Using Images to Find Accurate Orientation and Location of ODP Cores

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Although cores obtained through ocean drilling provide valuable information, recovered core pieces are often initially inaccurately located and unoriented in a geographical reference frame. In these situations, logging data are essential to supplement and enhance structural data from the recovered core.

One imaging tool used by ODP is a digital core scan device developed by DMT that produces 360° images of the outside of the core. These digital photographs can be unwrapped and displayed as a 2-D image showing the core's entire outer surface (Fig A). The images can then be used to locate and measure the dip and orientation of structural features (veins, fractures, boundaries between different rock types) in the core. The core images can be correlated with the same features on downhole image logs (Formation Microscanner or FMS) obtained during the wireline-logging programme (Haggas et al., 2001). FMS borehole images represent a partial electrical image of the borehole wall where individual structural features can be picked out due to conductivity contrasts (Fig B). As the tool records information in the true geographical reference frame, the true dip and orientation can be measured within the logged section. Matching structural features on the core and log images has subsequently allowed the accurate location and orientation of individual core pieces (Fig C).

ODP collected core images of this type during Legs 176 and 179 where the lower ocean crust was cored near the South-West Indian Ridge (Dick et al., 1999, Pettigrew et al., 1999). Both cores contain areas of crystal-plastic deformation (Fig. D). Analysis of the deformation zones in cores from Hole 1105A (Leg 179) using core and logging data suggests that the majority appear to dip southwards with ~5% dipping to the north. This is consistent with observations noted on cores from the South-West Indian Ridge drilled by the recently developed British Geological Survey rock drill (MacLeod, personal communication).

Application of this location and orientation method to subsequent drilling legs will greatly enhance the ability to interpret core structural observations.

References:
Dick, H. J. B., Natland, J. H., Miller, D. J. and Leg 176 Shipboard Scientific Party. 1999. Proceedings of the Ocean Drilling Program, Initial Reports, 176 [CD-ROM]. Ocean Drilling Program, Texas A&M University, College Station, TX.

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T.L. Pettigrew, J.F. Casey, D.J. Miller et al, 1999, Proceedings of the Ocean Drilling Program, Initial Reports, 179 (CD-Rom), Ocean Drilling Program College Station, TX, 1999.

Reorientation of core from ODP Leg 176 using correlation with a fracture imaged by the Formation Microscanner (FMS).

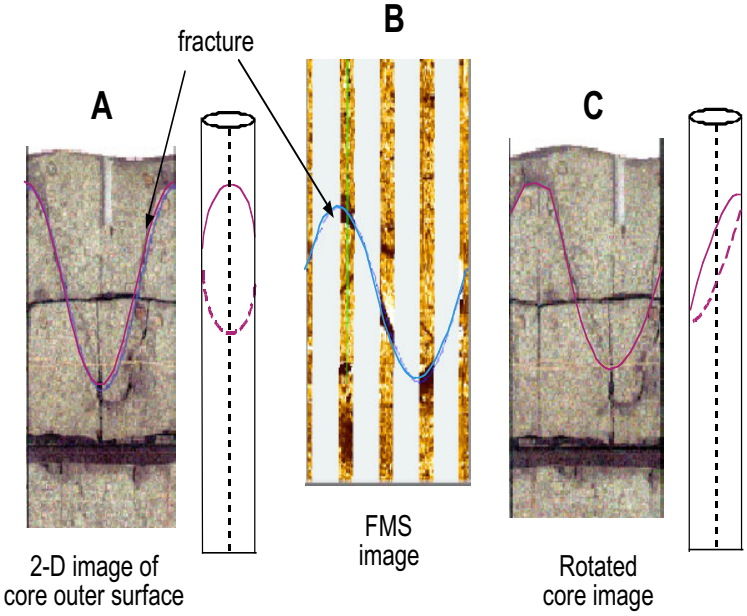

Figure D: 2-D image of deformed gabbro from ODP Hole 1105A