

STANISŁAW DŻUŁYŃSKI, JANUSZ KOTLARCZYK

O POCHODZENIU WARSTW POPIELSKICH W KARPATACH POLSKICH

Sedimentation of the Popiele beds in the Polish Carpathians

STRESZCZENIE

Warstwy popielskie w Karpatach polskich są w całości osadem spływów podmorskich. Utworzyły się one w stosunkowo krótkim czasie podczas osadzania się pierwszych menilitopodobnych utworów w basenie skolskim. Spośród licznych porwaków tkwiących w brunatnym mułowcu najliczniej występują duże płyty łupków i margli oraz fragmenty piaskowców. Część z nich pochodzi z warstw hieroglifowych, inne nie różnią się od łupków menilitowych i piaskowców kliwskich. Skamieniałości w warstwach popielskich są przemieszczone, a częściowo może i na wtórnym złożeniu.

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The name „Popiele beds” is used for strata which lie between the Hieroglyphic (Eocene) and Menilite beds (Upper most Eocene Oligocene) of the Skole nappe (K r o p a c z e k, 1919). The series is about 100 m. thick and can be traced from Przemyśl up to the Prut valley in the Eastern Carpathians. The geometry of the Popiele beds presents a picture of a narrow linear body changing in thickness (H o r w i t z, 1926) and with the length several times that of the width. Being restricted to the most external flysch folds, the Popiele beds crop out in Poland along the margin of the Carpathians, south of Przemyśl (W i ś n i o w s k i, 1908; R o g a l a, 1925; N e y, 1961; W a t y c h a, 1964). The Popiele beds have been known because of rich fauna, mainly of small molluscs and gastropods of Upper Eocene age (R o g a l a, 1925).

Lithologically, the Popiele beds consist of a massive unstratified, brownish sandy siltstone with variable amount of slump-balls, blocks and smaller rock-fragments; an important element of which are shales and marls. These bodies having a wide range in size with a maximum diameter up to several meters are randomly scattered throughout the silty matrix. Since many of them rest with their plane of greatest dimension parallel to the bedding, they may easily be confused with ordinary stratigraphic intercalations.

The Popiele beds may appear „brecciated” and consist locally of closely welded, large blocks of shales and marls. If there is little contrast in lithology between the neighbouring fragments, the sediment appears homogeneous, but an examination of bedding cleavage reveals its true

nature. The bounding surfaces of such blocks may also be made visible by smaller and harder fragments which stick in between the blocks.

Observations have not yet been carried sufficiently far to identify all the fragments enclosed in the Popiele siltstones. The dominant types are: 1- green shales or packets of green shales alternating with marls and /or grey shales and clay ironstones, 2- soft and hard marls of green and dark greyish colours, 3- fragments of coarse glauconitic sandstones (rare), 4- soft or hard, black and brownish shales, 5- quartzitic sandstones with dark silty lamination, etc. Whereas the rock-types (1) to (3) were evidently derived from the Hieroglyphic beds below, the types (4) and (5) resemble the Menilite shales and the associated Kliwa sandstones from above the Popiele beds. Fossils are irregularly distributed in the siltstone. Presumably some of the fossiliferous siltstone may also occur as isolated blocks in the matrix of the same kind. The base of the Popiele beds rests upon an eroded substratum.

From the foregoing it is evident that the Popiele beds in the Polish Carpathians were deposited by a huge sub-marine avalanche of the sediment-flow type, or by a number of successive avalanches. Distance and direction of flows is not apparent from the exposures. The problem of sources of the Popiele beds cannot be satisfactorily solved at present but certain evidences such as the limitation of these beds to the most external folds and the dominant direction of sediment transport in the Menilite beds suggest the northern or north-eastern side of the flysch basin as a possible source of sediment flows (transverse supply). The latter might have started from widespread slumpings generated in response to an increased tectonic activity within the flysch troughs and the flanking source lands (Pyreneic phase). The liquefaction of silty sediments deposited along the coastal areas of the flysch sea might have resulted in a catastrophic downslope movement of large masses of sediment. The Popiele beds are comparable with several features of Wild Flysch. However the exotics proper are rare in the area investigated though they tend to be more abundant in the Eastern Carpathians (K r o p a c z e k, 1919).

The Popiele beds were correlated with the Menilite beds by Wiśniewski (1908) and with the „sub-silex” beds by Świdziński (1948)¹ and considered as a facies of the Hieroglyphic beds by Vialoff (1961).

The Menilite and Kliwa types of rocks occur among the slump — blocks in the Popiele siltstone. Furthermore, the latter is cut by clastic dykes composed of the Kliwa type of sandstone and apparently injected from below. This means that at the time of avalanching which resulted in the formation of the Popiele beds, the Menilite type of sediments were already present on the bottom of the flysch sea in the northern trough. It is to be noted, however, that the formation of the Popiele beds was a short episode only.

Significant fact emerging from the above consideration is that the fossils in the Popiele beds are displaced. In case of lateral displacement only, the age of fossils would correspond to that of the Popiele beds. There might have been, however, a certain amount of redeposition involved; i. e., the vertical displacement of older fossils into younger sediments. Such a possibility depending on the thickness of the silts involved in gravity

¹ i.e. the „Lower Menilite beds” sensu Horwitz (1926).

mass-movements should not be ignored, though any significant redeposition is hardly to be expected.

The above indicated characteristic features of the Popiele beds may help to clear some conflicting opinions concerning the precise stratigraphic position of these strata (see: Rogala, 1925; Wiśniowski, 1908; Syniewska, 1937; Golev, 1954; Morgiel and Żgiet, 1964; etc.).

Pracownia Geologiczna w Krakowie
Zakład Nauk Geologicznych PAN
Geological Laboratory
Polish Academy of Sciences, Kraków

Katedra Geologii AGH w Krakowie
Department of Geology,
School of Mining and Metallurgy
in Kraków

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