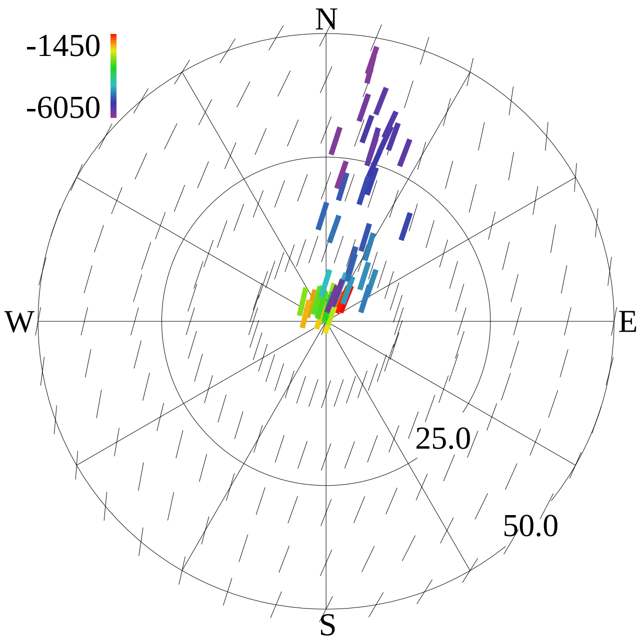

Figure 6. Compiled and processed data from the Sijan Deep Drilling Project in Sweden from *Qian and Pedersen* [1991] plotted on top of the theoretical breakout pattern for their best fitting stress state of $S_H/S_v = 1.2^{\infty}_{1.05}$ and $S_h/S_v = 0.6^{0.98}_{0.0}$, where S_H lies $108.4^{\circ}{}^{108.7^{\circ}}_{108.0^{\circ}}$ east of north. The nodal points for this stress state lie at a deviation of 90°; hence they do not show in this plot. A Poisson's ratio of 0.25 was used to calculate the breakout pattern. The vertical depth scale is in meters.

Since there are three error spaces, one for S_1, S_2, and S_3, we set S_{jj} to 2, $\phi+1$, and 1. We then find the third Euler angle that minimizes the misfit. This then generates three one-norm misfit data sets as a function of δ and ϕ, which we use to generate lower hemisphere contour maps of the 95% confidence misfits for the S_1, S_2, and S_3 axes.

When we vary the stress state ratio ϕ away from the minimum misfit and make the lower hemisphere contour plots of the 95% confidence misfit, we observe smaller enclosed 95% contour regions that are sometimes rotated away from their minimized locations.

Analysis of Qian and Pedersen's Borehole Breakout Data

As one test of our technique we reanalyze the borehole breakout data presented by *Qian and Pedersen* [1991] from the Sijan Deep Drilling Project in Sweden. The data are taken from Table 3 of *Qian and Pedersen* [1991] and are plotted in Figure 6. This table lists a depth range and the average borehole azimuth, deviation, and breakout orientation for that range. Also listed is the variance of the breakout direction in degrees over that interval. Figure 7 plots a histogram of the angular differences between the location of the high side of the borehole and the breakout angle as measured in the plane perpendicular to the borehole axis for all of the data. We see that the breakouts are clustered around the high side of the hole and could possibly be due to tool drag. Since we do not have the original caliper curves, we cannot apply our breakout selection technique to this data set, and we use the data set unmodified.

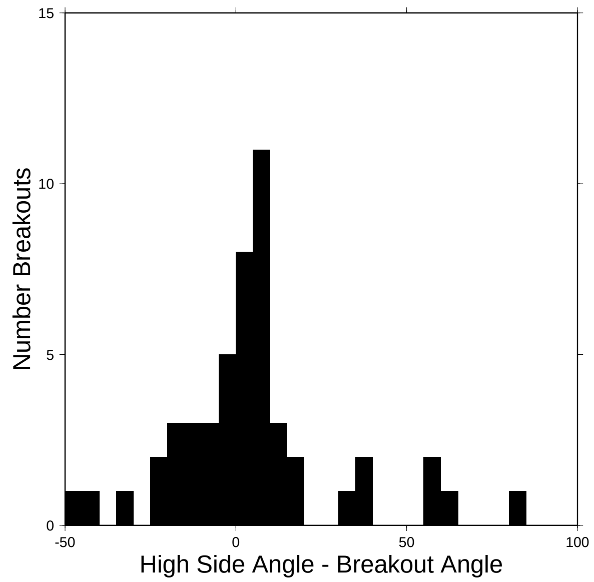

Figure 7. Histogram of the angular difference measured in the plane perpendicular to the borehole axis between the breakout orientation and the high and low sides of the borehole for the *Qian and Pedersen* [1991] data.

Qian and Pedersen [1991] applied a nonlinear inversion technique to their data, assuming a vertical principal stress direction with Poisson's ratio, ν, equal to 0.25. They found the stress state to be a strike-slip regime ($S_H > S_v > S_h$) with the maximum horizontal stress located $108.4^{\circ}{}^{108.7^{\circ}}_{108.0^{\circ}}$ east of north. The ratio of stresses was $S_H/S_v = 1.2^{\infty}_{1.05}$ and $S_h/S_v = 0.6^{0.98}_{0.0}$, which corresponds to a stress ratio ϕ of 2/3. The error bounds listed here are nonlinear error bounds calculated by varying the stress parameters until a large enough