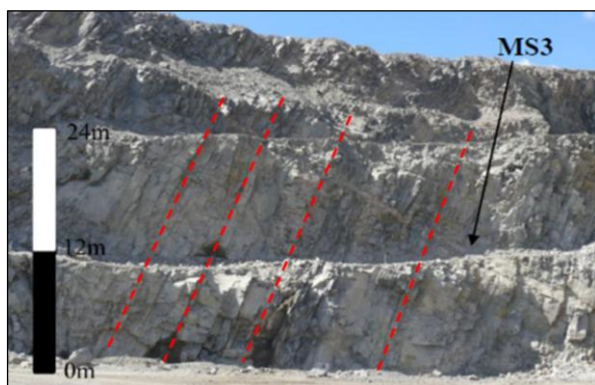


Venetia mine undertook a pit optimisation project between 2008 and 2011. The Geotechnical model and slope designs were updated taking into consideration the orientation of the pit slopes in relative to the foliation and jointing orientations present. Underpinning this project was a requirement to acquire as much foliation, jointing and fault orientation information as possible.

PROBLEM

The country rock assemblage at Venetia mainly consists of metamorphic and igneous rocks of the Limpopo mobile belt. Pit stability is structurally controlled with these structures divided into two main components, ductile structures (foliation) and brittle structures (joints and faults). A dominant metamorphic foliation crosscuts all geology which results in an anisotropic rock mass strength within the mine area. The interaction between the brittle jointing and ductile foliation locally impacts bench stability and performance. Slope stability is therefore highly dependent on the orientation of the pit slopes relative to the structural features (Ekkerd 2011).

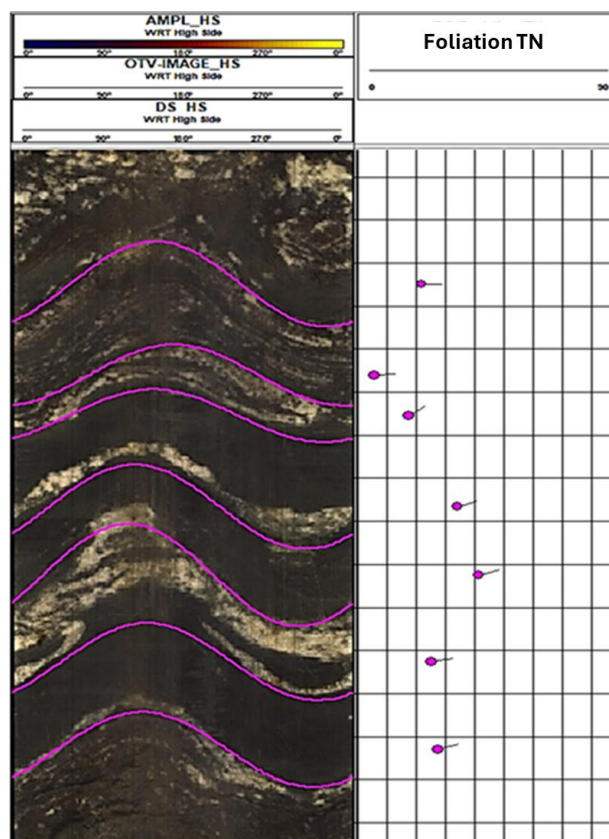


MS3 infilled structure in the pit east wall with foliation orientations indicated by red dashed lines (Ekkerd 2011).

SOLUTION

Orientated core drilling has been a long-time staple for the acquisition of in-situ foliation and jointing orientations at Venetia and elsewhere. This however comes with some limitations, with the most inconvenient being the requirement inclined holes as this technology does not allow orientation of core from subvertical holes.

