unclear boundary.

Bu - 55(85)-100 cm: loamy sand, dark greyish brown, without technogenic admixtures, slightly moist, gradual boundary.

C - 100-150 cm: sand, light greenish grey, loose, moist.

Comments:

Site 4 was located under the sidewalk along the local roadway connecting city center with north-western city quarters. Primary road construction was made in early fifties of the 20th century; surface of the road was few times rebuild.

Site 4 – Ekranic Technosol (Humic, Arenic)

Selected soil properties

HORIZON	AuBu	Bu	C	
DEPTH [cm]	20(28)–55(85)	55(85)–100	100–150	
PARTICLE SIZE DISTRIBUTION				
ϕ [mm]	[%]			
>2	19	–	–	
2.0–1.0	34	19	17	
1.0–0.5	29	30	30	
0.5–0.25	17	28	32	
0.25–0.1	9	12	15	
0.1–0.05	8	9	5	
0.05–0.02	2	1	1	
0.02–0.002	1	1	0	
<0.002	0	0	0	
TEXTURE CLASS (USDA)	sand	sand	sand	
SOIL MATRIX	dry	2.5Y 5/2	2.5Y 4/2	5GY 8/1
COLOUR	wet	2.5Y 4/2	2.5Y 3/3	5Y 7/4
BULK DENSITY [g·cm⁻³]	1.48	1.59	1.63	
OC [%]	1.6	2.0	0.6	
N_t [%]	0.44	0.35	0.06	
C:N	27	17	10	
P_t [mg·kg⁻¹]	5 100	2 500	600	
pH	H ₂ O	8.6	7.6	7.4
	1M KCl	8.3	7.2	7.1
CaCO₃ [%]	2.5	1.4	0.4	
EC_{1:2} [mS·cm⁻¹]	0.45	0.17	0.20	
CEC [cmol·kg⁻¹]	12.6	15.8	5.5	
K_t [mg·kg⁻¹]	0.67	0.85	0.50	
Ca_t [mg·kg⁻¹]	3.0	1.8	0.3	

Site 4 – Ekranic Technosol (Humic, Arenic)

Selected soil properties cont.

HORIZON	AuBu	Bu	C
DEPTH [cm]	20(28)–55(85)	55(85)–100	100–150
HEAVY METALS SOLUBLE IN AQUA REGIA			
Fe	3 090	6 300	2 970
Mn	100	110	107
Zn	68	64	28
Pb	16	14	7
Cd	0.4	0.4	0.6
Cu	15.3	51.9	8.9
Ni	4.1	15.9	10.7
Co	1.7	2.9	0.9
HEAVY METALS SOLUBLE IN 0.1M HCl			
Fe	780	3940	815
Mn	11	89	14
Zn	31	28	12
Pb	1	2	5
Cd	0.1	0.1	0.1
Cu	9.8	32.3	4.8
Ni	4.1/	4.5	1.7

Site 5 – Technic Gleyic Podzol (Novic)



Location:

Pod Topolami st.,
Zielona Góra,
western Poland

Coordinates:

51°56'29" N 15°30'25" E

Altitude:

135.5 m a.s.l.



Climate:

Average annual temperature: 9.2°C
Average annual precipitation: 591 mm

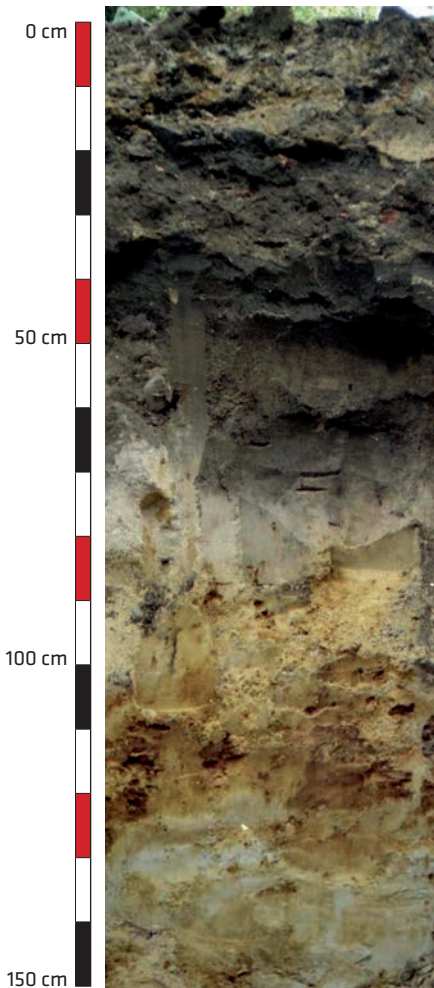
Land-use: wasteland in the city center

Relief and lithology:

Major landform: plain
Lithology: late Pleistocene (Vistulian,
Würm, Wisconsin) fluvio-glacial sands

Vegetation: herbaceous vegetation typical
for urban wasteland

Site 5 – Technic Gleyic Podzol (Novic)



Morphology:

Auh1 – 0–15 cm: humus and sand mixed with municipal wastes (40%), reddish brown, slightly moist, clear boundary.

