*Hans G. Richter**

Halle

MAIN LINES OF THE REGIONAL STRUCTURE OF PERIGLACIAL FACIES ON THE TERRITORY OF THE G.D.R.

Abstract

During Vistula time the whole territory of the GDR was covered by periglacial sediments, including the northern parts, which were occupied at times by the Scandinavian ice-sheet. Spatially important are the periglacial facies of the sand cover series, the loess series, the coarse cover series and the periglacial fluvial sediments. Using the stratigraphy of the loess series, the Vistula time may be divided into: the Lower, the Middle and the Upper Vistula. Correlations to the stratigraphy of the sand and the coarse cover series are possible.

The territory of the German Democratic Republic is only a small section of this part of the Middle Latitudes, which was influenced by periglacial regime during Vistula time. Nevertheless it gives excellent possibilites for studying the phenomena of periglacial facies, which are spread over the whole territory. Only on the valley bottoms, in the areas of peats and dunes, periglacial facies are covered by sediments originated during the Holocene.

The term *periglacial facies* is used in two meanings. Contrary to the current meaning of the well known term *glacial facies*, we extend it over several types of facies, which were built up by various processes, but all under conditions of periglacial climate. Secondly we use this term in the common sense for petrographic and dynamic differences. Some of these facies, such as lacustrine, fluvial, eolian or rainwash sediments, did not develop under typical periglacial conditions only. All other facies like those which were due to solifluction or cryoturbation, originated only under special periglacial conditions. All these different facies are influenced by more or less strong frost weathering. On the other hand, they are differentiated due to the rate of transportation. Only fluvial, eolian and lacustrine deposits have been transported over a wider range. During the transport, material from various places has become mixed and thus more homogeneous. Most of the other facies are restricted to slope surfaces. These sediments completely depend upon the special conditions of the slope, its rocks, its degree and exposure. Typical periglacial sediments

* Geographical Section, Martin-Luther-Universität, Halle, G.D.R.

were mostly influenced by several processes. Therefore it is difficult to reconstruct their complete genesis. Very often a vertical sequence of periglacial sediments originally accumulated regularly, but was later destroyed or reworked. For instance, older sediments of periglacial origin have been affected by cryoturbation, frost weathering or infiltration. Such sediments are not typical strata, because they are not built up with new material, but only by modification of the older ones.

The stratigraphy of periglacial facies of Vistula time is mostly similar. We are using two forms, which are well connected with the common geological stratigraphy of Middle and Eastern Europe (Mojski, Richter and Velichko, 1965; Woldstedt, 1967; Maruszczak, 1968; Čepek, 1968).

Table I

Main stratigraphy of Vistula time

<table>
<tr><td rowspan="2">Upper
Vistula</td><td>Vistula
Late Glacial</td></tr>
<tr><td>Vistula
High Glacial</td></tr>
<tr><td colspan="2">Paudorf-Interstadial</td></tr>
<tr><td>Middle
Vistula</td><td rowspan="2">Vistula
Early
Glacial</td></tr>
<tr><td>Lower
Vistula</td></tr>
</table>

The Paudorf interstadial is the most important interruption phase within the Vistula time. Probably the authors, who described sediments or soils of Paudorf age, did not in fact observe the same period (Čepek, 1965; Haase, Lieberoth, a.o. 1965; Steinmüller, 1967; Mania and Stechemesser, 1970). Radiocarbon datings of sediments of this interstadial are scattered over a wide range. Moreover we believe, that the whole Vistula time includes numerous interstadials and smaller fluctuations of climate, which cannot be observed in each section. Mania (1967) reported a highly interesting section, where periglacial sediments of different origin were accumulated at the bottom of a lake, which developed on top of a leaching salt dome. Under these special conditions 11 phases of warmer climate like interstadials or shorter interruptions are represented in Vistula time only. A comparison between such a strongly divided section and sections of other periglacial facies, shows that most of the periglacial facies reacted very feably. They were mostly inapt to record all the actual climatic fluctuations.

In spite of the abundance of periglacial facies their regional structure within the territory in question is very distinct. Especially two reasons seems remarkable:

– The distinctness of the regional structure depends on the special paleogeographic conditions of the country.

