The $\delta^{81}Br$ and $\delta^{37}Cl$ isotopic signatures and systematics of waters, evaporites and gases in the saline lakes of western Nebraska, U.S.A.

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Saline lakes and salt flats are capable of releasing a significant flux of reactive bromine into the atmosphere, a compound which is 45-70 times more efficient at ozone destruction than chlorine [1, 2]. A study conducted on a number of highly saline lakes in western Nebraska, USA provides the first dataset concerning the variability of bromine and chlorine stable isotopes in such an evaporative system. Evaporitic minerals, saline lake waters and shoreline gases were anlayzed over a four year time period. Several important processes that fractionate and alter the $\delta^{81}Br$ and $\delta^{37}Cl$ isotopic signature were documented during the study.

The alkaline lakes of western Nebraska formed as a result of fresh groundwater discharge and evaporation in a confined interdunal system. Composition of the most saline lakes is dominated by Na^+ and K^+ with variable amounts of Cl^- and SO_4^{2-} with alkalinities (HCO_3^-/CO_3^{2-}) between 10-200 g/L. Lake water $\delta^{81}Br$ and $\delta^{37}Cl$ isotopic values range from -0.5 to +2‰ vs SMOB and -1 to +1‰ vs SMOC respectively. A variety of salts have precipitated as salt crusts in and around these lakes. Salt $\delta^{81}Br$ and $\delta^{37}Cl$ isotopic values range from -1 to 0‰ vs SMOB and 0 to +1‰ vs SMOC respectively.

The analyses of bulk salt precipitates and corresponding lake samples showed that the salts preferentially sequestered the lighter ^{79}Br and heavier ^{37}Cl isotopes from the solution [3]. Captured gas samples taken from the shorelines adjacent to the alkaline lakes showed highly depleted values of $\delta^{81}Br$ isotopic signatures which ranged between -1.02 and -0.72‰ vs SMOB. This demonstrated that some process, suspected to be photochemical or microbial, may lead to an enrichment of $\delta^{81}Br$ in the lake shore soils as gases are released. Longer term evolution trends would favour lake waters to enrich in ^{81}Br and deplete in ^{37}Cl, through this and additional processes such as aeolian salt deflation

[1]Risacher et al. (2006) *Geochem et Cosmo Acta.* **70,** 2143-52. [2] Eggenkamp (2014) *The Geochemistry of Stable Chlorine and Bromine Isotopes.* Berlin:Springer [3] Hanlon et al. (2017) *Isotopes in Env and Health.* Manuscript in press