Novel application of lithium and its isotopes in marine ecotoxicology

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Lithium (Li) and its isotopes are poorly documented in aquatic ecosystems, despite its massive and increasing industrial production, essentially for batteries, ceramics and medicine [1-2], and its potential in paleoceanography [3]. Here, we present field measurements and laboratory experiments that evidence Li accumulation and isotope fractionation in marine organisms. Li concentrations were analyzed in 433 organs or whole organisms (soft parts) of bivalves, cephalopods, crustaceans and fish from 3 oceans. Li concentrations and isotope ratios were also followed in soft tissues of mussels exposed in laboratory conditions for 5 days to different dissolved Li concentrations. Field results show that tissue Li in marine organisms range from 0.005 to 1.203 µg/g, with an average of 0.15 (±0.17) µg/g. Results also evidence a systematic biodilution of Li along trophic chains, from bivalves (Li-rich) to carnivorous fish (showing the lowest Li levels). Among organs, significant differences are observed too. Higher Li concentrations are measured in gills and kidneys, suggesting a key role of the Na-H Exchangers activity on Li transport. Experimentally, cultured mussel soft parts display δ^7Li values systematically higher than seawater, contrasting to most fossil and modern shells measured thus far [4]. Li isotope fractionations between mussel and solution increase with the aqueous Li contents, and are modeled by increasing Li excretion *vs.* uptake rate ratio. Our model also shows that Li transport favors the light ^{6}Li isotope. Overall, these results show that Li and Li isotopes are promising in ecotoxicology and will help to better apprehend the impact of biological activity on fossile signatures.

[1] Choi et al. (1998) *Nat. Commun.* **10**, 5371–5378 [2] Léguérinel et al. (2018) *COMES seminar* [3] Misra and Froelich (2012) Science. **335**, 818-823 [4] Dellinger et al. (2018) *Geochim. Cosmochim. Acta*. **236**, 315-335.