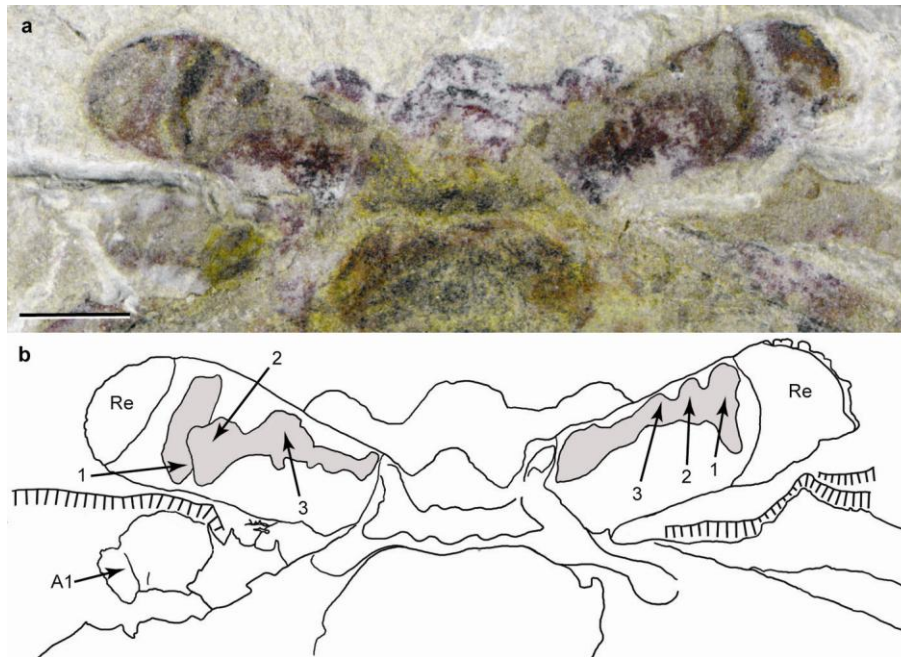


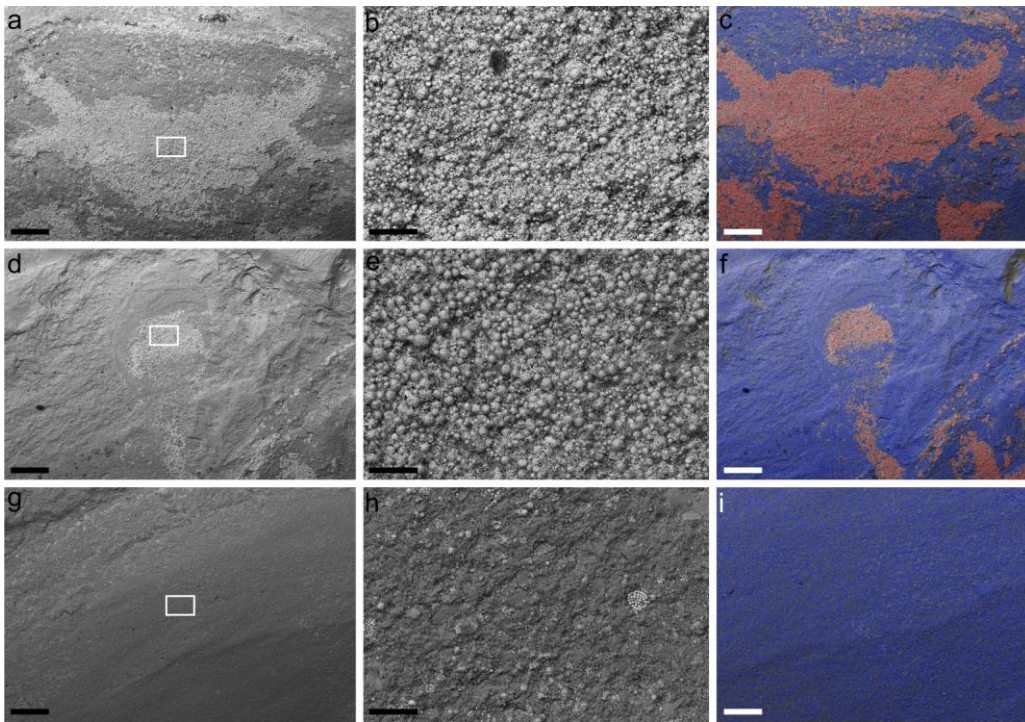
SI Figure 1. *Fuxianhuia protensa*. **a**, Eye stalks and head capsule of YKLP 15006 (Fig. 2a-c). Blue, green and carmine have been desaturated to provide maximum contrast between the fossil and matrix. **b**, Tracing of neural areas, with three successive swellings (1-3) in the eye turrets indicative of nested optic neuropils. Scale bar, 1 mm.



SI Figure 2. *Fuxianhuia protensa*. **a**, Head and eye stalks with putative neural areas. In this specimen (YKLP 11324), pale coloured areas in the eye stalks correspond to successive optic lobe domains, which are shown as grey areas (numbered 1-3) in the tracing. **b**. A1, antenna; Re, retina. Scale bar, 250 μm .



SI Figure 3. Eyestalks and active vision in *Fuxianhuia protensa*. **a**, Paired eyes of specimen YKLP 11324. **b**, Paired eyes of specimen YKLP 11325. **c**, Interpretive diagram showing variation in the attitude of the eyestalks in different specimens. Specimens in **a** and **b** show the extent of eyestalk convergence from their extended positions laterally to their frontal positions, as diagrammed in **c**. Differences in the profiles of the compound eye margins (**c**) further suggest rotation of each the eyestalk around its long axis by about 15° - 25° (counterclockwise right, clockwise left). The maximum lateral-forward eyestalk extension is approximately 80° in the horizontal plane. Scale bars, 1 mm.



SI Figure 4. SEM and EDX analysis of YKLP 15006 (Fig. 2a-c) showing brain and optic lobes as areas of iron enrichment. a-c, brain; d-f, optic lobe; g-i, head shield. a, d, g, Back-scattered electron micrographs; b, e, h, Close up back-scattered electron micrographs of areas indicated by boxes in b, e, h, respectively, showing dense framboids in brain (b) and optic lobe (e) that are sparse on the cuticular surface of the head shield (h); c, f, i, EDX combined element maps (Fe = red, Si+Al = blue) showing iron enrichment in the brain (c) and the optic lobe (f), in contrast with the head shield (i). Scale bars, a, c, d, f, g, i = 500 μm , b, e, h = 50 μm .