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TA-54, MDA J FRACTURE CHARACTERIZATION

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1. INTRODUCTION

Fractures in disposal trenches 5 and 6 at TA-54, MDA J were characterized per ER-SOP-3.06, R1 *Fracture Characterization*. Fractures were measured in the trench walls, which trend approximately east-west. Transects on the south wall in pit 5 and on the north wall of pit 6 were measured; these transects will not represent fractures running parallel or close to parallel with the trench walls. However, fracturing in the Bandelier tuff throughout the Pajarito Plateau is predominantly NE-SW, which at MDA J intersects the trench walls. Two primary types of fractures occur in the trench walls: cooling fractures and construction fractures. Only those fractures interpreted as cooling fractures were included in this exercise. Construction fractures appear as lower angle, discontinuous fractures that are predominantly near surface. Cooling fractures are of primary interest for fracture studies related to potential contaminant transport.

The fractures measured are entirely within Unit 2 of the Tshirege Member of the Bandelier Tuff. Unit 2 is the moderately welded cliff-forming unit forming the cap rock of Mesita del Buey; it is also the most fractured unit underlying the mesa. Unit 1, which underlies Unit 2, is poorly welded and not highly fractured; additionally, fractures in Unit 2 tend not to continue through the contact with Unit 1. The fractures in Unit 2 are the most important with respect to contaminant transport related to near-surface disposal. The parameters measured and observed during this investigation include distance between fractures, fracture strike and dip, fracture aperture, and fracture filling.

1.1 FRACTURE MEASUREMENTS

Table 1 summarizes the fracture density calculated from the measurements in the two trenches. Figure 1 summarizes the dip angle distribution of the fractures. Figure 2 summarizes the orientation of the measured fracture set. Table 2 summarizes the measure fracture apertures. The raw field data is provided in Attachment A.

Table 1. Fracture density at MDA J.

Transect	Number of Fractures	Total Distance (ft)	Average Spacing (ft)	Median Spacing (ft)
Pit 5	25	107.8	4.49	3.25
Pit 6	27	174	6.69	4.84
Combined	52	281.8	5.64	4.21

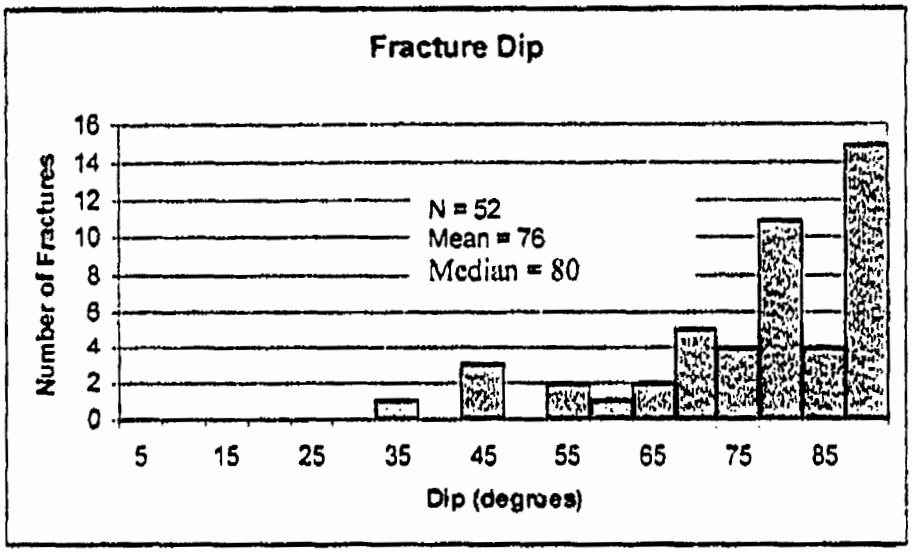

Figure 1. Fracture dip histogram.

