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Poster Session Day 3

Aqueous alteration on asteroid Ryugu: Insights from H-C-N-O and Mn-Cr isotope systematics

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Aqueous alteration processes on the progenitor body of the asteroid Ryugu are presented primarily on the basis of H-N-C-O and Mn-Cr isotopic data of the 16 representative particles returned by JAXA's Hayabusa2 mission. Most of the constituent minerals in these particles were formed by aqueous alteration on Ryugu's progenitor body [1], which occurred <4.1 Myr after the formation of the Ca-Al-rich inclusions [2]. Variations in $\delta^{18}O$ values are attributed to the modal abundances of the major oxygen storage phases (phyllosilicate, carbonate, magnetite), indicating that the fluid involved in aqueous alteration was not significantly different between two different sampling sites (TD1 and TD2), and the equilibrium temperature decreased from phyllosilicate to carbonate-magnetite formation processes at both sites. One exceptional particle (A0022 from TD1) has higher $\delta^{18}O$ values for bulk, carbonate and magnetite. In addition, while there is no significant difference in organic carbon $\delta^{13}C$ or bulk δD values for the 16 Ryugu particles, A0022 has a higher bulk $\delta^{13}C$ value. Furthermore, A0022 was found to be rich in dimethylglycine, a rare amino acid in extraterrestrial samples that can form under high partial pressures of CO_2 [3]. These results, together with the highest Mn/Cr and $\varepsilon^{53}Cr$ values on the Mn-Cr isochron of the Ryugu particles, suggest a significant involvement of ^{18}O- and ^{13}C-rich fluids from CO- or CO_2-rich ice in the alteration of the Ryugu progenitor body. TD1 particles showed higher carbonate-C/organic-C ratios and elemental fractionation compared to TD2, suggesting different fluid/rock ratios and CO or CO_2/H_2O ratios in ice components among Ryugu particles, influencing the evolution of organic matter on Ryugu's progenitor body.

References

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