

Formation of the chemical composition of water in channel head in postglacial areas (West Pomerania, Poland)

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The channel head is a zone of hydrological changes determining the hydrochemical features of water in the final stage of groundwater flow and the start of the surface cycle. The chemistry of water flowing out of a channel head reflects not only the characteristics of groundwater feeding the zone, but also changes it undergoes in this area during the organisation of channel flow. Groundwater interacts with surface water in the hyporheic zone where water from different environments is mixed and exchanged due to high hydraulic and chemical gradients. The goal of this study was to assess spatial differences in the concentrations of nutrients and compounds produced by chemical weathering in a channel head and to establish the role of the hyporheic zone in the transformation of the chemical composition of groundwater supplying a 1st-order stream. The research area was the channel head Żarnowo, located on the southern slope of the upper Parsęta valley. Three hydrochemical mappings were conducted in the headwater alcove consisting of three parts developed in a glaciofluvial plain and an erosional-accumulative alluvial terrace. Water was sampled in places of groundwater outflow in the footslope zone (9 sites), the hyporheic zone (14 sites), and outflows in the individual alcove parts and the rivulet they formed (5 sites). Water temperature, pH, and electrical conductivity were measured in the field. Concentrations of K, Ca, Mg, Na, Fe, Mn, HCO₃, Cl, NO₃, PO₄, SO₄ and SiO₂ were determined in the laboratory. The chemical composition of ground- and surface water shows the concentration of geogenic components like K, Ca, Mg, Na, HCO₃, and SiO₂ to be an effect of chemical weathering and the leaching of its products taking place in a zero-discharge catchment. Those ions display little spatial variability and a stability of concentration in individual measurement periods, while the greatest disproportions in their concentrations among the alcove parts were recorded for Cl, NO₃ and PO₄, representing an anthropogenic component. Like iron and manganese, nitrates are components with the highest horizontal gradients of concentration in the alcove. Nitrate levels drop considerably in each hyporheic zone. The levels of iron and manganese found in porewater at the bottom of the alcove can be both high and low, which indicates a highly local nature of their determinants in the hyporheic zone connected mainly with changes in its hydrogeochemical conditions. This should be considered an effect of biogeochemical processes involving a change in the oxidation level of nitrogen in porewater. The bottom of the channel head is permanently waterlogged, fed by water with a stable temperature of ca. 8.8°C, and consequently supporting a green *Cardamino amarae*-*Beruletum erecti* Turmanova 1985 community even in winter. Plants are a source of organic matter, the decomposition of which brings about an oxygen deficit necessary for the development of microorganisms deriving oxygen from oxygen complexes of nitrogen. Those are conditions facilitating a reduction of nitrates to free nitrogen and the migration of reduced forms of iron and manganese.