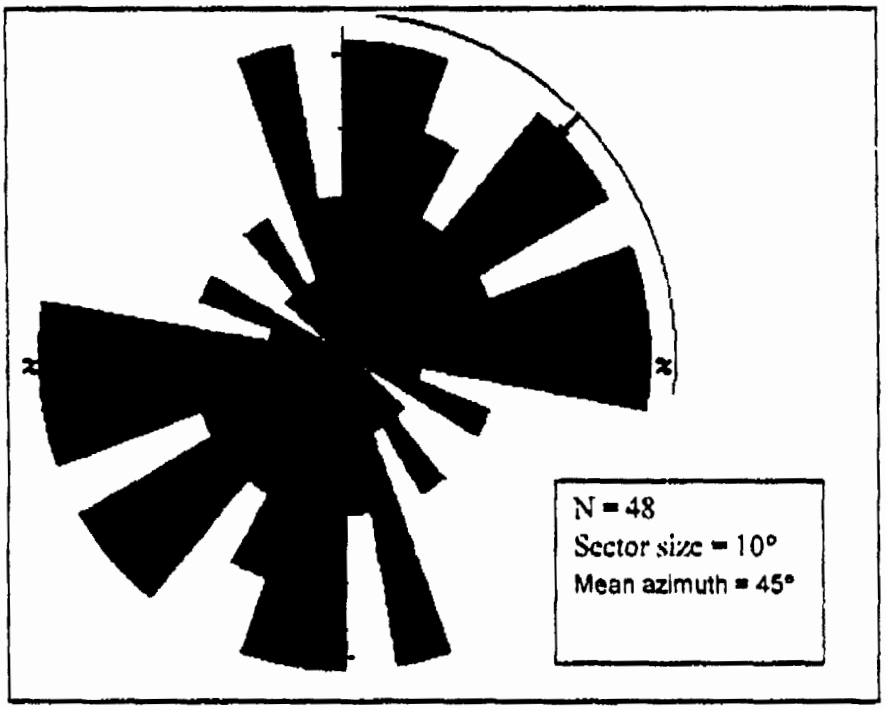

Figure 2. Fracture orientation rose diagram.

Table 2. Fracture aperture.

Transect	Number of Fractures	Minimum (in.)	Maximum (in.)	Mean (in.)	Median (in.)
Pit 5	25	0	2.5	0.6	0.5
Pit 6	27	0	6	0.63	0.3
Combined	52	0	6	0.62	0.35

Fractures were observed to be open, partially filled, completely filled, lined, and filled and lined. Fracture filling includes clay, soil, calcite, and rubble. Fracture lining includes clay skins and calcite. Calcite linings and fillings are most common near surface. Soil filling is most common in near-surface fractures with relatively large apertures. Clay lining and filling is the most common occurrence.

2. CONCLUSIONS

The fracture characterization conducted at MDA J is representative of fractures that would intersect an east-west plane, i.e., Mesita del Buey. This fracture set is representative of the majority of the fractures that occur in volcanic tuffs constructing the mesas throughout the Pajarito Plateau. Given the proximity of MDA J to MDA H, and the equivalent stratigraphy at each location, the fracture characterization at MDA J is a good representative of the conditions at MDA H. A similar fracture characterization effort was conducted in 1998 at pit 39 in TA-54, MDA G, which is several miles to the east of MDA J. The MDA G measurements were collected in a similar manner from Unit 2 tuffs. The majority of fractures measured at MDA G trend between N-S and E-W, as do the fractures at MDA J. Additionally, the majority of the fractures at MDA G are near vertical, as are those at MDA J. Also, the average and median fracture densities at MDA G, pit 39 are slightly greater (i.e., the fracture spacing is less) than those at MDA J. The mean spacing at MDA G ranges from 3.3 – 4.0 fractures per foot and the mean at MDA J ranges from 4.49 – 6.69 fractures per foot. The median at G ranges from 2.1 – 3.6 as compared to 3.25 – 4.84 fractures per foot at MDA J. Finally, the fracture aperture and fracture fills at MDA G are very similar to those observed at MDA J. Therefore, any scaling of the conceptual model and/or contaminant transport behavior from MDA G to MDA H, with respect to fracture properties, should be analogous, based on the characterization of fractures at MDA J.