– Only a few of the great number of periglacial facies are important for the regional structure.

The surface of the territory (Fig. 1) gradually rises from the shore of the Baltic Sea. To the south, the lowland situated between sea level and 150 m changes into a hilly country and then into a mountainous region, which is a part of the Middle European Mountains. The crests of these mountains in the southern and southwestern part range 600 to 1000 m, their tops rising up to 1200 m above sea level.

In the eastern part of the territory, the surface ascends nearly continuously. In the west, a big spur from the mountainous region disturbs the gradual rising. Therefore the climatological regionalisation of the country is stronger than might be expected. East of these mountains the hilly-and lowland has nearly 25% less precipitation than the areas outside their influence. This effect is very remarkable for the regional structure of the periglacial facies.

Also the rocks influence the conditions of periglacial facies. Only in the mountain region and in small parts of the hilly country, there are cristalline rocks and bedded limestones and sandstones. But otherwise the greater part of the country is covered by more or less thick layers of glacial materials, boulder clay and fluvioglacial sands. These materials were spread over the territory far southwards during the Elster and the Saale glaciations, but also during the Vistula High Glacial over the northern part of the territory. Before the Vistula time, parts of the country were also covered by fluvio-periglacial sediments of the river terraces and by loess of Saale time along the northern border of the mountainous region.

According to the surface, the paleoclimatic and rock conditions, the periglacial facies of the Vistula time is belt-like arranged (Richter, 1965; Haase, Lieberoth, *et. al.*, 1965). From north to south we notice the following belts of periglacial facies (Fig. 1):

– Sand cover series north of the Pomeranian Stadial (No. 1)

– Sand cover series between Pomeranian and Brandenburgian Stadials (No. 2)

– Sand cover series in the old morainic region (No. 3)

– Sand loess (No. 4) and mostly thin Vistulian loess (No. 5)

– Thick Vistulian loess and older loesses (No. 6)

– Thin Vistulian loess and older loesses, mostly derivated (No. 7)

– Locally mixed loess and coarse cover series (No. 8)

– Dominant two-layer-type of the coarse cover series (No. 9)

