



Figure S3. Mn oxides produced by *Hydrogenophaga* sp. and associated selected area diffraction patterns (SAED). **(A)** Initial Mn infillings comprising nanoscale wavy sheets. The associated SAED pattern had diffuse diffraction rings, and weak reflections at ~ 7.2 and ~ 3.6 Å that fit well with the (001) and (002) basal planes in birnessite. There were also weak reflections at ~ 2.1 , ~ 1.7 and ~ 1.4 Å but the characteristic ~ 2.4 Å (100) reflection that originates from within the MnO_6 octahedral layers in phyllosulfates was absent. Instead there were comparatively strong reflections at 3.0 and 2.6. **(B)** Blade-shaped precipitates. The polycrystalline SAED pattern has reflections of randomly oriented crystallites at 8.5, 6.0, 4.8, 4.1, 3.5, 3.0, 2.6, 2.2, 2.1, 1.7 and 1.4 Å. Overall, these reflection points correspond reasonably well with todorokite.