

Pu-I-Xe and the timing of early mantle degassing

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^{244}Pu and ^{129}I are now extinct radionuclides (half-life = 16 and 82 Myrs respectively) that produced ^{129}Xe and $^{131-136}\text{Xe}$ isotopes shortly after the formation of our Solar System. Therefore xenon isotope systematics of the mantle and the atmosphere provide a potential chronometer of volatile depletion and the formation of the atmosphere. Our re-evaluation of the Xe-Xe age in a simple two stage model suggests that the xenon budget of the atmosphere is only consistent with higher initial $^{244}\text{Pu}/\text{U}$ content than the frequently quoted initial value (0.0068 ± 0.001) [1]. However, literature data acquired on Xe and Nd abundances of angrite and eucrite meteorites suggests an even lower initial $^{244}\text{Pu}/\text{U}$ ratio of the Solar System ($\sim 0.0046 \pm 0.0016$) [2,3,4]. Here we present a model of mantle degassing and re-evaluate the applicability of the xenon chronometers and the origin of radiogenic xenon isotopes in the atmosphere. We discuss the interpretation of early atmospheres, the initial heavy xenon isotope signature of the silicate Earth and the probability and nature of late veneers on Earth. It is possible that the difference between the Earth's atmosphere and mantle merely reflects the difference between the $^{244}\text{Pu}/^{130}\text{Xe}$ and $^{129}\text{I}/^{130}\text{Xe}$ ratio of the late veneer and the mantle.

[1] Hudson G. B., Kennedy B. M., Podosek F. A., Hohenberg C. M., *19th LPSC*, 547 [2] Hagee B., Bernatowicz T. J., Podosek F. A., Johnson M. L., Burnett D. S., (1990) *GCA* **54**, 2847 [3] Marti K., Lugmair G. W. (1977) *EPSL*, 35, 273 [4] Jones J. H. (1982) *GCA.*, **46**. 1793

Experimental investigation of proton and cadmium adsorption by *mucin*, a commercially-available extracellular polymeric substance (EPS) analog

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Extracellular polymeric substances (EPS) produced by microorganisms play a key role in metal complexation and mineral precipitation as it often comprises the primary and highly reactive interface between microbial communities and their extracellular milieu. However, natural EPS, in addition to a polysaccharide matrix, may contain other constituents (i.e., proteins, lipids) that have made results from previous work on metal adsorption to EPS difficult to interpret. Accordingly, in this work we employ the commercial EPS-like polysaccharide *mucin* as an analogue for microbial EPS to better understand the role of EPS and its components in metal complexation and mineral precipitation reactions. We characterized surface site concentrations and acidity constants using potentiometric titration, and modelled the data using a two site model. Total surface site concentrations were 17.3 ± 1.07 mmol/g, higher than, but consistent with, previously-determined values for natural microbial EPS. Cd adsorption experiments were further conducted as a function of pH, and the results are best fit with a two-site surface complexation model with average log Cd-ligand stability constants of 2.72 ± 0.11 and 4.70 ± 0.18 . Our results indicate that high molecular weight polysaccharides may be responsible for the majority of ion binding in natural EPS.