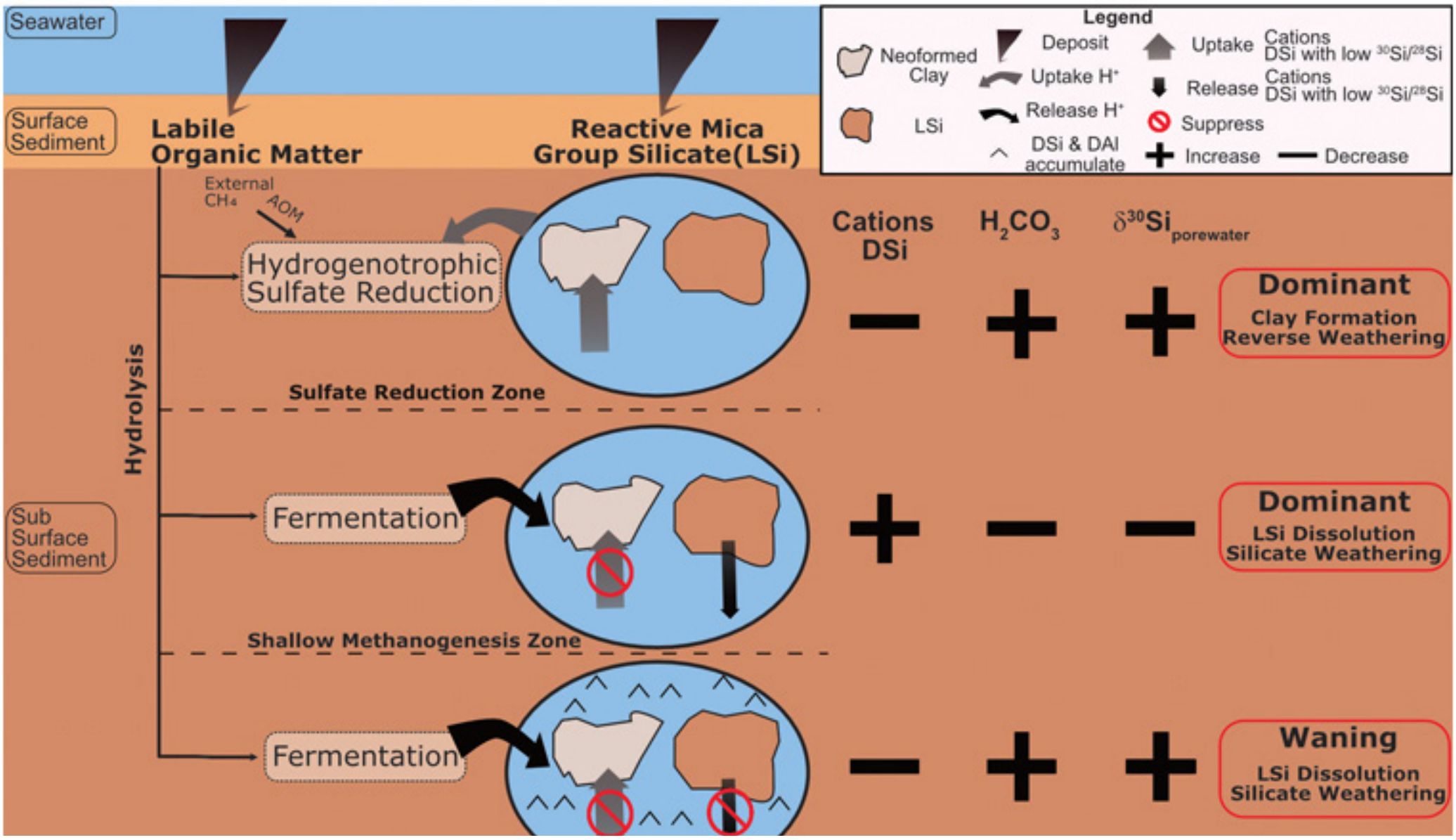

Constraining marine silicate alteration in the Ulleung Basin (East/Japan Sea) using stable Si isotope and reaction transport modelling

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Time & place: January 23, 2025 at 15h00. William-Olsson lecture hall, Geohuset –

Marine silicate alteration impacts long-term carbon cycling through lithogenic silicate (LSi) dissolution, which consumes carbonic acid (H_2CO_3) and results in marine silicate weathering. Clay formation, on the other hand, produces H_2CO_3 in a process known as reverse weathering. Their net effects on H_2CO_3 of both processes are however poorly constrained due to limited understanding of the responsible silicate phases and control of their alteration. This study addresses these by investigating the coupling between marine silicate alteration using Si isotope signatures ($\delta^{30}Si$) of porewater and solid Si phases, including LSi, biogenic silica, and amorphous secondary Si phases in two drill cores from the Ulleung Basin. This area exhibits high porewater total alkalinity (up to 131 meq L^{-1}) as a result of net LSi dissolution. The results conclude that marine silicate weathering is primarily driven by the dissolution of phyllosilicates, potentially the mica group silicates in the Ulleung Basin. This is evident from elemental content (Si, K and Al) as well as $\delta^{30}Si$ of the reactive LSi phase in sediments. Numerical modelling supports such an inference and further reveals shifts in the downcore predominance of LSi dissolution to clay formation corresponding to major early diagenetic zones. The collective results demonstrate the diagnostic potential of porewater $\delta^{30}Si$ in tracing marine silicate alteration and unveil the complex interplay among marine silicate alteration, microbial processes, porewater pH, and aluminium availability.

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