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Roman CHLEBOWSKI[1]*, Dariusz CISZEK*[2]*, Zdzisław JARY*[2]*, Janusz KIDA*[2]

ORIGIN OF LOESS FROM KSIĘGINICE MAŁE (ŚLĘŻA MASSIF) BASED ON HEAVY MINERALS ANALYSIS

Abstract: The sedimentology of upper younger loesses and older members took place uninterrupted due to the accumulation of material from the same source areas. These included local rock massifs of the Western Sudetes and their foreland, i.e. the region of Ślęża and Sobótka massifs, the weathered deposits of which were rich in amphiboles, garnets and epidotes.

Keywords: loess, heavy minerals, Sudetes

INTRODUCTION

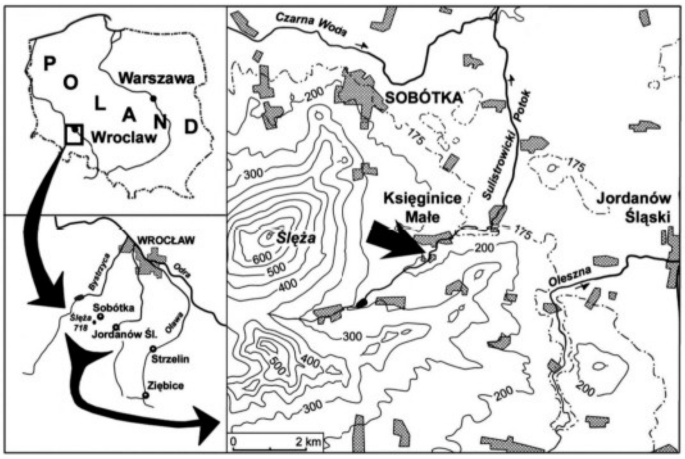

Fig. 1.
Location map of the loess section in Ksieginice Male.

The exposure of loesses in Księginice Małe is located in the southern part of the village, ca. 197 m above sea level (Fig. 1).

The loess section reaches almost 10 m and is the thickest loess section in the Ślęża Massif area. The loesses represent the Vistulian stage of loess cover formation in the Lower Silesia (Krajewska 1994, Jary 1999, Jary et al. 2001).

[1] *Institute of Geochemistry, Mineralogy and Petrology, Department of Geology, University of Warsaw, Al. Żwirki i Wigury 93, 02-089 Warszawa, Poland.*
[2] *Institute of Geography, University of Wrocław, Pl. Uniwersytecki 1, 50-137 Wrocław, Poland*

At the base, the loess section is developed as a complex of gley and marsh tundra palaeosols – bed “a” – samples KM-8 – 10 (Fig. 2), which in their top part bear strong cryoturbations/solifluction deformations (bed “b” – sample KM-7).

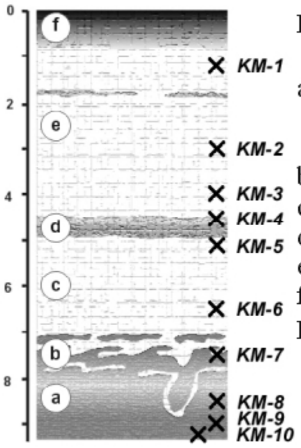

Fig.2. Lithological column of the loess exposure in Ksieginice Male:
a - set of tundra-gley soils of the middle pleniglacial age developed on lower and middle younger loesses (LMd + LMs)
b - cryoturbations/solifluction layer
c - upper younger loesses (LMg) - lower horizon
d - weak developed brown arctic soil
e - upper younger loesses (LMg) - upper horizon
f - recent soil
KM-1 - KM-10 - samples collected for mineralogical analyses.

Both horizons “a” and “b” belong to the *middle younger loesses* according to Maruszczak (1976). Above lies a ca. 2-m thick loess horizon (bed “c” – samples KM-5 and KM-6), with arctic brown soil (bed “d”) in their top part, covered by a 4-m thick loess complex (bed “e” – samples KM1-4), representing the *upper younger loesses* (Maruszczak 1976), with a recent soil on top (bed “f”).

MINERALOGIC ANALYSES

The assemblage of transparent heavy minerals was sub-divided into 5 mineral groups (Table 1 and Fig. 3), according to criteria presented earlier (Chlebowski et al. 2002).

Group I includes minerals with the highest resistance to weathering factors: anatase, andalusite, kyanite, monazite, rutile, sphene, staurolite, topaz, tourmaline and zircon.

Group II comprises apatite, epidote, garnets and sillimanite, which are also resistant to weathering factors, but to a lesser degree than group I minerals.

Minerals from group III are characterised by easy disintegration into small fragments due to perfect cleavage; this group includes amphiboles and pyroxenes.

Group IV comprises glauconite, which similarly to group III is a good indicator of short transport, and additionally characterises particular sedimentation environments.

