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Origin and geochemical evolution of porewater in clay aquitards in North Jiangsu coastal plain, China

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Decline of groundwater levels, resulting in water pressure decreasing, skeleton pressure increasing and porewater releasing from clay aquitards under these conditions, may cause the change of groundwater quality. This study provides insights into the origins and geochemical interactions of porewater in unoxidized and nonfractured aquitards under the influence of groundwater declining. Field investigations were conducted and a borehole was drilled with a depth of 250m in North Jiangsu coastal plain, China. 138 porewater samples were collected for isotope analysis, and 44 water samples were extracted from the clay for major ion analysis. Porewater, changing with the TDS tested, showed large variations with depth through the aquitards from 0.3g/l to 26.0g/l. The water type could be classified into fresh water (<1g/l, SO4-Cl-Na, Cl-Ca-Na; 85-180m), brackish (1-3g/l, Cl-Na, Cl-Ca-Na; 35-80m, 180-250m) to saltwater(>3.0g/l, Cl-Na; 3-35m). The changing trend of salt-porewater was mostly accordant with the mixing line between fresh porewater and seawater end-members. Nevertheless molar Br/Cl ratios (3.7-6.5*10-3) were larger than those of seawater (1.5*10-3), and δ2H and δ18O values showed depleted isotopic signatures (between -1.0‰ and -3.5‰ and -19.1‰ and -29.3‰ respectively) compared to modern seawater, indicating that salt-porewater evolved from paleo-seawater that was more saline and subsequently diluted with fresher water over the long-term. However, fresh and brackish porewater did not coincide with the mixing line; δ2H and δ18O values were much lower than salt-porewater and below the global meteoric water line. Also, molar Br/Cl ratios (0-7.3) and the trend of δ18O with chloride contents manifested evapotranspiration might be the dominate mechanism of brackish formation. The deltas values of Na+ (<0), and Ca2+(>0), and molar Na/Cl ratios (<1) showed it probably occurred cation-exchange in salt-porewater and brackish relating to freshening, especially a strong exchange in salt-porewater. Then, it was not obvious the influence of geochemical interactions on fresh porewater , and it preserved paleowater signature. Key words: porewater , paleowater, isotope analysis, geochemical interactions, origins