

**Jan Nowak.**

## **Brzeg lodowca czwartorzędowego w okolicy Lwowa i kierunek ruchu lodu na Roztoczu Lwowsko-Tomaszowskiem.**

**The limit and the Direction of the advance of the ice on  
the Roztocze Lwów - Tomaszów.**

1. The southern limit of the Quaternary glacier in the environs of Lwów, between the basins of the upper course of the Dniestr and the Bug, according to M. Łomnicki<sup>1)</sup>, does not appear in the morphology of the terrain. Consequently the limit of the glacier in this country could not be determined otherwise than by way of studying the distribution of big erratic blocks, while it was necessary to consider the small rounded boulders reaching farther toward the South as formations of the transport of glacier waters. M. Łomnicki<sup>2)</sup> has found such small boulders of northern proveniency in the vicinity of Kulików, 13 km E. and near Karaczynów, 15 km W. of Lwów.

This investigator has stated that the line of the southern limit of morainic formations, containing big boulders of northern crystalline rocks, is to be traced in the environs of Gródek (Artyszczów), along the valley of the river Wereszyca, and that its further course passes on to Kamienobród, Dobrostany, Lelechówka, Majdan, Działowa Góra, Wulka Kunińska, Horozdów, Lipniki and Hujcze. But just S. and W. of this line are to be found only small fragments of crystalline rocks and gravels of glacier proveniency, while big erratic blocks lock.

Thus came to be drawn the southern limit of the Quaternary glacier N. of Lwów, as is known from geological maps.

<sup>1)</sup> Atlas geolog. Galicji zesz. 10.

<sup>2)</sup> Kosmos, Lwów 1893.

<sup>3)</sup> Kosmos, Lwów, p. 668.

In the year 1914, wishing to examine once more the fissures in the Tertiary of the Grzybowice ravine, N. of Lwów, I walked up along it. In one of its highest embranchments, which I present in the enclosed photograph (Fig. 1), I remarked a relatively big block, light on the surface and at first sight I took it for a larger block of Senonian marl. However, when I broke it at the edge, I saw that it



Fig. 1. The erratic block laying into Senonian marl. Grzybowice near Lwów.

was red northern granite of glacier proveniency. The side visible on the photo was 52 cm long and 24 cm high. It was completely embedded in crushed Cretaceous limestone, about 1,5 m beneath the upper limit of the Cretaceous, which here was not covered by the Tertiary, but a 20 cm layer of humus. The northern glacier was here on the plateau where comes up the ravine and the block was forced either by the ice or the glacier waters into the uneven surface of the Cretaceous rock. Afterwards the block was covered with triturated Cretaceous and in this manner was kept from the further activity of the erosion. It is possible that the crushed Cretaceous in which the block is embedded presents a kind of local moraine, the material of which is mixed with northern granite.

At any rate, this finding testifies that the glacier itself advanced almost to the gates of actual Lwów, and that its southern limit must be drawn at least so far as Grzybowice. The lack of a larger number of such blocks in this country was the cause of their having escaped the attention even of so perspicacious investigators as among others M. Ł o m n i c k i. This emphasizes the already known thesis of the thinness of the ice at its southern limit and the deriving from it small power of transport in relation to bigger boulders. That is the cause of their sporadic appearance. It seems that the glacier has lost its bigger boulders before ascending from the valley Wereszyca on to the heights of the Roztocze Lwów—Tomaszów, so that on the other side of it particularly at the southern limit of the glacier, a bigger block may be found but exceptionally. Independently of this, the erosion of the certainly scarce moraine formations was probably remarkable on the Roztocze and its eastern part, owing to rapid slopes, which was equally unfavorable to the conservation of well developed traces of the existing here glacier.

2. On the eastern limits of the Roztocze Lwów—Tomaszów, near Potylicz, I have found amidst erratic material, two boulders about 1 dcm large and I mention them here because they indicate the direction of advance of the Quaternary glacier in this country. One of the boulders is yellowish-gray, compact Upper Jurassic limestone, with a bit of well preserved *Perisphinctes*. The second is a conglomerate composed of pebbles of light, milky quartzite as large as a pea, or somewhat smaller than a hazel nut. Cementis dark brown, sondy-limonite.

There were yet more Jurassic blocks here, however I found only one with *Perisphinctes*, which proves that the glacier carried the Jurassic material from the St. Cross Mountains. Even more characteristic is the block of conglomerate, because it comes from the northern slope of the St. Cross Mountains. S a m s o n o w i c z <sup>1)</sup> describes an identical rock from the borders of the river Swiślina, coming from conglomerates at the top of the Muschelkalk formation of the northern slope of the St. Cross Mountains. In the collection of the Polish Geological Institute in Warsaw, I could state myself the petrographical identity of these formations. Hilber <sup>2)</sup>, to whom we owe the list of the erratic materials in this area, does not

<sup>1)</sup> Comptes-Rendus de l'Institut Géol. de Pologne 1929, p. 68.

<sup>2)</sup> Sitzungsberichte Akad. d. Wiss. Wien. Math. natur. Cl. I 1889.

mention these rocks in his statement. If we remark that in the region between Potylicz and the St. Cross Mountains the oldest rocks appearing on the surface are of Upper Cretaceous age, then the finding discussed above proves undoubtedly the eastern or rather south-eastern direction of the course of the glacier.

3. So long as it was thought probable that only the icesheet Cracovian (S z a f e r) advanced so far as these localities, one expressed almost with certainty the supposition that the above described erratics belong to this ice-sheet. Presently, as yet older icesheet (Jaroslavian, S z a f e r) having been found in the environs of Jarosław, this certainty is less absolute, for we have not been able to separate in terrain both these glaciations. Therefore it becomes probable that the erratics belong to the Cracovian, but one cannot eliminate the possibility of their belonging to the Jaroslavian.

## TREŚĆ

Znalezienie północnego granitu w jarze grzybowickim wśród kredy wskazuje, że granica lodowca północnego (Cracovian Szafera?) sięgała niedaleko na N od Lwowa, gdy znalezienie wśród narzutowców okolic Potylicza koło Rawy Ruskiej wapienia jurajskiego z *Perisphinctem* i zlepieńca górnotriasowego z północnego zbocza Gór Świętokrzyskich dowodzi kierunku E, względnie SE ruchu lodu na Roztoczu lwowsko-tomaszowskim.