Group V includes minerals with a platy habit, such as muscovite, biotite and chlorite, susceptible to aeolian transport.

Table 1. Content of groups transparent heavy minerals (%) in loesses from Księginice Małe

Mineral Groups	Samples									
	KM-1	KM-2	KM-3	KM-4	KM-5	KM-6	KM-7	KM-8	KM-9	KM-10
I	27.7	20.4	19.1	10.2	17.3	9.2	6.6	6.7	8.8	6.0
II	37.7	28.7	42.7	24.7	28.9	26.1	42.0	33.9	31.2	12.1
III	21.8	23.8	27.4	47.0	24.1	49.7	39.8	48.8	51.1	69.7
IV	0.5	0.4	0.5	1.0	0.5	1.2	0.8	0.5	0.2	0.0
V	11.8	26.3	9.8	16.1	28.5	13.3	9.8	9.6	8.2	12.0

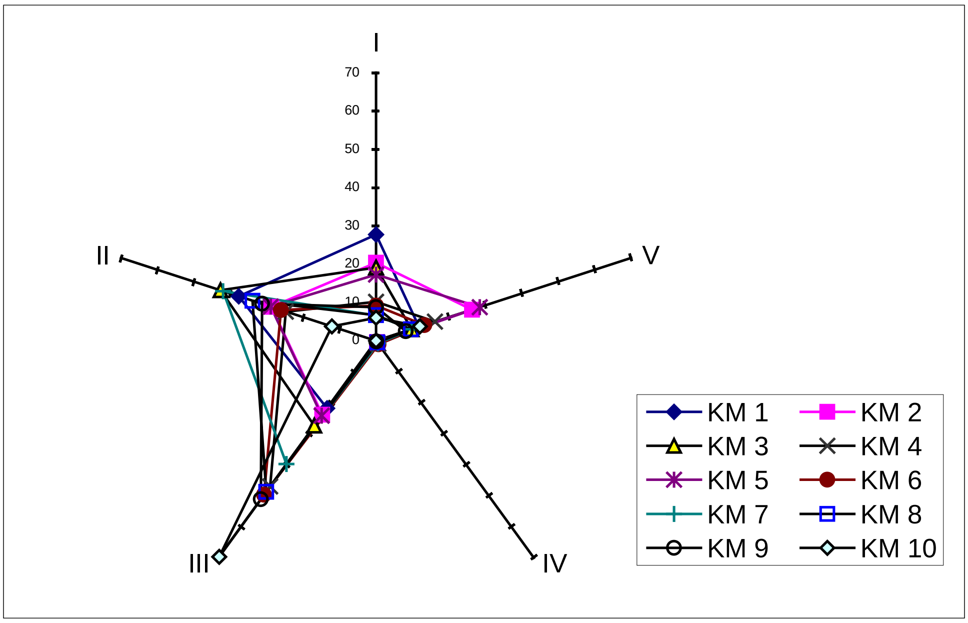

Fig. 3. Chart showing the contents of transparent heavy mineral groups (I-V)(see Table 1) in loess from Księginice Małe (samples KM-1 - KM-10)

CONCLUSIONS

The presented results and their interpretation point to the following conclusions:

1. In relation to the mineralogical composition the section is bi-partite: the lower part (beds “a-b”) comprising the gley-palaeosol complex and the upper part (beds “c-e”) comprising loesses. The lower part, particularly sample KM-10 from the lowermost part of bed “a” is distinctly depleted in group II minerals, particularly garnets. The upper parts of the loess section are generally characterised by the domination of two mineral groups: II (mainly garnets) and III (mainly amphiboles).
2. The large content of amphiboles (group III) as well as garnets and epidotes (group II) in loesses from Księginice Małe points to short transport of the loess-forming material, which most probably came from the debris of local basement rocks building the Western Sudetes and their foreland, i.e. the nearby Ślęża and Sobótka massifs.

3. Along with amphiboles, the close vicinity of the alimentation areas for the loess-forming material is testified by the presence of derived microfossils (foraminifers) (Paruch-Kulczycka et al. 2003) and glauconite. All these components are characteristic of the so-called “local material vector” (Chlebowski et al. 2002), determining the influence of local material on the origin of loesses.
4. The spatial distribution of the analysed loesses in relation to the Ślęża and Sobótka rock massifs rich in amphiboles, garnets and platy minerals, may indicate western winds blowing in the lower parts of the atmosphere, and transporting local loess-material.
5. The lower content of garnets in the gley-palaeosol horizons may indicate disintegration of these minerals caused by organic matter, taking place after deposition of the loess-forming material.
6. The constant composition of the main mineral components in the analysed section indicates that the sedimentation of the upper younger loesses and older members (middle younger loesses) took place uninterrupted due to supply of the loess-forming material from the same alimentary areas.

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