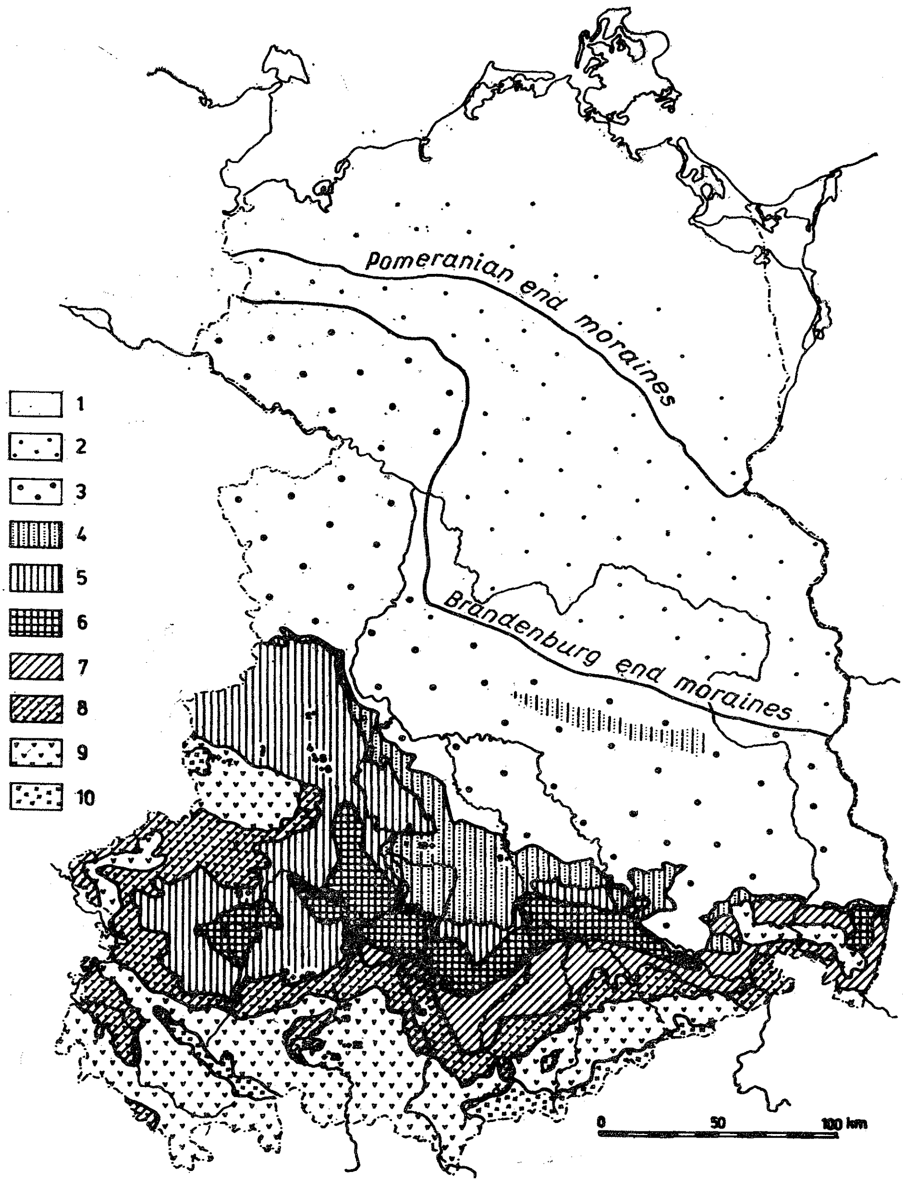

Fig. 1. The pattern of periglacial facies on the territory of GDR (Compiled by H. Richter, 1969)

Explanations in the text

– Dominant three-layer-type of the coarse cover series (No. 10).

Fig. 1 shows only three groups of periglacial facies, which are dominant: the coarse cover series in the mountainous region and parts of the hilly country, the sand cover series in the northern part of the lowland and the loess series in the hilly country and southern part of the lowland.

The coarse cover series consists of layers built up by stone-rich or fine grain-sized materials, developed under the influence of frost weathering, solifluction, cryoturbation, rainwash and infiltration, but also by eolian processes (Schilling and Wiefel, 1962; Schwanecke, 1967; Richter, Ruske and Schwanecke, 1970). The so-called three-layer type is the most typical formation of the coarse cover series. It starts with a stone-rich horizon, followed by a fine grain-sized, more silty horizon and is covered at the top by the upper stone-rich horizon. This type is developed only in the highest parts of the mountain region above 700/800 m above sea level, sometimes also on steeper slopes at lower altitudes. Besides in the greater areas of the mountains and the hilly country the two-layer type dominates (fig. 2).

The sand cover series represent the periglacial facies in the region north from the loess belt. We choose this term, because often the top layer in this region is more sandy than the lower horizons affected by periglacial processes. In the southern belt of the sand cover series there are infilling of hollows, which are relics from the Saale Glaciation. In all the belts of the sand cover series large periglacial slope sediments occurred in many places (Lembke, Altermann, *et al.*, 1970). But these accumulations are not entirely comparable to the stratigraphy of loess and the coarse cover series.

Most widespread is the following type of the sand cover series (Schultz and Nitz, 1965; Kopp, 1965). A stony horizon developed above older sediments of various origin. Below this pavement the original stratification was relaxed to a depth of 2 to 10 dm. The pavement itself is covered with a more or less sandy material, partly eolian sand, partly similar to the material under the stony horizon. It is striking, that this type of the sand cover series is well developed in larger areas not only south but also north of the marginal moraines of the Brandenburgian stadial. Only in that part of the lowland of the Pommeranian belt the intensity of these phenomena decreases (Kliewe and Schultz, 1970; Kopp, 1965).

