

*Supplementary Information for:*

**Catalyzed Synthesis of Zinc Clays by Prebiotic Central Metabolites**

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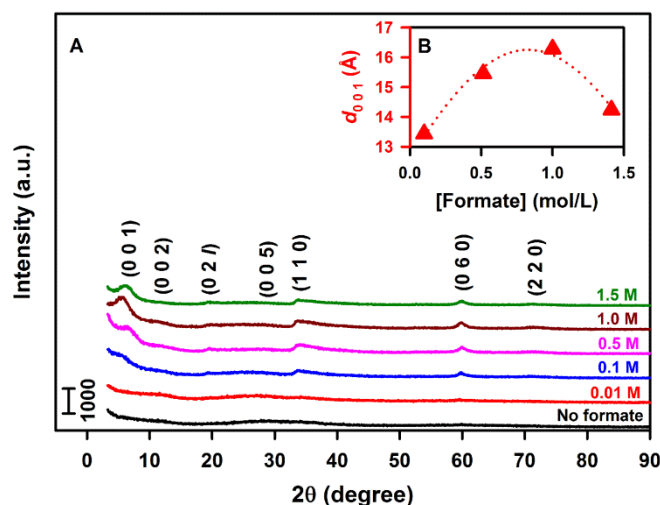
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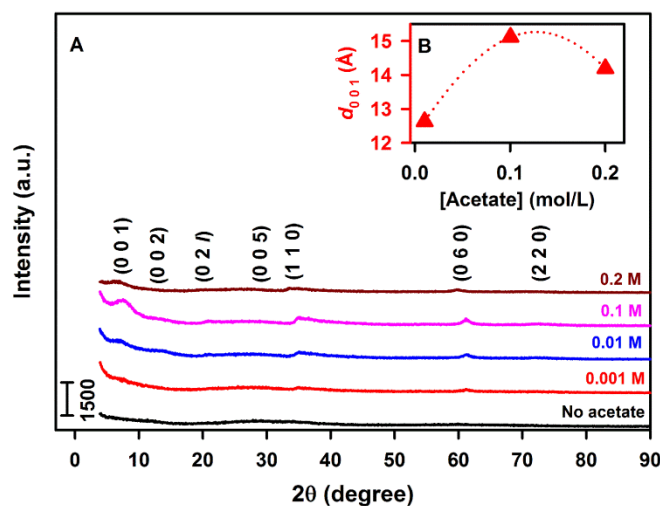
Number of *SI* pages: 7

Number of *SI* figures: 9

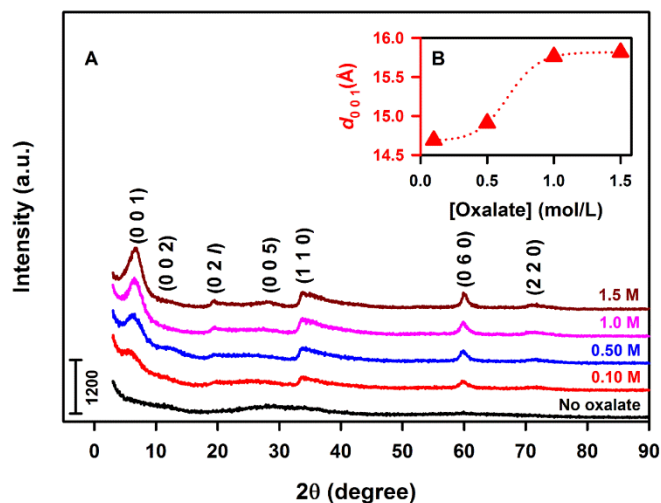
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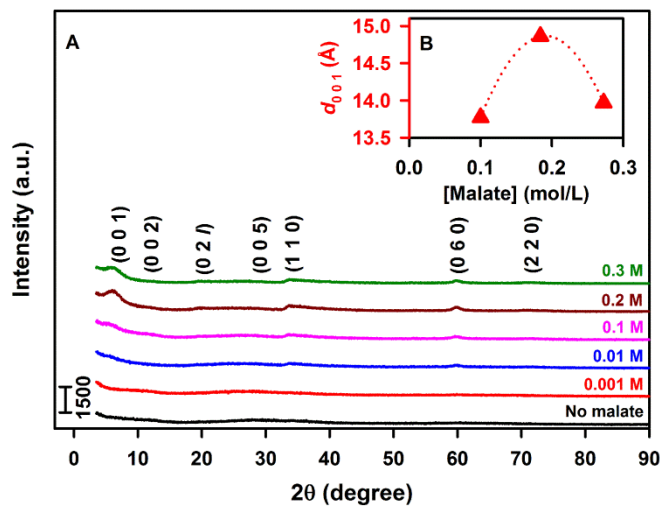
**Figure S1.** (A) Powder XRD diffractograms of saunonite synthesized at pH<sub>0</sub> 6.3 at 90 °C during 20 h under the variable [formate] listed above each trace. Subscript numbers, e.g., (0 0 1), indicate basal reflections of the identified phases. (B) The layer to layer distance for 2:1 saunonite ( $d_{001}$ , red solid triangle) for traces in (A) vs [formate].



