The Brzozówka river valley development based on palaeogeographic and geographical methods

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The main aim of this presentation is to present the results of palaeographic research on the Brzozówka River (NE Poland) and its left-bank tributary, the Biebła River. In particular, environmental changes occurring within the river valley bottoms will be recognized, as well as the phases of the dynamics of fluvial processes and the phases of peatland initiation, as well as the natural and / or anthropogenic causes of these changes.

In prehistory, this area became an ecumen of the community of Lusatian Urn Fields, with which the settlement in Jatwież Duża should be associated [6], [8]. This archaeological culture from the Bronze Age, functioning in the Subboreal period, was the first to use the nearby natural environment on a large scale for its needs, and traces of its activity are recorded in the area of the Brzozówka and Biebła valleys.

The relief of this area was shaped during the last two glaciations. The Middle Polish glaciation in the Warta Cold Stage gave the main relief [4], [5]. During the next glacial advance (Vistula glaciation), this landscape was remodeled in periglacial conditions (Fig. 1).

During this period the Pleistocene relief of the bed of the Brzozówka valley, probably of melt-out origin [4], underwent evolution under the influence of two factors. The first of these was meltwater from the melting ice sheet, which flowed down to the south and entered the valley floor to form a series of fluvioglacial terraces (sandur plains) [1]. The second factor was probably the intrusion of a part of flood waters from the outflow of the Narocz-Vilno and Skidel lakes into the Brzozówka depression. This current followed the valley of the Łososna River and the Pripilin-Nurki. It reached the Biebrza and Narew valleys [2]. This event occurred around 15.5-15.0 ka, [3] or 16.2 ka [2]. During this period, the river had a stream development (Fig. 1).

The Pleistocene relief of the Brzozówka river valley was transformed during the late glacial and Holocene periods. The flow direction was reversed and the river was flowing in the N direction into the Biebrza. The reason for this may have been the decreased erosion base after the undercutting of the Biebrza River at the end of the younger Pleniglacial.

At present, the river in the surveyed section has a meandering character.

The Brzozówka depression is filled with peats which started to develop from 9770±110 BP (MKL-5082), which considering probability at 95,4% gives intervals 9457 - 8805 BC (91, 3%), 9551 - 9481 BC (2.4%) and 9657 - 9605 BC (1.7%) and a probability of 68.3% determines the interval 9371 - 9123 BC (57.4%), 8997 - 8997 BC (10.5%) and 8884 - 8880 BC (0.4%) (Fig. 2).