The loess belt is divided strongly by several facies (Haase, Lieberoth, *et al.*, 1965, 1970; Lieberoth, 1963; Ruske and Wünsche, 1964). The width of the belt is only 10 to 60 km. Mostly the accumulation of dust in this belt took place under cold, but humid conditions. Therefore loess derivates are prevailing. After sedimentation by wind the loess has been moved by rainwash, solifluction or cryoturbation. Only loesses accumulated during the High glacial are typical loess with striking porosity, yellow grey colour and higher content

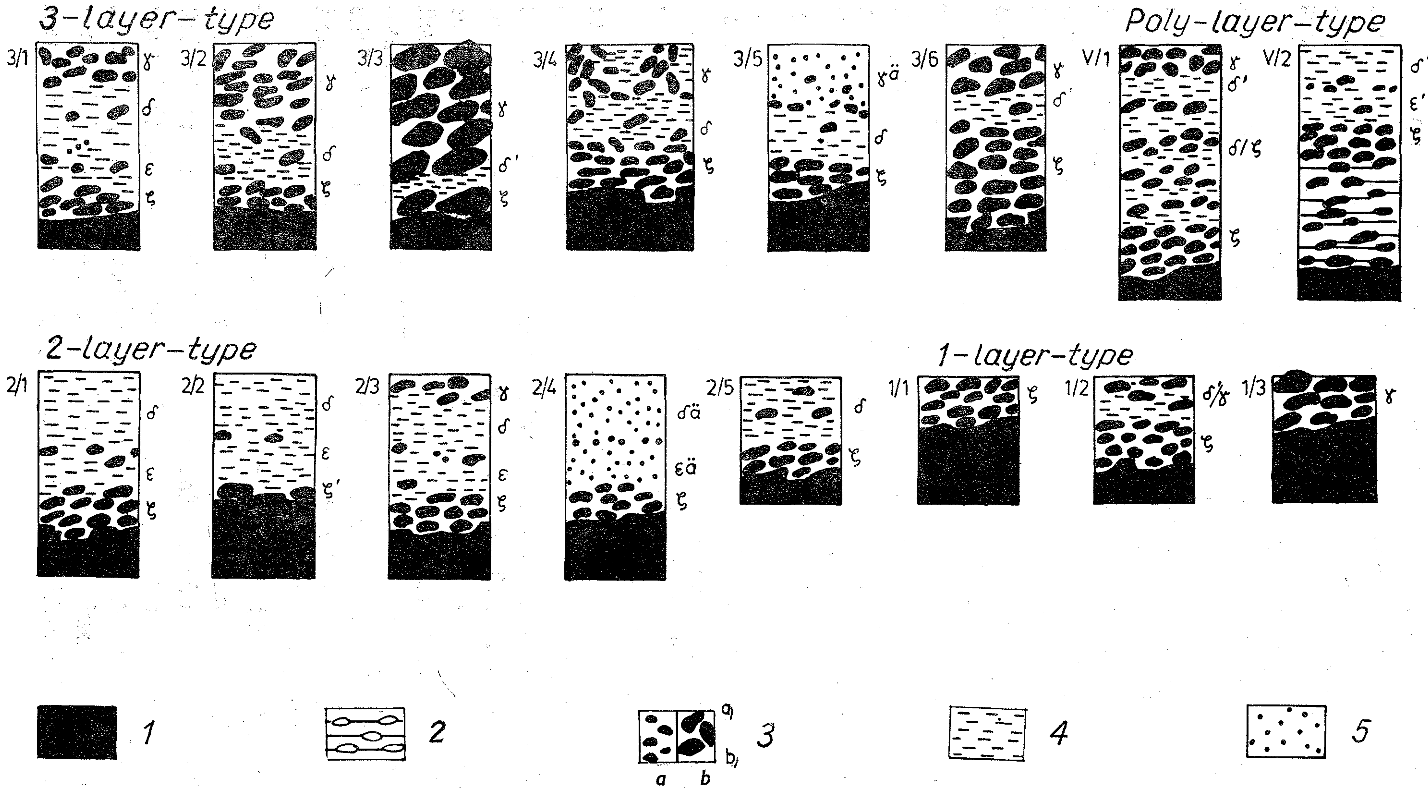

Fig. 2. Types of the coarse cover series (Compiled by W. Schwanecke, 1969)

1. bedrock and slightly removed solid rock; 2. older solifluction materials; 3. stone-rich (a) and heavy stone-rich (b) horizons; 4. coarse, more silty material; 5. loess

of calcium carbonates. These typical loesses are well developed with a thickness up to 10 m in more arid areas east of the mountain region. Therefore they indicate different loess provinces. Loess sediments gave the best possibilities to explain the stratigraphy of the periglacial region, because these sediments exactly record the important changes of climate during Vistula time over larger areas. They preserved also insignificant signs of soil development.