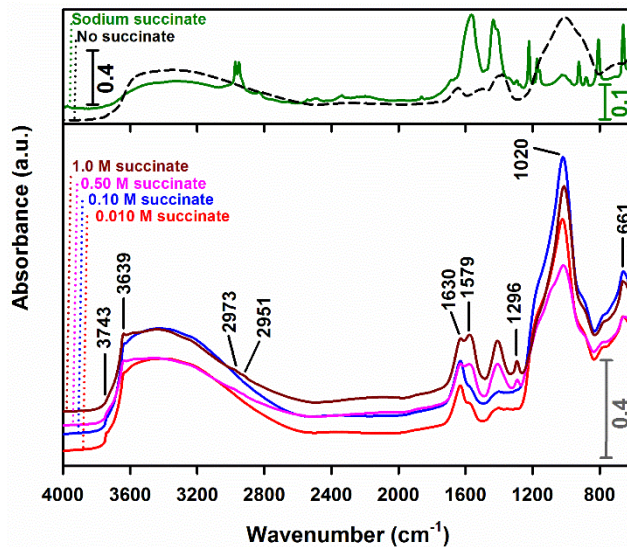
**Figure S2.** (A) Powder XRD diffractograms of saunonite synthesized at pH<sub>0</sub> 6.3 at 90 °C during 20 h under the variable [acetate] listed above each trace. Subscript numbers, e.g., (0 0 1), indicate basal reflections of the identified phases. (B) The layer to layer distance for 2:1 saunonite ( $d_{001}$ ) for traces in (A) vs [acetate].



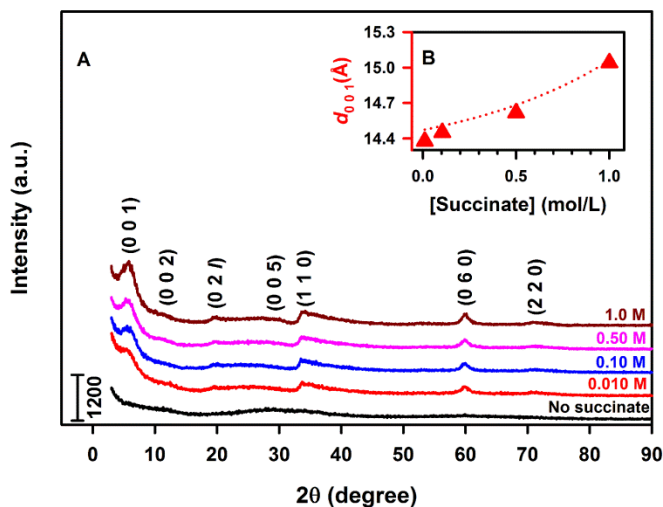
**Figure S3.** (A) Powder XRD diffractograms of saucanite synthesized at pH<sub>0</sub> 6.3 at 90 °C during 20 h under the variable [oxalate] listed above each trace. Subscript numbers, e.g., (0 0 1), indicate basal reflections of the identified phases. (B) The layer to layer distance for 2:1 saucanite ( $d_{001}$ ) for traces in (A) vs [oxalate].



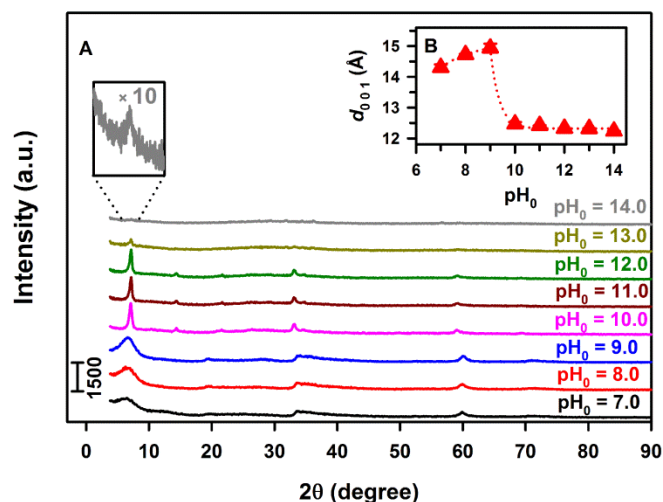
**Figure S4.** (A) Powder XRD diffractograms of saucanite synthesized at pH<sub>0</sub> 6.3 at 90 °C during 20 h under the variable [malate] listed above each trace. Subscript numbers, e.g., (0 0 1), indicate basal reflections of the identified phases. (B) The layer to layer distance for 2:1 saucanite ( $d_{001}$ ) for traces in (A) vs [malate].



