Core orientation – data QC as a key to discovery

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Core orientation tools have improved markedly in recent years. However, without good data QAQC these improvements cannot deliver the quality of data required for exploration success. The discovery of the Josh Vein, a large high-grade epithermal vein at the North Bullfrog Project in Nevada, has been attributed directly to our successful use of oriented core. The innovation presented in this paper is the methodology developed to create clean structural data used in real time to guide exploration.

There are several sources of error inherent in core orientation but the most important are the mark quality and the line quality. Together these errors are manifested in the lock angle between successive orientation lines. If undocumented these errors create scatter that can result in incomprehensible noise. Our methodology aims first to control the sources of error but even more importantly we document the errors so each structural measurement can be assigned a confidence value. In this way data quality can be taken into account when evaluating structural patterns.

The first step to gaining control of orientation line quality is to create an orientation log. This log should be generated while the core is in its most pristine state, recording the quality of the orientation mark and the line interval that is drawn from the mark. The log also records the lock angle between lines on successive runs. If the ACT tool is used the orientation log must record whether the core is loose in the shoe. If the EZY Mark tool is used the number of balls aligned must be recorded.

An important innovation at North Bullfrog has been the development of the “Bamboo Forest” method for evaluation and correction of rotation errors between lines. This simple process involves constructing a plot that resembles a bamboo stick to visualize the linkage of lines in successive locked core runs. This method allows quick identification of problem areas where the line needs to be re-examined and also indicates when runs with poor quality locks can be rotated back to high quality runs. Once the linkage between runs has been evaluated an “interval quality” can be assigned to each line interval.

The final critical step is to link the orientation log to the actual structural measurements. This link means that orientation line rotations can be applied to the measured beta angles from the structural log. Line rotations can result in the recovery of many readings that would otherwise be wrong or discarded. Even more important is the fact that the “interval quality” attribute of the line is transferred to each structural reading.
Using this approach at North Bullfrog we have transformed what used to be clouds of data into tight clusters and we have been able to confidently recognize changes in the strike and dip of the Josh Vein system predicting its location to within meters in spite of these changes. The methodology is simple but effective and can add immediate value to any project that is dependent on an accurate interpretation of structure.