According to the stratigraphy of loess sediments, three main phases may be distinguished for the development of the whole periglacial facies during Vistula time, the Early Glacial including the Paudorf interstadial, High Glacial and Late Glacial.

The paleogeographical situation during the Early Glacial is to be observed only south of the Brandenburgian marginal moraines.

In the loess belt, particularly in that part where thick loesses were deposited later, the loess accumulation began during the Lower Vistulian time. Nearly, often an Eemian soil was fossilized. The humid climate of the Lower Vistulian was interrupted once or twice by warmer periods when chernozem-like soils occurred. During the Middle Vistulian loess accumulation became stronger but under colder and more arid conditions. At the end of the Early Glacial a remarkable soil developed during the Paudorf interstadial. In the dryer areas it is a brown coloured soil, in the wetter region – a gleyey soil, often disturbed by cryoturbation.

During the whole Early Glacial north of the loess belt a desert pavement occurred, which originated owing to wind action, rainwash and solifluction. Numerous hollows developed during the Saale glaciation were filled up with lacustrine sediments and other deposits of periglacial origin.

The southern border of the loess belt depended on the higher precipitation in the foot region of the mountains. Here loess sediments and much of the coarse cover series were lying side by side. Loess sediments preferred the lower mostly east-facing slopes. The dust was deposited on the lee side by westerly winds.

In the higher parts of the hilly country and in the mountains strong frost weathering gave rise to formation of solifluction materials. The lower stone--rich horizon of the coarse cover series was developed. But only in the lower parts of the slopes larger accumulations were observed. Most of the slope denudation material has been transported into the rivers. At the bottom of the valleys the Lower Terrace was built up. In smaller rivers accumulation ceased at the end of the Early Glacial as a result of the more arid climatic conditions. Only greater rivers accumulate also during the High and Late glacial (Marcinek, Präger and Steinmüller, 1970).

The High Glacial was the most arid phase of the Vistula time (Büdel, 1960). Just this climatic condition is the most important for the type of periglacial facies. Noteworthy is the increase of the loess belt to the north. Nearly everywhere in the loess belt, typical loess was accumulated. To the north this young sediment covered the pavement developed during the Early Glacial. Here the typical loess became more sandy. This sandy loess formed a belt, which is 2 to 5 km wide; only in the Lowland of Leipzig it became wider than 20 km. The sand loess passes over to typical wind-blown sand accumulations or to the sandy cover horizon of the sand cover series. Also to the south, loess accumulation overlapped the stone-rich sediments of the coarse cover series, above all in dryer regions on the eastern side of higher elevations. In the mountains the horizon with a greater content of silty material of the coarse cover series arose under the influence of frost weathering and wind action, but only by slow solifluction and cryoturbation.

The Late Glacial of the Vistula time was interrupted by several climatic fluctuations. But only a few situations were found, which permitted to study their entire action in the development of all the periglacial facies. The belt of the sand cover series extended to the north like the Scandinavian ice sheet melted. Wind action was nearly stopped, because the cover of vegetation was gradually growing. Dunes were blown up especially on the surface of the lower terrace, but also in the vast sandy areas near the marginal moraines. More sandy sediments were accumulated on the river terraces, mostly in the eastern neighbourhood of the valleys. During the Older and chiefly the Younger Tundra time a strong activity of periglacial processes was observed once more, particularly in the coastal region owing to the close vicinity of the Scandinavian ice sheet (Kliewe and Schultz, 1970), but also in the highest parts of the mountainous region. Here, the upper stone-rich horizon was built up. Thus, the three-layer type of the coarse cover series was completed. The influence of these processes on the fluvial accumulation is only small. Sometimes a second Lower terrace was noticed. But this terrace was mainly accumulated during the earliest part of the High Glacial.

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