Assessing the origin of water appearances in salt mines: triple isotope analyses (δ^2H, $\delta^{18}O$, $\delta^{17}O$) of heavy brines from the Klodawa salt mine, central Poland

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We present a dedicated study aimed at quantifying the origin of heavy brines occurring in the Klodawa salt mine located in central Poland. The mine is producing 6×10^5 tons of salts annually. Full isotopic composition (δ^2H, $\delta^{18}O$, $\delta^{17}O$) of 13 brine samples collected in various regions of the mine has been measured using Picarro L2140-*i* analyser.

Three main groups of waters were identified in the mine on the basis of their isotopic composition. The first group represents syngenetic waters. They are of Zechstein age and represent different stages of evolution of sea water during gradual desiccation of shallow lagoons. Stable isotope compositions of these waters are shifted to the right-hand side of the WMWL and form characteristic "hook" on the δ^2H-$\delta^{18}O$ diagram. Those waters reveal also most negative values of $\Delta^{17}O$ (up to -100 per meg).

The second group represents meteoric waters of different age. Those waters pose certain risk for the mine operation (flooding). Most of them carry significant evaporation signature. Some of these waters were recharged under climatic conditions significantly colder than those prevailing at present in central Poland, whereas others represent pre-Quaternary infiltration, characterized by elevated air temperatures when compared to present-day conditions.

The third group represents technological waters and waters of unknown origin.