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A new hydrogeological model of charging shallow and deep aquifers in the Lake Neusiedl – Seewinkel region (Northern Burgenland, Austria)

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The hypothesis of ascending thermal groundwater in the Seewinkel was introduced by Tauber (1965), favoured by Schmid (1970), and followed up by Wurm (2000). The main idea of this hypothesis was up welling of saline waters from a deep aquifer along faults, which in the 1950s have been identified as such in seismic sections. An aquifer of marine deposits of Badenian to Sarmatian age was postulated as source, and hydrochemical composition of water should have changed during migration due to high contents of sodium carbonate and sulphate instead of potassium chloride in the shallow groundwater bodies of the Seewinkel. Häusler (2010) argued, however, that fault aquifers discharging saline waters nowhere have been identified in this region. Supposed that according to the ascendance hypothesis ion composition of up welling formation water could have undergone a change, the primary isotope signal of marine water should have not.

In order to get a better insight to the groundwater cycle we compare results from geochemical analyses, clay mineralogical analyses, and leachates of source rocks of potential recharge areas with respective analyses of shallow and deep aquifers, and apply the method of stable hydroisotopes such as oxygen, deuterium, strontium and chloride for distinguishing origin of groundwaters. We evaluate the hypothesis of up welling connate waters, and eventually come up with a new conceptual hydrogeological model for the Neusiedl-Seewinkel region regarding composition, origin, flow direction and residence time of groundwater in shallow and deeper aquifers.

The very low value of –12.26‰ for oxygen isotope ratio of thermal groundwater from the deepest aquifer drilled to a depth of about 1000 metres at Frauenkirchen in northern Seewinkel, which is not highly mineralised, excludes connate water as major source, which basically is characterized by high oxygen isotope ratio values. Taking into account that oxygen isotope ratio-values ranging from –12.0‰ to –10.5‰ in the catchment of Lake Neusiedl are characteristic for waters derived from the cooler period of the Pleistocene (Rank et al., 1982), we conclude that groundwater of the deepest aquifer of the Seewinkel is not of Badenian to Sarmatian age but only several tens of thousands of years old. The artesian wells of the Seewinkel region drilled down to several hundreds of metres yielded groundwater with oxygen isotope ratio-values ranging between –11.90‰ and –10.83‰ values fitting well to waters of Pleistocene age of that region. Since wells discharging the Leitha Mountains also revealed oxygen isotope ratio-values varying from –11.10‰ to –10.22‰ we conclude that the mountain chains surrounding Lake Neusiedl basically charged both shallow and deeper aquifers of the Seewinkel.

From oxygen isotope ratios of these groundwater bodies we therefore conclude that first the majority of aquifers of the Lake Neusiedl region was charged from the surrounding mountain chains, and second that salinity of soils in the Seewinkel region cannot be derived from up welling connate water, as has been proofed for Lake Kelemenszék area south of Budapest (Simon et al., 2011). There is no doubt on the fact, however, that differing amounts of free carbon dioxide in several aquifers of the Seewinkel region originate from deep-seated post volcanic activity in this region.

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