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Correction to “Constraints on the stress state of the San Andreas Fault with analysis based on core and cuttings from San Andreas Fault Observatory at Depth (SAFOD) drilling phases 1 and 2”

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[1] In the paper “Constraints on the stress state of the San Andreas Fault with analysis based on core and cuttings from San Andreas Fault Observatory at Depth (SAFOD) drilling phases 1 and 2” by Sheryl Tembe, David Lockner, and Teng-fong Wong (*Journal of Geophysical Research*, *114*, B11401, doi:10.1029/2008JB005883, 2009), a factor of 2 was missing in the expressions for the normal stress and pore pressure in equations (4) and (5). The expression $r\mu \sin^2\psi$ in these equations should be replaced by $2r\mu \sin^2\psi$. Accordingly, the correct relations should be

$$\sigma_n = p_o + \left[\frac{\sqrt{1+\mu^2}+\mu-2r\,\mu\sin^2\psi}{\sqrt{1+\mu^2}-\mu}\right](\sigma_V - p_o) \quad (1)$$

$$p_f = p_o + \left[\frac{\sqrt{1+\mu^2}+\mu-r\,\mu\left(2\sin^2\psi+\sin 2\psi/\mu_f\right)}{\sqrt{1+\mu^2}-\mu}\right](\sigma_V - p_o) \quad (2)$$

Similar changes should be made in equations (A3), (A7), (D3), and (D4) in Appendices A and D. As noted in our paper, the contribution from this term is relatively small in cases we considered, since they typically involved a small angle ψ corresponding to near fault normal compression. Indeed this particular term was dropped subsequently in equations (6), (7), (A8), (A9), and (A10). The most significant impact is on Figures 3 and 8, which considered a broad range of angles. Here we present in Figures 1 and 2 the corrected plots according to equation (2) above.

[2] The normal stresses and pore pressures as presented in Figures 5–7 are slightly higher than the correct values given by (1) and (2) above. In our analysis, we fixed the fault angle ψ = 20° and assumed water and rock densities ρ_w = 1000 kg/m^3 and ρ_r = 2500 kg/m^3, and friction coefficient μ = 0.85. Hence, for the normal stresses plotted in Figure 5a, a very small correction of −3.17r MPa/km should be applied, where r denotes the stress ratio. This corresponds to linear increases of 0, −1.59, and −3.17 MPa/km for r = 0, 0.5, and 1, respectively. For the normalized pore pressures plotted in Figure 5b, 6b, and 7b a very small correction of −0.13r should be applied. This corresponds to constant increments of 0, −0.07, and −0.13 for r = 0, 0.5, and 1, respectively.

[3] It should be noted that since the effective normal stress $\sigma_n - p_f$ does not involve the $2r\mu \sin^2\psi$ term, all results pertaining to effective normal stress are not impacted by this error. In particular, our analysis of the coefficient of friction μ_f depends on only the effective normal stress, and therefore data in Figures 4, 5a, 6a, 7a, and B2 are correct as presented. For the same reason Figures 5c, 6c, and 7c require no correction.

[4] We thank S. Ghimire of Hokkaido University for alerting us to this minor error in our analysis.

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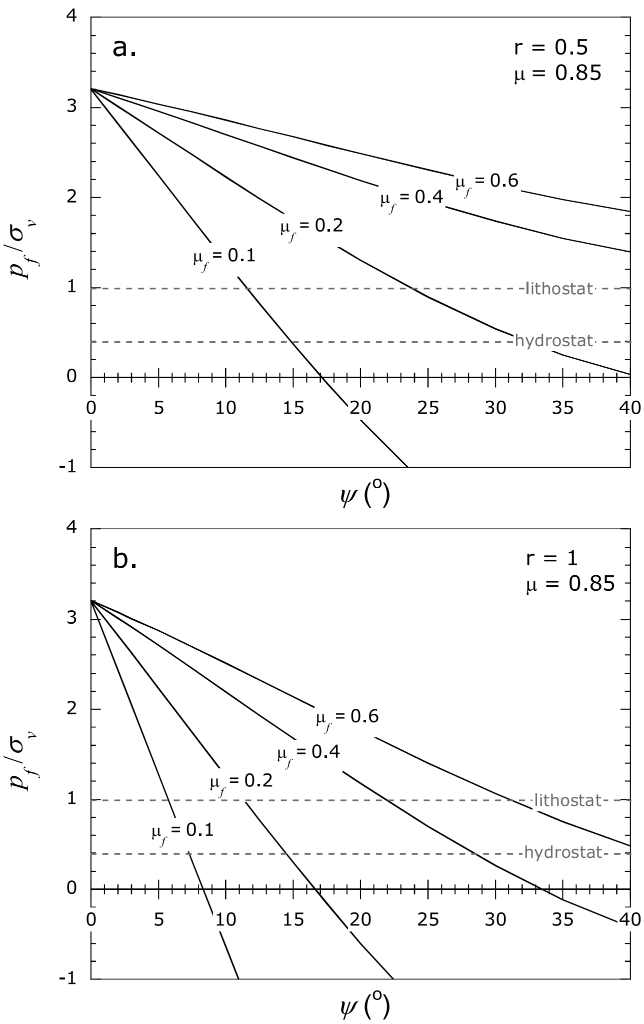

