

Supplementary Materials for **Controlled hydroxyapatite biomineralization in an ~810 million-year-old unicellular eukaryote**

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Published 28 June 2017, *Sci. Adv.* **3**, e1700095 (2017)

DOI: 10.1126/sciadv.1700095

The PDF file includes:

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- Legend for table S1

Other Supplementary Material for this manuscript includes the following: (available at advances.sciencemag.org/cgi/content/full/3/6/e1700095/DC1)

- table S1 (Microsoft Excel format). All geochemical and geochronological data presented in the paper.

Supplementary Materials

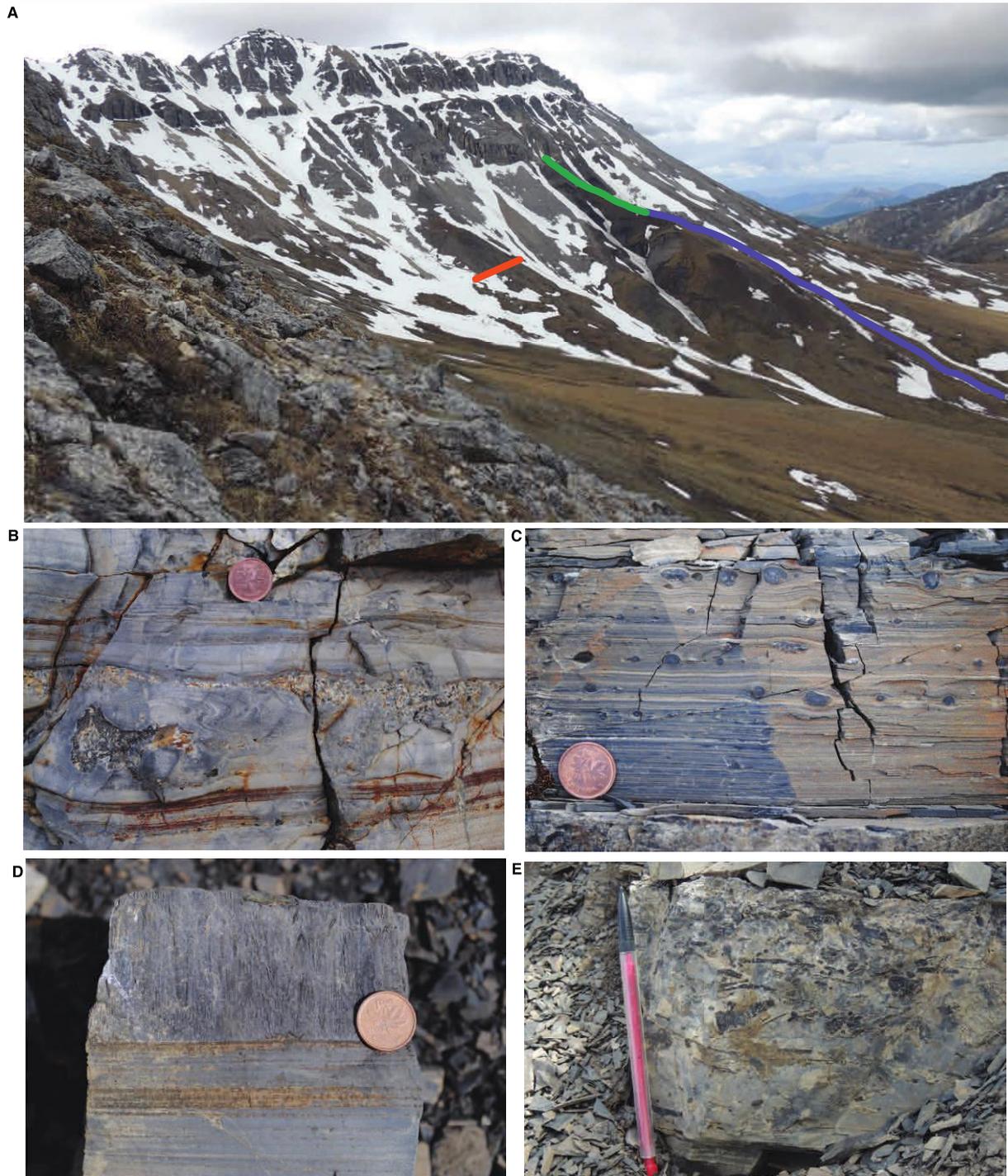


fig. S1. Stratigraphy and sedimentology at Mount Slipper. (A) Fifteenmile Group exposure at Mount Slipper looking SW into Alaska. The approximate path of the measured section plotted in Fig. 1 up to

~400 m is marked in blue; the upper section was measured along strike out of this view. The fossiliferous interval is highlighted in green and the dated Re-Os horizon is marked in red. **(B)** Planar-laminated lime mudstone interbedded with discontinuous matrix-supported rudstone. Note the intense soft-sediment deformation beneath the rudstone horizon. Coin for scale is 2.54 cm in diameter. **(C)** Millimeter-scale planar lamination punctuated by small chert nodules in lime mudstone and calcisiltite of the Fifteenmile Group. ASMs are found in both the chert nodules and macerates from the laminated carbonate strata. Coin for scale is 2.54 cm in diameter. **(D)** Centimeter-scale carbonate-replaced gypsum precipitates within the fossiliferous interval. Coin for scale is 2.54 cm in diameter. **(E)** Reworked tabular clasts of chert and *in-situ* chert nodules suspended in light-grey laminated lime mudstone and calcisiltite of the Fifteenmile Group. Pencil for scale is 14.8 cm long.