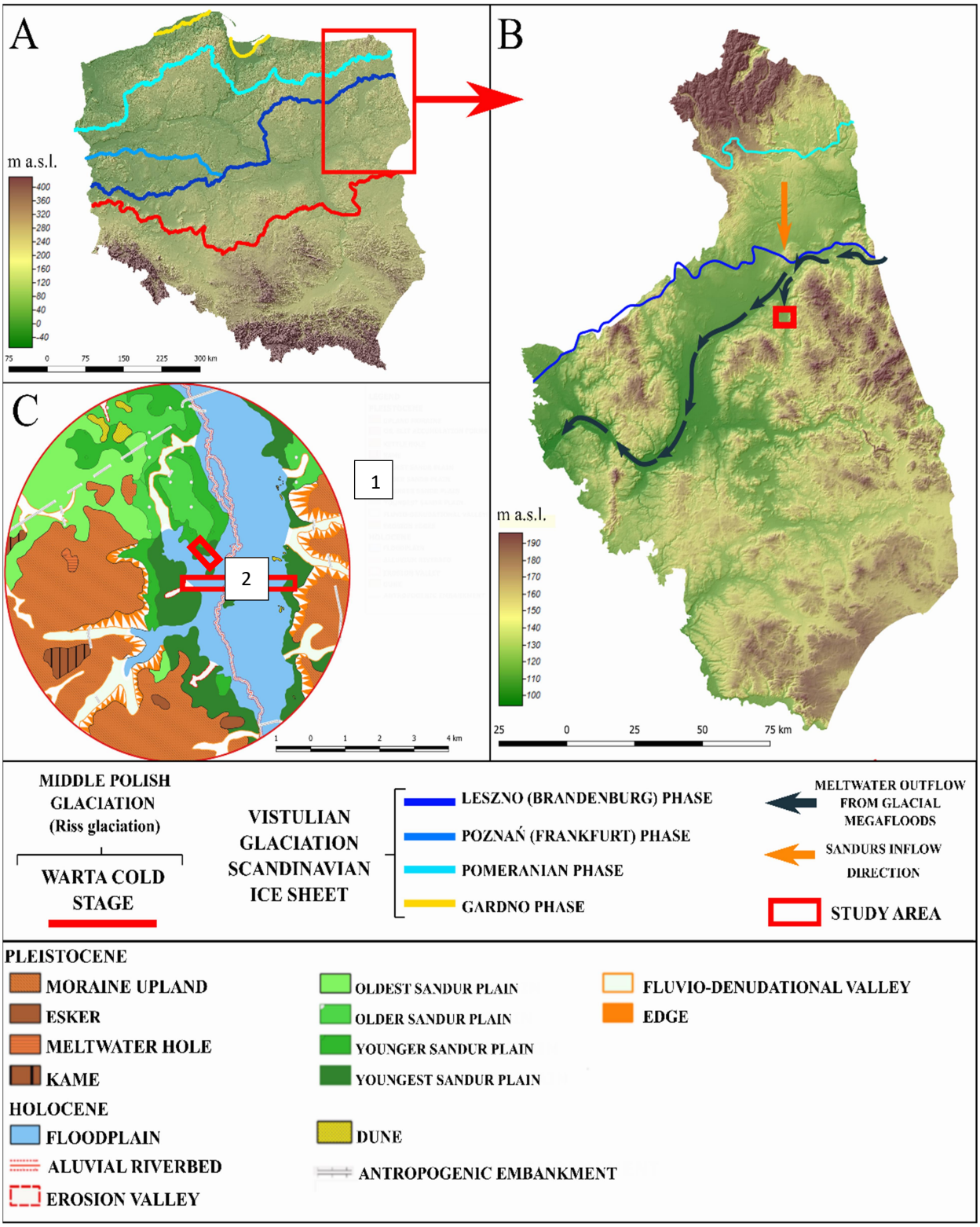

Fig. 1. Location of the study. A – Hypsometric map of Poland with glaciation ranges (compiled after [5]); B – Hypsometric Map of Podlasie Voivodeship (compiled after [7]); C – Geomorphological map of the study area (by M. Frączek, T. Kalicki); 1- Brzozówka cross-section profile, 2 - Biebła cross-section profile.