Figure 1. Hubbert-Rubey pore pressure coefficient $\lambda = p_f/\sigma_V$ for the fault zone as a function of the fault angle for a range of friction coefficients μ_f, with the country rock friction coefficient μ fixed at 0.85. The pore pressure coefficient was evaluated using equation (2) for two stress ratios: (a) r = 0.5 and (b) r = 1. The pore pressure excess is predicted to increase with increasing friction coefficient and decreasing fault angle. For reference, the Hubbert-Rubey coefficients corresponding to hydrostatic and lithostatic pore pressures are represented by the two dashed lines. Coefficient values below zero are not physically permissible.

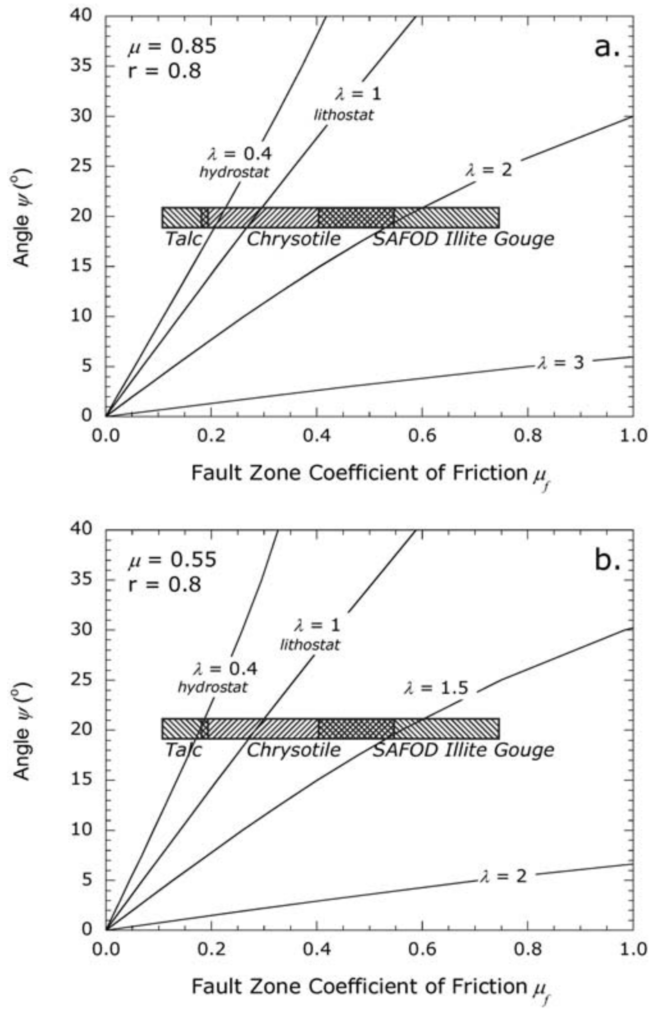

Figure 2. The control of gouge friction coefficient μ_f and fault orientation ψ over pore pressure in a critically stressed fault zone according to (2). Two different friction coefficients for the country rock were considered: (a) μ = 0.85, and (b) μ = 0.55. The shaded fields correspond to ranges of friction coefficient for the three gouge materials measured in the laboratory. The stress ratio is fixed at r = 0.8 and if we consider ψ = 20° as constrained by the latest SAFOD findings, then the modeled pore pressure is hydrostatic only if the fault zone has an abundance of relatively weak materials such as talc and chrysotile. If the stress state is such that r approaches 1 or if the fault orientation is such that ψ is significantly larger, then hydrostatic pore pressure may be viable for all three gouges, but then the shear stress will become so high that it is very difficult to satisfy the heat flow constraint on stress magnitude.