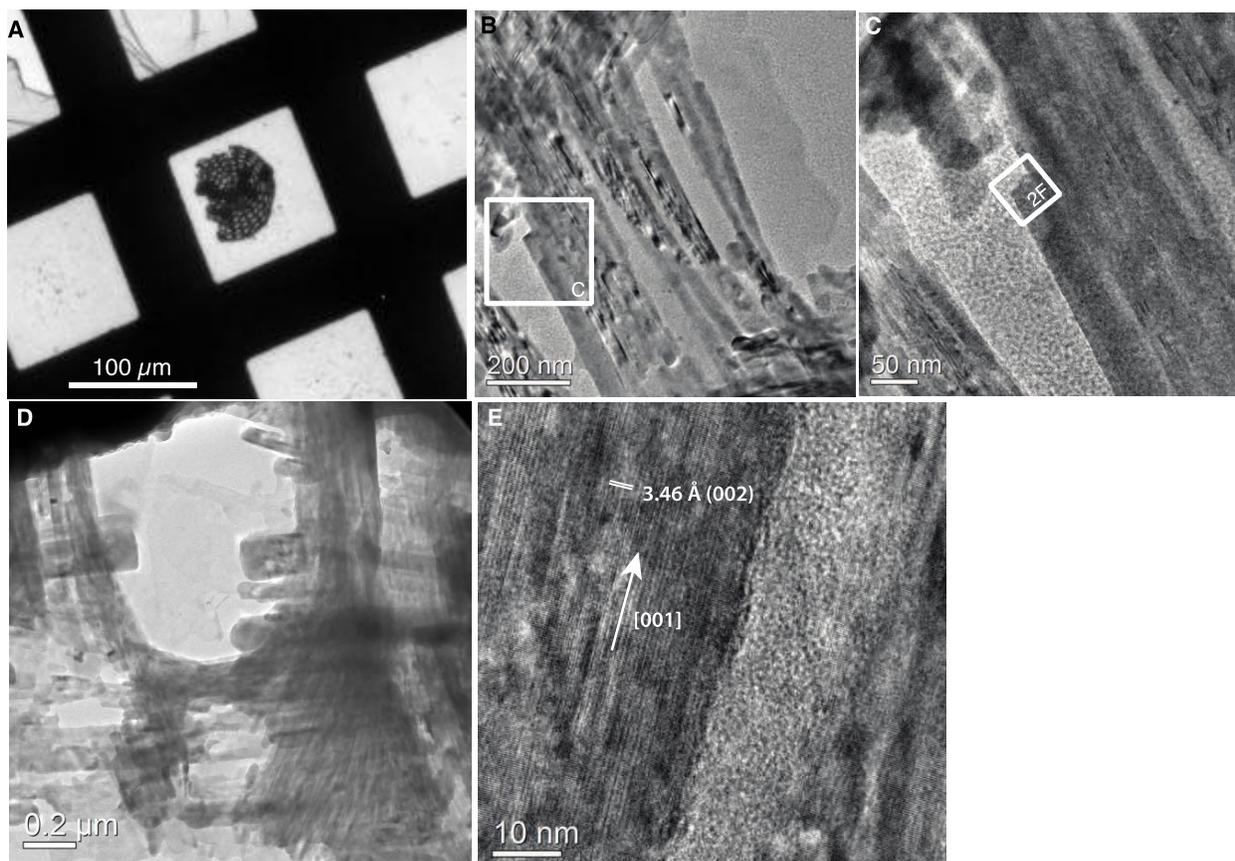


fig. S2. Additional TEM and HR-TEM images of an ASM specimen. (A) Low magnification overview image showing scale on Formvar coated copper grid. (B) Image of HAP fibers connecting two open ovoid pores in meshwork structure of specimen. (C) Higher magnification image of area highlighted in (B) showing single HAP crystals analyzed and imaged in Fig. 2F of the manuscript; crystal source for SAED in Fig. 2F inset. (D) Low magnification image of ovoid pore of HAP meshwork structure. (E) High magnification image showing lattice fringes with 3.46 angstrom spacing corresponding to the (002) HAP lattice plane. [001] direction is indicated with arrow, which corresponds to the elongation direction of the crystal and indicates the direction of highest growth rate during crystallization.