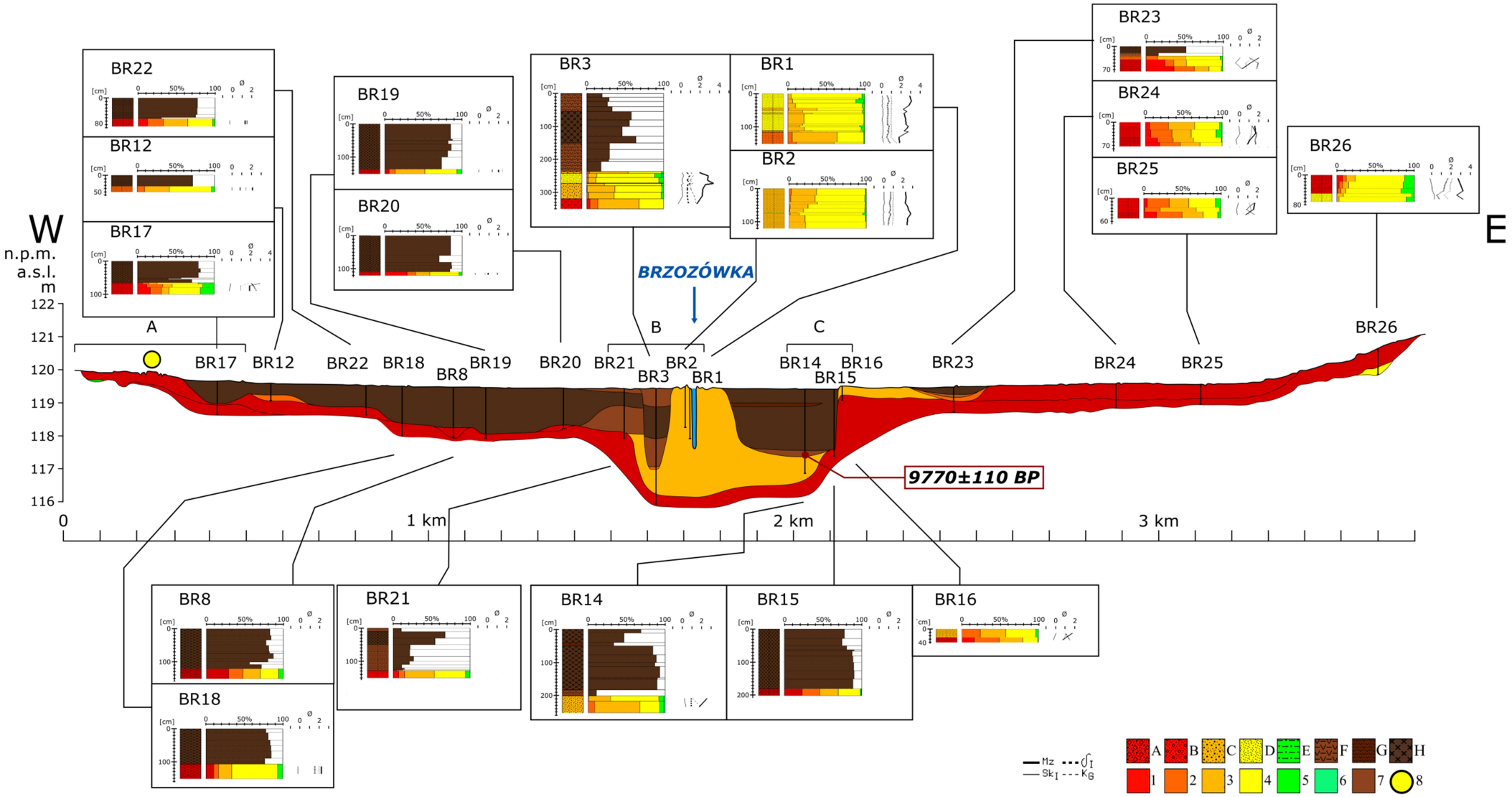

Fig. 2. Schematic geological cross-section of the Brzozówka valley. Lithology: A - sand with gravels, B - sands with single gravels, C - medium-grained sands, D - fine-grained sands, E - silts and clays, F – peaty silt, G - silty peats, H – peats; Fractions: 1 – gravel, 2 - coarse sand, 3 - medium sand, 4 - fine sand, 5 - silt and clay, 6 - clay, 7 - the content of organic matter; Folk-Ward's distribution parameters: Mz - mean diameter, δ_I - standard deviation (sorting), Sk_I - skewness, K_G -kurtosis

