The comparative geochemical and isotopic study of confined and unconfined Chalk groundwaters of the Paris Basin and the N German Basin proves a significant chemical evolution during groundwater flow from the recharge zones to the deep confined aquifer. Different time dependent geochemical parameters have been tested as dating tools: Cation ratios (Sr^{2+}/Ca^{2+}, Mg^{2+}/Ca^{2+}), $N–NO^{-}_{3}$, noble gas contents as paleotemperature indicators (Ne, Ar, Kr, Xe), radiogenic He, ^{13}C, ^{14}C, ^{18}O, ^{2}H, ^{3}H. Cation ratios and ^{13}C show the importance of incongruent dissolution processes in the Chalk aquifer. Water–rock interactions were taken into account in a multi-step dissolution model to determine radiocarbon groundwater ages. The oldest waters in the confined part of the Paris basin Chalk with maximum ^{14}C ages of 14,000 a B.P. contain pleistocene recharge components as can be shown by a stable isotope depletion and noble gas temperatures significantly lower than in recent groundwaters. Chalk waters at the Lägerdorf site in Northern Germany show a distinct stratification with respect to residence times and hydrochemistry.