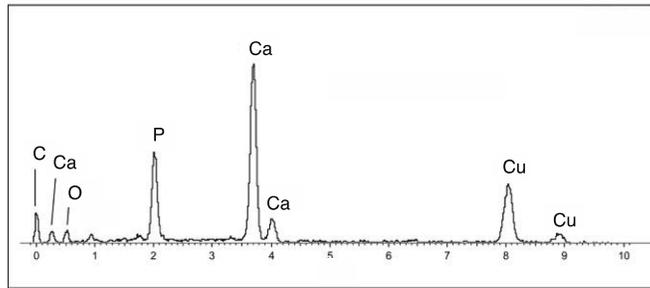


fig. S3. Energy-dispersive x-ray spectrograph of an ASM sample. Data shows presence of C, Ca, P and O, and the absence of other elements above detection limit, including Cl or F, which are present at the several weight percent level in diagenetic chloro-fluoro-apatite (francolite). Cu is from sample coating.

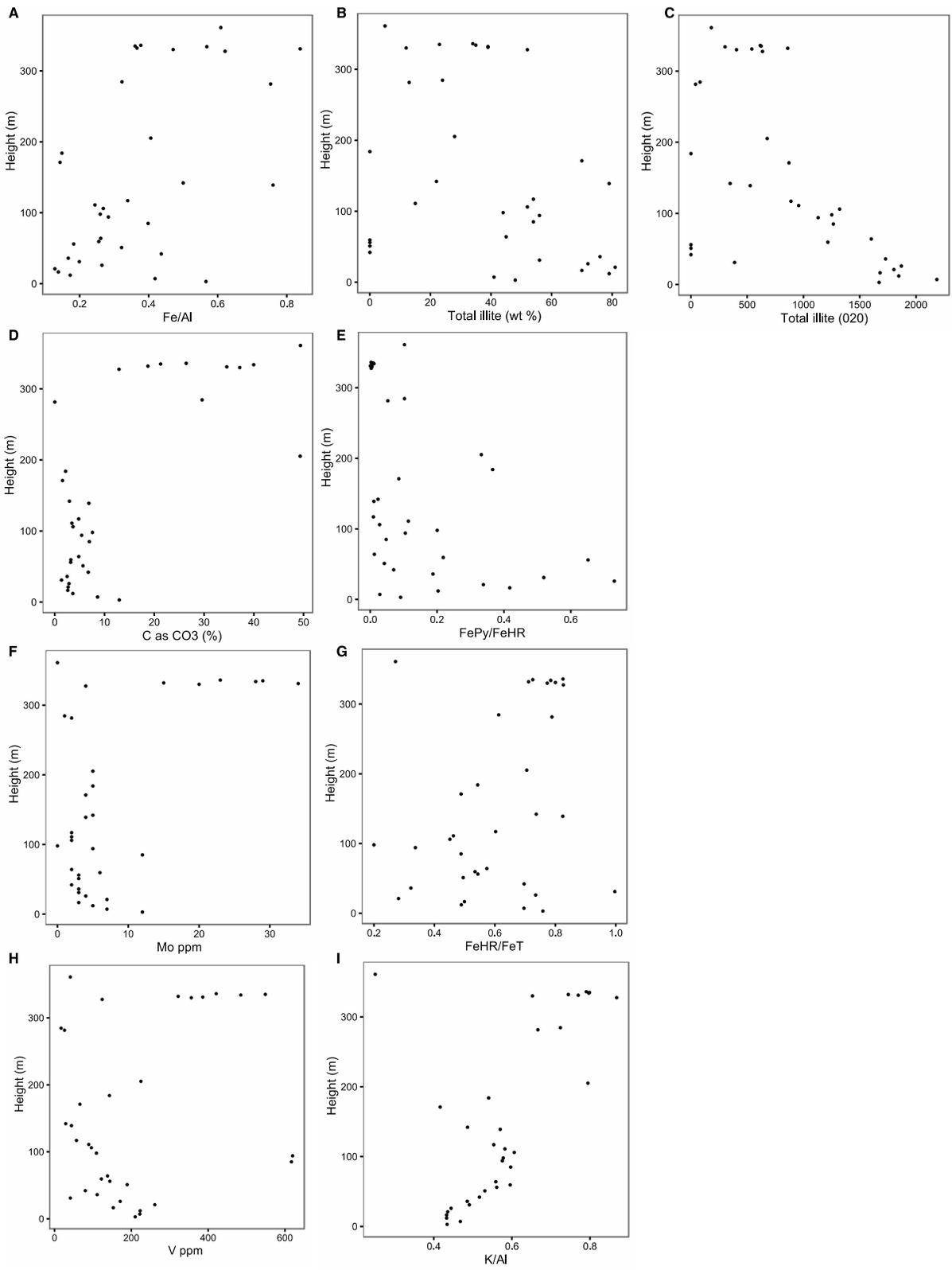


fig. S4. Additional geochemical and mineralogical data for Mount Slipper. (A) Fe/Al ratio. (B) Total illite as weight percent. (C) Total illite (020). (D) Percent carbon as CO₃. (E) Pyrite to highly reactive Fe ratio. FePy/FeHR does not exceed 0.8, indicating ferruginous conditions. (F) Mo ppm. (G) Highly reactive Fe to total Fe ratio. The FeHR/FeT ratio generally exceeds 0.38 indicating deposition from a dominantly anoxic water column. (H) V ppm. (I) K/Al ratio. Data for (A), (D-I) from (18).

table S1. All geochemical and geochronological data presented in the paper. Uploaded separately as Excel file