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THE ROLE OF DENUDATION AND EROSION IN THE  
TRANSFORMATION OF THE MIDDLE POLISH (RISS)  
GLACIATION RELIEF

There is a wide-spread opinion that the relief formed during the Middle Polish glaciation has been considerably transformed. The main role is attributed to processes of denudation particularly connected with the periglacial morphogenetic environment. This opinion is reflected in synthetic works, lectures, commentaries to geomorphological maps and even in school-books.

The consequences of such an assumption concern the origin of certain landforms. One of these consequences is the fact that the so-called dry valleys (dells) are generally attributed a periglacial origin. Detailed field investigations carried out in areas of different stages of the Riss glaciation, from the oldest Odra stage to the youngest Mława stage, do not fully confirm this statement. There are opinions now that those might have been closely connected with glacial origin — with melting blocks of dead ice of the Middle Polish glaciation, T. Krzemiński (1974) calls simply such valleys, occurring in the middle Warta region, "melt-out" valleys or "glacier basins". Z. Klajnert (1978) uses the term of interkame basins in reference to the Skierniewice Upland. A. Musiał (1983) has described many "dry valleys" in the Kolno Upland and he also attributes them a melt-out origin. D. Kosmowska-Suffczyńska in a separate article (in press), has given much attention to this problem.

The investigations were carried out in the northern foreland of the Holy Cross Mountains, i.e. in the area of the maximum extent of the Riss glaciation. Also in the author's opinion the formation of small dry valleys is connected with glacial origin, though not directly with melt-out processes. The described forms of small valleys, apparently resembling the so-called denudation valleys, were formed as the result of uneven accumulation of the glacial lobe in the zone of areal deglaciation. It created convex kame-type forms and narrow depressions between them, void of sand and gravel deposits. These depressions are the subject of the author's study. It should be emphasized that the comparison of morpho-

metric features of those forms does not reveal any essential differences with valleys where the denudation origin has been proved (H. Klatkowska 1965).

The conclusions as to the non-denudation origin of the forms under discussion are based both on their geological structure and their relation to the surrounding relief.

Boulder clay occurs in the bottom of these dells. It is an important argument in the author's considerations. Within the dells this clay is not covered with sand or silt deposits the presence of which would prove that denudation processes had participated in their origin. The boulder clay is not thick and it lies directly on the bedrock. With growing distance from the axis of the dell, i.e. the axis of the depression, the clay hides deeper and deeper under fluvio-glacial kame deposits. It has been encountered in numerous bores. It may be that dells were places where water from melting blocks of dead ice flew off; may be they acquired or increased then their inclination but the absence of deposits connected with this process proves that it was not the main morphogenetic factor in their formation. For the sake of clarity in the discussion, it is worth noting that the top of subglacial clay hidden under kame hills and outcropping within the reach of the so-called dry valleys has the form of a dome falling down toward vast depressions bordering the area (the Szabasówka and the Iłzanka valleys).

It is also essential in our considerations that small closed depressions and swamps occur in watershed zones or in the upper sections of the dells. The presence, in dry valleys, of undrained depressions (kettles) is a strange element in such forms (karst origin is not excluded) and gives evidence of the absence both of legible accumulation processes and of processes of erosion and denudation in their formation.

Important conclusions concerning the origin of dry valleys can be drawn from their situation in relation to kames which they accompany. The slopes of the valleys pass imperceptibly without any distinct border-line, into the slopes of adjacent kames. The absence of any break between these forms denies the erosive or denudation origin of the valleys.

Other arguments confirming the glacial origin of the dells are the character of the relief and the structure of larger depressions to which those small forms refer. River valleys in the investigated area (the valleys of the Szabasówka and Iłzanka) in spite of their width have no accumulation or erosive terraces, their bottoms are wet, meliorated, and water flows away through an artificially dug melioration canal. In their wide, flat bottoms, the same as in the dells, boulder clay or varve clays occur at the surface or under a thin cover. Such shallow occurrence of glacial deposits in the valley bottoms and, at the same time, the absence of terrace levels proves that those landforms acquired their present relief as a result of glacial and melting processes rather than owing

to postglacial processes of erosion and fluvial accumulation typical in river valleys. The above-mentioned vast valleys are old, deep forms, with rock bottoms lying some 16 m below the present-day surface. Their formation dates back at least to the period before the Riss glaciation. Fluvial and fluvio-glacial deposits covered with glacio-lacustrine deposits or boulder clay of the Riss glaciation are the youngest recorded fluvial accumulation (Kosmowska-Suffczyńska 1988).

