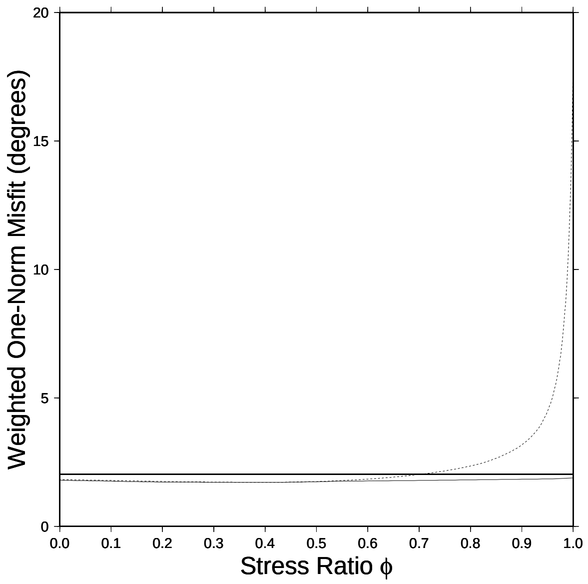

Figure 9. Results from the reanalysis of the *Qian and Pedersen* [1991] borehole breakout data. Plot of the weighted one-norm misfit as a function of ϕ, where the thick solid line is the 95% confidence limit (2.03°), the thin solid line is the minimized misfit when ϕ is held constant and the principal stress directions are unconstrained, and the dotted line is the misfit using the principal stress directions from the best fitting model.

most unconstrained about an arbitrary rotation about the S_1 axis.

In Figure 9 we plot the 95% confidence limit (thick solid line), the weighted one-norm misfit as a function of ϕ using the Euler angles from the best fitting model (dotted line), and the weighted one-norm misfit allowing the Euler angles to vary to minimize the misfit for a particular ϕ (thin solid line). The plot demonstrates that the stress ratio ϕ is unconstrained, since there exists a stress state that can be rotated in such a way to fit the borehole breakout data within the 95% confidence limits for any ϕ. We have created lower hemisphere stereographic projection plots of the 95% confidence misfit for nonoptimal ϕ values. These plots do not show any smaller confidence regions, a finding that is not surprising given that the minimum misfit as a function of ϕ is almost constant. Given the sparseness of the borehole orientations sampled by these data, the lack of constraint on ϕ is not surprising. However, the stress states that fit the data for any ϕ may not have a principal stress direction anywhere near vertical, so the mathematics of this fit does not take into account some of the geophysics of the problem.

The orientation of S_H determined by *Qian and Pedersen* [1991] and determined in this paper differ by only 1.6°. However, the remaining components of the stress state differ considerably. *Qian and Pedersen* [1991] found a strike-slip stress state with $\phi = 2/3$. We found a thrust faulting stress state with $\phi = 0.40$. The stress direction contour map (Figure 8) also shows that S_2 and S_3 may be allowed to rotate almost freely about the S_1 axis, thereby switching from a thrust faulting to a strike-slip environment. This finding is consistent with the observation that nondegenerate thrust and strike-slip faulting stress regimes can have very similar, nearly constant, breakout orientations for small deviations (Figure 2). *Qian and Pedersen* [1991] state that their inversion clearly shows a strike-slip stress regime. We feel that their conclusion is too strong, given their breakout data and the analysis presented here.

Qian and Pedersen [1991] also state that it is not feasible to relax the assumption of a vertical principal stress direction given their analysis of inversions of theoretical breakout data. However, there are several reasons why stress states with nonvertical principal stresses should be considered. First, the extra degree of freedom gives a clearer sense of how poorly or well constrained the stress state is from *Qian and Pedersen*'s [1991] data. Second, it allows a much better fit of the data. The weighted one-norm misfit of the data using *Qian and Pedersen*'s [1991] best fitting stress state