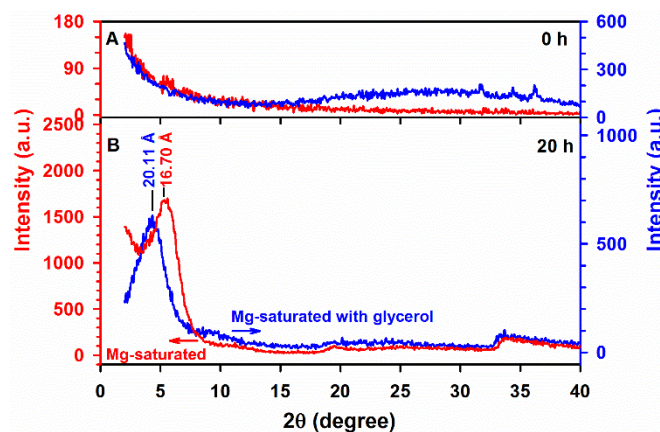
**Figure S5.** DRIFT spectra of saunonite synthesized under variable [succinate] for the same conditions of Figure 1 (20 h at pH<sub>0</sub> 6.3 and 90 °C) compared to sodium succinate and the starting gel.



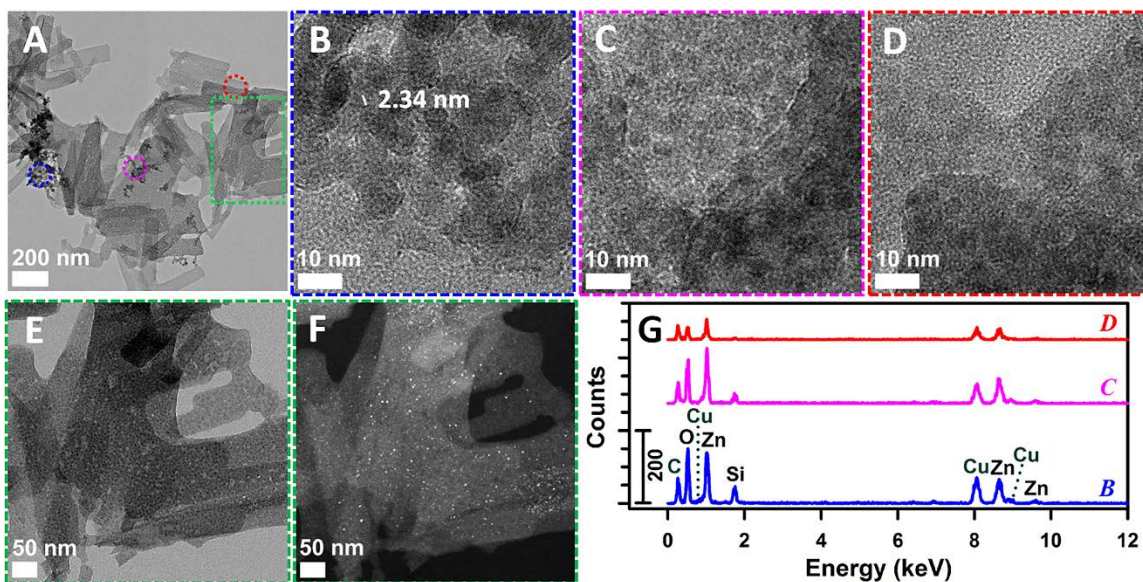
**Figure S6.** (A) Powder XRD diffractograms of saunonite synthesized at pH<sub>0</sub> 6.3 at 90 °C during 20 h dried under room temperature instead of in the oven as in the other Figures. The variable [succinate] is listed above each trace. (B) The layer to layer distance for 2:1 saunonite ( $d_{001}$ ) vs [succinate].



**Figure S7.** (A) Powder XRD diffractograms of saunonite synthesized with 1.0 M succinate at 90 °C during 20 h under the variable pH<sub>0</sub> values indicated over the traces. (B) The layer to layer distance for 2:1 saunonite,  $d_{001}$  from  $2\theta = 5.82^\circ$  is (A) vs pH<sub>0</sub>.



**Figure S8.** XRD patterns of (red) Mg-saturated and (blue) Mg-saturated with glycerol of synthesized saunonite with 1.0 M succinate at pH<sub>0</sub> 9.0 and 90 °C for timepoints at (A) 0 and (B) 20 h.



**Figure S9.** Transmission electron micrographs (TEM) and energy dispersive X-ray spectra (EDS) of initial gel with 1.0 M succinate and pH<sub>0</sub> 9.0 before starting reflux showing morphologies in different parts. (A) Large region showing the inhomogeneity of the gel with four demarked sections displayed in close-ups: (B) blue circle for thick-agglomerated microspheres; (C) pink circle for thin-agglomerated microspheres; (D) red circle for a more translucent region without microspheres; and (E and F) green square for the bright and dark field modes of a translucent region contrasting the presence of nanoscopic nuclei in the bulk structure but not on the surface. (G) EDS for the close-ups in panels A, B, and C.

**Video M1.** Different rotational views of the sample in Figure 7 after 20 h of synthesis.

**Video M2.** Different rotational views of the sample in Figure 7 after 20 h of synthesis.

**Video M3.** Tomograms of the sample displayed in Figure 7 after 20 h of synthesis.

**Video M4.** Tomograms of the sample displayed in Figure 5 after 20 h of synthesis.