

# DISCRETE FRACTURE NETWORK (DFN) MODELING AND SYNTHETIC ROCK MODELING FOR MINE CAVING ASSESSMENT — NORTH PARKES (1)

**Purpose(s):** discrete fracture network (DFN) modeling for additional Synthetic Rock Mass (SRM) properties assessment and caving modeling.

**Client:** SMI (Sustainable Mineral Institute) University of Queensland, Brisbane Australia

**Date:** 2005-2006

**Location:** Northparkes Mine

**Partners:** Itasca Consulting Group

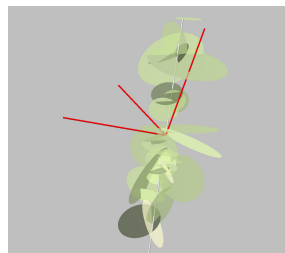
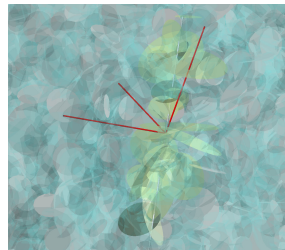
**Project executive manager:** Caroline DARCEL

**Code(s) used:** 3FLO, (DIPS 5.0, Origin 7.1), PFC3D

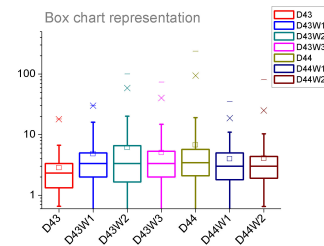
The first stage of caving modeling is a PFC3D analysis of the rock properties over a "local" length scale of 30 m. The resulting properties subsequently are used as input to a site-scale FLAC3D model. The initial stage of this analysis determines the properties of the **Synthetic Rock Mass (SRM)**, which couples the intact **rock mass characteristics** with the **embedded fracture network**. For the latter part, Itasca was tasked with providing synthetic **DFN models reflecting fracturing within the mine**.

The available fracture data are obtained from **borehole logs**. These boreholes cut through **several lithologies** that have been identified (mainly volcanoclastic and sandstone). In particular, fracture intensity is measured along 3-meter intervals. The available data are not sufficient to derive a unique DFN model. (For instance, no information is available on fracture size distribution.) The resulting **DFN models are calibrated based on observations** and depend on a number of additional hypotheses. No scale analysis could be performed given the available data.

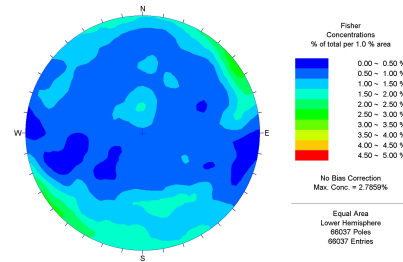
(above) lithologies identified in one borehole: volcanoclastic in orange and sandstone in green are dominant).



DFN sampling illustration: available data consist of fracture occurrences on boreholes.



Statistical analysis (box-chart representation) of fracture intensities, measured every 3 meters, for all boreholes.



Contoured stereonet for all fracture poles.

**KEYWORDS:**

- Discrete Fracture Network
- Joints
- Scaling Model
- Borehole, Fracture trace map
- Stereological analysis
- SRM (Synthetic Rock Mass)
- Mine, Caving, undercutting

⇒ **RESULTS :**

- Fracturing property variations from one lithology to the other (except for the shear zone) are weaker than internal variations.
- No distinction according to lithology is done on the DFN modeling. One bootstrapped orientation distribution is retained to reflect orientations. The DFN fracture-size distribution follows a power with an exponent such that smaller structures are dominating down to a lower cut-off limit (1 meter)
- Several DFN realizations are generated for several densities, reflecting the large range of fracture intensities encountered.