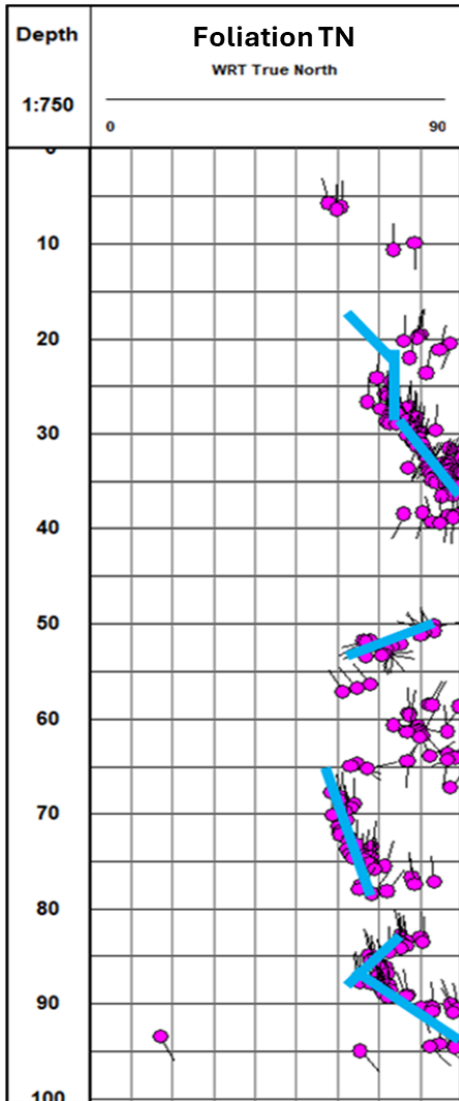
Televiewers enable acquisition of in-situ orientated images / digital twins in both vertical and inclined holes, without the need to core orientation. Any hole logged within an area of interest becomes a valuable source of structural information.



Foliation is clearly defined and easily interpreted in an optical televiewer image acquired in a blast hole.

DIGITAL Surveying

Informed decisions through integrity and innovation



Trends in the changes in the orientation of foliation along the length of the borehole.

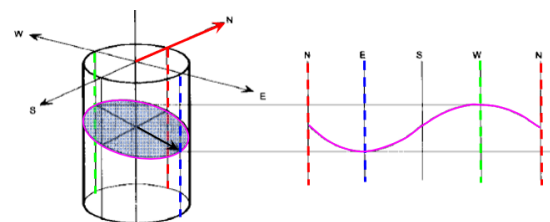
IMPACT

The use of televiewers across the mine, complementing the acquisition of orientated core, has made it possible to collate a significant database of foliation, joint & fault orientations. These data have been obtained in a shorter time period than by traditional means alone, and with significantly less drilling. These data were instrumental in the successful optimization of the geotechnical domains and pit slope models (Ekkerd 2011) resulting in more rapid, lower cost and safer mine excavation design.

TECHNOLOGY

Acoustic Televiewer: (ATV) generates images of the borehole wall by transmitting ultrasound pulses from a fixed transducer, with a rotating acoustic mirror, and recording the amplitude and travel time of the signals reflected at the interface between the borehole fluid and the formation (borehole wall). The reflection amplitude is controlled by the acoustic impedance of the formation. Variations of the acoustic impedance both vertically and radially are mapped in the generated image. Changes in borehole diameter result in variations in acoustic travel-time and these variations are used to generate a second image of the travel time data.

Optical Televiewer: (OTV) uses high resolution optical scanning of the borehole wall and captures the intensity and color of the reflected light. The OTV image is presented as a continuous, oriented, true color image of the borehole wall enabling the interpretation of litho-structural features intersecting the borehole. The OTV requires optically transparent fluid inside the borehole (air or clear water) to capture high quality images. Interpretation of the OTV image allows for the true dip and dip direction determination of low to high angle geological and structural features that intersect the borehole. OTV image quality is negatively affected by tool eccentricity within the borehole, very large borehole diameters, turbid borehole fluids or dust / mud on the borehole wall.



3D structural feature and its unwrapped sinusoidal digital twin.