Fig. S1. Geological map of the study area (Left) and regional map (Right) showing location of study area. (Right is modified from ref. 1).

Fig. S2. Evolving morphology of encrusting/domical stromatolite through bed 1 at Anchor Ridge. (Left) Outcrop photo of encrusting/domical stromatolite. Numbered increments on scale rule = 10 cm. (Right) Sketch map of the outcrop in Left, showing geometry of laminae. Dotted lines represent cm-high palisade (crystal) layers. Uppermost strata shown consist of large, acicular crystal pseudomorphs. Locations of images in Figs. 1 and 2 and Fig. S3 are indicated.
Fig. S3. Fabrics in middle to upper strata of encrusting/domical stromatolites studied at Anchor Ridge. (a) Outcrop showing horizontal lamination overprinted by large crystal pseudomorphs that grew in the subsurface. (b) Polished slab showing acicular crystal pseudomorphs. The slight radiating habit of the crystals leads to a lanceolate (thin, elongate leaf-shape) appearance of crystals in this face, which was cut perpendicular to bedding. (c) Polished slab showing side of an encrusting/domical stromatolite at the level where precipitated fabrics (arrow) become abundant. (d) Polished slab showing basal section of acicular crystal pseudomorphs. (e) Polished slab showing detail of precipitated fabric on side of an encrusting/domical stromatolite. (f) Polished slab showing detail of precipitated layer on the paleohorizontal surface of an encrusting/domical stromatolite. (Scale bars: ~1 cm.)
Fig. S4. Dolomite microfabrics in thin section view, plane polarized light. (a) D1 dolomite. (b) D2 and D3 (euhedral) dolomite with chert. (c) D2 dolomite around larger dolomite crystals. (d) D2 dolomite at the margin of D1 dolomite crystals.
Fig. S5. Representative Raman spectrum of organic-rich lamina in encrusting/domical stromatolite, showing quartz, dolomite, and disordered carbonaceous material (G and D bands in the carbon first-order region). Acquired with a Renishaw MicroRaman Spectrometer with an argon ion laser (514.5 nm).
Fig. S6. Cuspate swale stromatolite fabrics in outcrop and polished slab. (a) Cross-section view of stromatolite in outcrop. Frame is ~40 cm wide. (b) Intercolumn space with low-angle cross-lamination (outcrop, cross-section view). Ruler at base is 15 cm long. (c) Left-hand margin showing transition from stromatolite fabric to interspace fabric. (d) Polished slab showing fabric at the stromatolite's apex. (e) Scan of a polished slab showing transition of fabrics at stromatolite margin: stromatolite apex to the left.