Another important argument proving the absence of fluvial erosive processes in the shaping of these landforms is the occurrence of kame hills on their slopes, below the upper level of the upland. This fact also indicates that these vast dry valleys were places where dead ice stagnated in the last periods of deglaciation. Such situations and the following conclusions were described by Z. Klajnert (1984) and Z. Klajnert and G. Wasiak (1984) in reference to the Łódź region.

Summing up considerations on the origin of small, dry valleys it should be stated that without detailed geomorphological and geological investigations one cannot determine properly the origin of those forms commonly occurring in Poland's relief. The criteria of their shape and waterlessness do not allow us to attribute them *a priori* a denudation origin, which is still a current stereotype.

The investigated relief and its structure afford no data that could justify an assumption of a significant role of erosion and denudation (in particular periglacial denudation) in their formation. Many facts can be quoted in support of our interpretation, such as: 1. the character and structure of dry valleys (clay in the bottom, kettles, no break between the slope of the valley and that of the kame); 2. the morphology and structure of larger valleys to which the small forms refer (flat, wide bottoms with closed depressions, no river terraces, the occurrence in the top parts, of deposits connected with the glacier); 3. the character of their drainage (no natural stream, wet valley bottoms are meliorated, water flows out through melioration canals); 4. no correlative slope and under-slope deposits corresponding with processes of postglacial denudation; 5. the survival of slopes of the ice contact with its characteristic structure, in the marginal parts of kames.

It seems that all these statements, as well as those of the authors quoted above, give not only a new outlook on the origin of denudation "dry valleys" but also bring substantial elements to the discussion on the transformation of glacial relief of the Riss glaciation and the role of periglacial processes.

## REFERENCES

- Klajnert, Z., 1978, „Zanik lodowca warciańskiego na Wysoczyźnie Skierniewickiej i jej północnym przedpolu” (The recession of the Warta glacier on the Skierniewice Upland and its northern foreland), *Acta Geographica Lodz.* 38, Łódź.
- Klajnert, Z., 1984, „Analysis of kames for paleogeographical reconstructions”, *Boreas* 13, Oslo.
- Klajnert, Z., Wasiaś, G., 1984, *Rola polodowcowych obniżen dolinnych w procesie deglacjacji arealnej lodowca warciańskiego na Wyżynie Łódzkiej. Przewodnik Konferencji Zlodowacenia środkowopolskie na Wyżynach południowopolskich i terenach przyległych* (The role of sub-glacial valley depressions in the process of areal deglaciation of the Warta glacier on the Łódź Upland. Guide-book for the conference on Middle-Polish glaciations on South Poland Uplands and adjacent areas), Sosnowiec.
- Klatkowska, H., 1965, „Niecki i doliny denudacyjne w okolicach Łodzi” (Denudation basins and valleys in the vicinity of Łódź), *Acta Geographica Lodz.*, 19, Łódź.
- Kosmowska-Suffczyńska, D., (in press), „O genezie niektórych tzw. dolinek denudacyjnych” (On the origin of some so-called denudation dells), *Acta Geographica Lodz.*
- Kosmowska-Suffczyńska, D., (1988), „Rzeźba podczwartorzędowa okolic Szydłowca. Rola litologii i tektoniki” (Sub-Quaternary relief of the Szydłowiec vicinity. The role of lithology and tectonics), *Prace i Studia Wydziału Geogr. i St. Regionalnych* 9, Warszawa.
- Krzemiński, T., 1974, „Geneza młodoplejstocenijskiej rzeźby glacialnej w dorzeczu środkowej Warty” (The origin of young-Pleistocene glacial relief in the drainage-basin of the Middle Warta), *Acta Geographica Lodz.* 33, Łódź.
- Musiś, A., *Rozwój rzeźby glacialnej Wysoczyzny Kolneńskiej* (The development of glacial relief on the Kolno Upland), PWN, Warszawa.