

Significance of hydrogeology in the chemical and isotope composition of formation water in different basinal environments

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Deep formation water was studied from a deep sub-basin with sedimentary sequences up to 7000 m thick, and from fields with only 2000 m of sediments, in the central part of the Pannonian Basin. The studied depth interval involves the lower part of the Upper Miocene (named Lower Pannonian), and the upper part of the Upper Miocene and Pliocene (named Upper Pannonian). The Upper and Lower Pannonian sediments are separated with a widespread aquitard (Algyo Formation), at the top of the Lower Pannonian. However, above basement highs, it occasionally contains sand lenses and sedimentological discontinuities resulting in a more conductive character. NaHCO₃-type water is characteristic in the sub-basin, and NaCl-dominated water in the fields above the elevated basement. The isotopic composition of most NaHCO₃-type samples indicates a pure paleometeoric origin, while a few samples are a mixture of paleometeoric and non-meteoritic waters. The NaCl-type samples all have a non-meteoritic contribution. Based on hydrogeological, chemical and isotopic data, the Cl-dominated water is a mixture of ascending pre-Pannonian evaporated water and fresh water trapped during the Late Miocene and Pliocene sedimentation in the area above the elevated basement, where, due to the sedimentological discontinuities, the Algyo Formation is locally conductive. The source and evolution of the NaHCO₃ non-meteoritic water in the sub-basin are similar to those of the NaCl-dominated water, with the main difference being the aquitard character of the Algyo Formation in the sub-basin. The aquitard, consisting of siltstone and clay-marl, behaves like a membrane, and has resulted in enrichment of Cl- and probably heavy isotopes in the formation water below the Algyo Formation. Above the Algyo Formation, the squeezed water, depleted of the heavier isotopes and Cl-, mixes with in situ pore water. The ascending pre-Pannonian water squeezed through the compacted clay by overpressure is exposed to microfiltration.

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