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# Dehydration behaviour of $MgHPO_4$ $3H_2O$ (newberyite) under low pressures

**SHOGO TACHIBANA** AND YUKAKO MATSUMOTO
The University of Tokyo

Mg phosphates containing Na are the abundant phosphates in Bennu samples [1]. The Mg phosphates are amorphous and could be hydrated spectroscopically, while their cracked texture indicates that they may have experienced dehydration [1]. Similar amorphous Mg phosphates have been reported in Ryugu samples although they are rare [2, 3]. Mg phosphates could record the hydrous activity on the Bennu (and Ryugu)'s parent planetesimal and subsequent dehydration. However, their dehydration under low pressures is not yet fully understood (there have been TG-DTA studies at 1 atm [e.g., 4]). Here we report dehydration behavior of $MgHPO_4$ $3H_2O$ (newberyite), a possible Mg-phosphate in Bennu [1], under low pressures.

About 0.2 mg of synthetic $MgHPO_4$ $3H_2O$ powder was heated for 0–70 hours at 50–300°C and at ~200 or ~$10^{-4}$ Pa in vacuum furnaces (Thermo-Riko GFA430VN). The ~200 Pa experiments were done for better temperature control at lower temperatures. The ~$10^{-4}$ Pa experiments were done to check the total pressure effect on dehydration and for better simulation of dehydration on the surface of asteroids. The weight losses of the samples were used to evaluate the degree of dehydration (QMS analysis showed that $H_2O$ vapor is the dominant phase released from the sample).

We found that, under low pressure conditions, dehydration proceeds even at 50°C, lower temperatures than in 1-atm studies. No change in dehydration degrees was observed between 200 and $10^{-4}$ Pa. We also found that dehydration under low pressures led to amorphization of Mg-phosphate. Time-series experiments showed that there may be temperature-dependent upper limits on the dehydration degree and that complete dehydration occurred at 300°C in this study. The upper limits may appear due to the increase of bonding energy between $H_2O$ and Mg along with $H_2O$ loss. The $H_2O$ content of Mg phosphates may thus record heating processes after aqueous alteration (e.g., heating on the asteroid surface).

[1] Lauretta D. S., Connolly H. C. Jr. et al. (2024) *MaPS* doi.org/10.1111/maps.14227 [2] Nakamura T. et al. (2022) *Science* **379,** eabn8671. [3] Ma C. et al. (2022) *84th MetSoc* #6134. [4] Frost R. L. et al. (2012) *J. Therm. Anal. Calorim.* **107,** 1143.