Auh2 – 15–32 cm: dark brown, slightly moist, artefacts (mortar, stones, concrete elements, plastics, glass; 10%), clear boundary.

Auh3 – 32–48 cm: very dark brown, slightly moist, clear boundary.

Au – 48–68 cm: sand, few artefacts (stones, brick elements, < 1%), slightly moist, gradual boundary.

Es – 68–84 cm: sand, white, loose, slightly moist, gradual boundary.

Bs – 84–125 cm: sand, yellow, humic and ferrous deposits, slightly moist, gradual boundary.

CG – 125–150 cm: sand, pale yellow/light greenish grey, loose, moist.

Comments:

Site 5 was located on the area, situated just outside the medieval city walls, opened for development in 16th or 17th centuries. Until the end of 20th century waterlogged empty area (on the maps from the 30's of the 20th century signed as meadow). Build-up at the beginning of 21st century.

Site 5 – Technic Gleyic Podzol (Novic)

Selected soil properties

HORIZON	Auh1	Auh2	Auh3	Au	Es	Bs	CG	
DEPTH [cm]	0-15	15-32	32-48	48-68	68-84	84-125	125-150	
PARTICLE SIZE DISTRIBUTION								
ϕ [mm]				[%]				
>2	43	9	< 1	< 1	–	–	–	
2.0-1.0	26	19	17	33	34	34	34	
1.0-0.5	24	25	24	26	26	29	31	
0.5-0.25	16	25	25	16	17	18	22	
0.25-0.1	9	11	13	11	9	9	7	
0.1-0.05	7	10	10	11	9	7	3	
0.05-0.02	6	7	5	3	3	2	0	
0.02-0.002	9	3	6	0	2	1	1	
<0.002	3	0	0	0	0	0	2	
TEXTURE CLASS (USDA)	loamy sand	loamy sand	loamy sand	sand	sand	sand	sand	
SOIL MATRIX COLOUR	dry	2.5YR 4/4	10YR 3/3	10YR 2/2	7.5YR 4/3	2.5Y 8/1	5Y 7/6	5Y 7/4 5G 8/1
	wet	2.5YR 3/3	10YR 2/2	10YR 2/1	7.5YR 3/1	2.5Y 7/2	5Y 5/4	5Y 6/6 5G 7/1
BULK DENSITY [g·cm⁻³]	1.20	1.36	1.40	1.60	1.62	1.67	1.70	
OC [%]	5.79	4.21	3.91	0.89	0.10	0.16	–	
N_t [%]	0.56	0.41	0.39	0.05	0.01	0.01	–	
C:N	10	10	10	18	10	16	–	
P_t [mg·kg⁻¹]	4 800	3 300	3 100	800	n.d.	n.d.	n.d.	
pH	H ₂ O	7.7	7.7	6.8	6.2	6.3	6.4	6.1
	1M KCl	7.4	7.4	6.5	5.9	6.0	6.0	6.0
CaCO₃ [%]	1.5	1.1	0.4	0.2	–	–	–	
EC_{1:2} [mS·cm⁻¹]	0.32	0.28	0.26	0.20	0.17	0.18	0.29	
CEC [cmol·kg⁻¹]	24.7	24.5	12.5	5.8	2.5	1.8	5.6	
K_t [mg·kg⁻¹]	1.08	0.99	0.73	0.48	0.40	0.40	1.71	
Ca_t [mg·kg⁻¹]	7.77	7.40	2.00	0.37	0.19	0.19	0.11	

Site 5 – Technic Gleyic Podzol (Novic)

Selected soil properties cont.

HORIZON	Auh1	Auh2	Auh3	Au	Es	Bs	CG
DEPTH [cm]	0–15	15–32	32–48	48–68	68–84	84–125	125–150
HEAVY METALS SOLUBLE IN AQUA REGIA							
Fe	9 440	10 950	7 830	3 820	1 350	5 390	4 970
Mn	165	225	593	131	22	100	17
Zn	184	186	97	35	22	14	30
Pb	73	90	43	12	4	4	8
Cd	0.5	0.6	0.5	0.4	0.2	0.2	0.4
Cu	52	61	25	11	7	6	11
Ni	14	14	9	6	2	4	14
Co	n.d.	1.1	2.1	0.2	1.2	1.3	4.8
HEAVY METALS SOLUBLE IN 0.1M HCl							
Fe	1 300	1 200	875	753	356	751	1 020
Mn	109	138	558	118	12	88	14
Zn	14	51	26	7	3	3	5
Pb	4	4	27	10	1.8	0.6	5
Cd	0.1	0.2	n.d.	n.d.	n.d.	n.d.	n.d.
Cu	0.8	1.5	9	5	2	1.2	4
Ni	n.d.	1.7	2.4	0.8	0.6	1.4	2.8

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