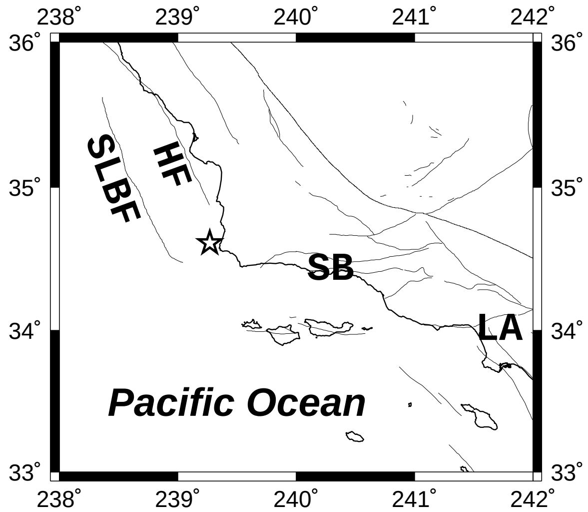

Figure 10. Location (star) of the Point Pedernales field in the offshore borderland along with some of the major Quaternary faults in the southern California region. LA, downtown Los Angeles; SB, Santa Barbara; SLBF, Santa Lucia Bank Fault; and HF, Hosgri Fault.

is 2.15°, which is outside our 95% confidence limit of 2.03°. Finally, there might be some breakout data sets in which the assumption of a vertical principal stress direction is invalid, leading to an improper understanding of a region's stress state. The cost of this extra degree of freedom is slight in comparison with the potential gain in understanding of stress states.

Borehole Breakouts in Point Pedernales, California

We applied our technique to determine the stress state in the offshore Santa Maria Basin, California, from wells drilled by the Unocal Company from an offshore platform in the Point Pedernales Oil field (Figure 10). The offshore Santa Maria Basin is an elongated, structural basin parallel to the California coast northwest of Point Arguello [*McCulloch*, 1987]. It lies between two NNW trending structural boundaries: a zone of east dipping normal faults, including the Santa Lucia Bank fault, on the west side, and the Hosgri fault on the east side. However, it appears to be stratigraphically continuous with the onshore Santa Maria Basin, east of the Hosgri fault, and to have experienced a similar Miocene deformational history [*Sorlien*, 1994].

The basal Tertiary section in the offshore Santa Maria Basin comprises volcanic rocks of probable early Miocene age which rest on basement and have been displaced by normal faults [*McCulloch*, 1987]. This volcanism and a subsequent phase of subsidence 18-16 Ma, documented by use of backstripping techniques in several wells in the region, have been attributed to the capture of the Monterey microplate by the Pacific plate [*Sorlien*, 1994] and the beginning of clockwise rotation of the Western Transverse Ranges [*McCrory et al.*, 1995]. This development was followed by slow thermal subsidence from ~16 to ~7 Ma [*McCrory et al.*, 1995]. Since 6 Ma the tectonics of this offshore region has been locally complicated because of an overall transpressional regime, which produced NE-SW directed shortening between 5 and 3 Ma and much slower deformation in Quaternary time [e.g., *Clark et al.*, 1991; *Crouch et al.*, 1984].

Unocal provided us with five paper logs of four wells from the Point Pedernales field. All four wells were drilled from the same platform and all of the dipmeter data lies within a 4.3 km radius of the platform. Table 2 lists the type of tool used to log the hole and some of the properties of the wells, including the logged depth interval, the depth interval of processed dipmeter data, and the maximum deviation of the well over the processed interval.

To analyze the well log data for the ambient tectonic stress, we ran the raw dipmeter data through a series of steps. The steps were as follows:

1. Digitize the paper logs and resample them to 0.125 m intervals.

2. Apply caliper calibration corrections to the caliper arm data for those wells in which the well log shows a caliper correction.

3. Compare the dipmeter's borehole azimuth data with the data from an independent directional survey of the hole (single-shot deviation surveys or gyroscopic logs). If the two data sets differ by roughly the magnetic declination (15°E for this location), then apply the declination correction to the dipmeter's borehole azimuth and pad 1 azimuth data. We applied the declination correction to A-1 and A-7. The data from A-13 and A-16 agreed with their directional surveys to within 5° and hence were not further corrected.

4. Calculate the borehole elongation direction, using the four- and six-arm technique described above. These data are plotted at every meter in Figure 11 as lower hemisphere stereographic projections of the borehole elongation. Also shown are enlargements of certain regions of the plot to better show the borehole elongation directions.

5. Select breakouts from the borehole elonga-