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Spectroscopic investigation of cadmium sorption to oncoids.

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Oncoids are nodular coated grains that are formed by biological activity in water environments [1]. These grains are carbonate rich coated and most commonly produced by cyanobacteria. They result in concrete laminations that can trap organic, bioclastic, or lithostatic material [1]. There is a growing interest in preserving water quality, prevention of contamination and remediation of water systems. Once a metal contaminant enters into a system, it is important to understand how the minerals and microbes making up a system will react to the contaminant. In this study, we are interested in how oncoids, found in an alkaline lake in the Canadian Rockies, would take up metals in a contamination event. Oncoids were collected from a carbonate-rich mountain lake in western Alberta, Canada, near the town of Nordegg. The oncoid material was dissected and exposed to Cadmium (Cd), a highly toxic metal. The pH range studied was between pH 4-11. Following exposure, the oncoid was removed from the solution and the aqueous phase was analyzed by inductively coupled plasma optical emission spectroscopy (ICP-OES), while the oncoid was analyzed using Fourier transform infrared (FTIR) spectroscopy. An oncoid sample that was also not exposed to Cd was also exposed to the same pH range of the Cd experiments, as a control, where the aqueous phase was again analyzed by ICP-OES and the oncoid was analysed by FTIR spectroscopy. Raman spectrometry was also used to characterize variations in the Cd binding across the oncoid, before and after exposure to Cd. Adsorption of Cd by the oncoid was found to increase as a function of pH with 24% at pH 4 rising to as high as 96% at pH 11, however above pH 8 much of that removal from solution was related to Cd precipitation. Assessing how environmental components, such as oncoids take up metals, such as Cd, is important as it could inform us on possible syncs of metals, to improve water qualities and environmental hazards in present day contamination events, but also inform us of potential metal syncs in geologic history.

[1] Rodrigues, A.D., et al. 2020. Braz. J. Geol. 52 (2).