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One kilometre-thick ultramylonite, Sierra de Quilmes, Sierras Pampeanas, NW Argentina

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12 **ABSTRACT**

13 We describe a 1km-thick ultramylonite forming the high strain base of the >3.5 km thick El
14 Pichao shear zone in the Sierra de Quilmes. This shear zone thrusts granulite facies
15 migmatites onto amphibolite facies rocks during the 470 Ma Famatinian orogeny. Strain
16 grades upwards from ultramylonites to weakly sheared migmatites across the 3.5 km zone
17 and the mylonitic rocks define a geochemical field narrower than the protolith suggesting
18 they underwent mixing and homogenization through shearing. Ultramylonites this thick are
19 uncommon. The width of a shear zone, in the absence of significant compositional
20 rheological contrasts controlling strain localization, is controlled by the balance between
21 shear heat generation and diffusion. Under typical crustal conditions a strain rate of 10^{-12}s^{-1} is
22 required to form a 1 km-thick ultramylonite, and this is achieved when large movement
23 velocities are imposed across the shear zone. We postulate that the El Pichao shear zone and
24 its thick ultramylonite accommodated a significant fraction of convergence velocities driving
25 the orogeny, and that the wide mylonitic shear zones characteristic of the Cambrian-
26 Ordovician deformation of the Sierras Pampeanas result from the convergent movement
27 being taken up by only a few active major shear zones.

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