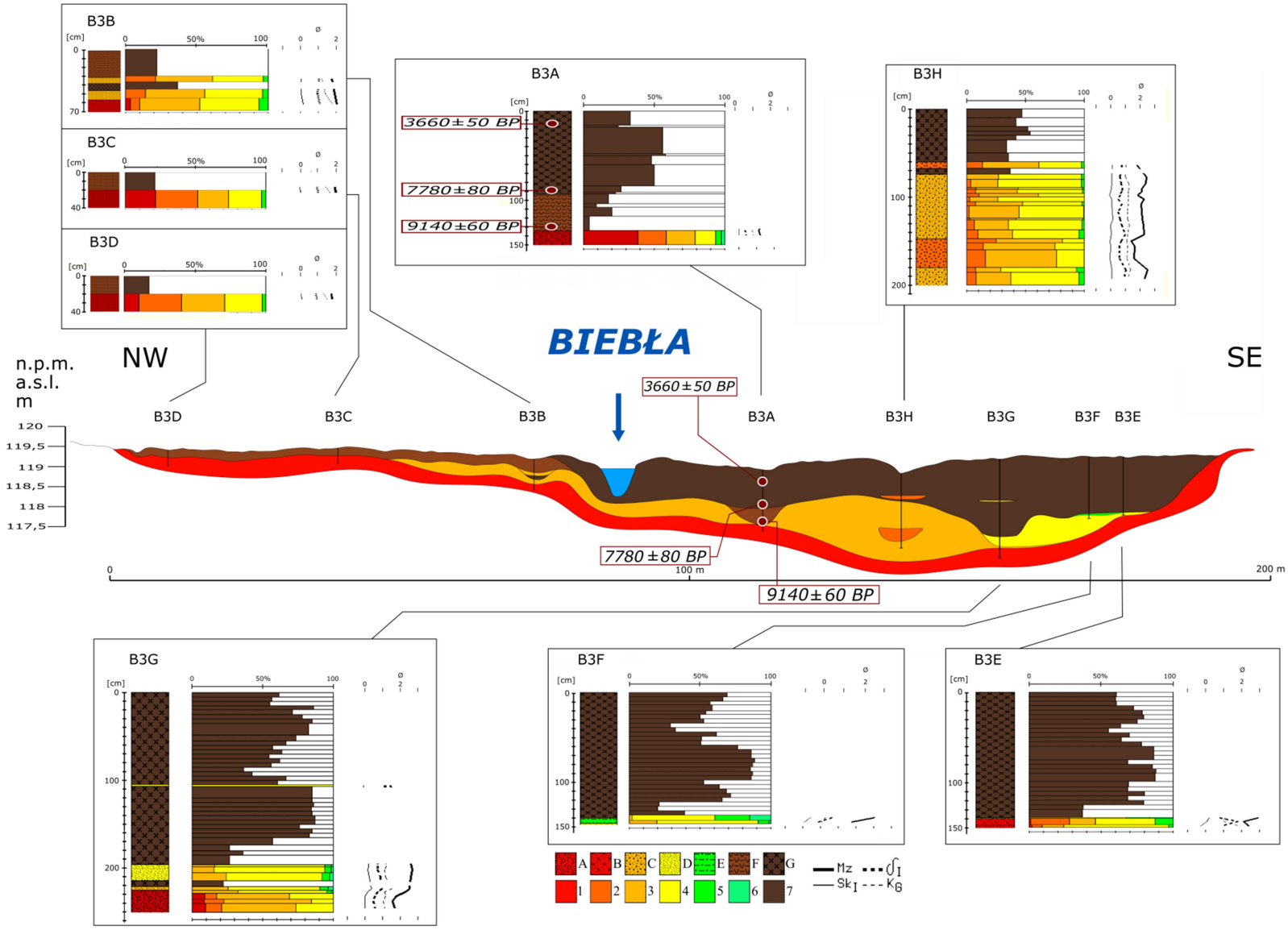

Fig. 3. Schematic geological cross-section of the Biebła valley. Lithology: A - sand with gravels, B - sands with single gravels, C - medium-grained sands, D - fine-grained sands, E - silts and clays, F – peaty silt, G – peats; Fractions: 1 – gravel, 2 - coarse sand, 3 - medium sand, 4 - fine sand, 5 - silt and clay, 6 - clay, 7 - the content of organic matter; Folk-Ward's distribution parameters: Mz - mean diameter, δ_I - standard deviation (sorting), Sk_I - skewness, K_G -kurtosis

Recognition of geological structure of the bottom of the Brzozówka valley (fig. 2) made it possible to differentiate three segments of the valley of different age and structure:

a. sand terrace of the valley built of sand and gravel deposits,
b. peat plain of 0.5 to 2 m thickness, which started to grow from the beginning of the Holocene on uneven mineral substrate, which may be a remnant of an old system of rivers,
c. alluvia accompanying the modern river bed, made up of well-sorted sands of the meander drainage (fig. 2).

Reorganisation of the fluvial environment of this area is better visible in the Biebła valley bottom (fig. 3), which is a left-sided tributary of the Brzozówka River. The results of the research made it possible to distinguish several phases in the evolution of the valley:

a. erosion phase, which took place after the Warta cold stage. During which two levels of sand and gravel series were formed in the bottom of the Biebła valley,
b. the gradual concentration of flows and the establishment of a single-channel system. This may have occurred at the turn of the Late Glacial and Holocene, as organic sediments in the bottom of the shallow palaeochannel have been dated to 9100 BP,
c. development of valley floor peatlands during the period of full Atlantic forestation (from 7780 BP),
d. Holocene period of meandering rivers where the development of valley bottom peatlands began during the period of full Atlantic afforestation (from 7780 BP),
e. Subboreal period - during this period intensive human activity takes place in the catchment area From 3660±50 PB, cal. 2147-1897 BC (B3A) a marked decline in the organic matter content of the peats is observed. This probably indicates deforestation of the catchment.

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