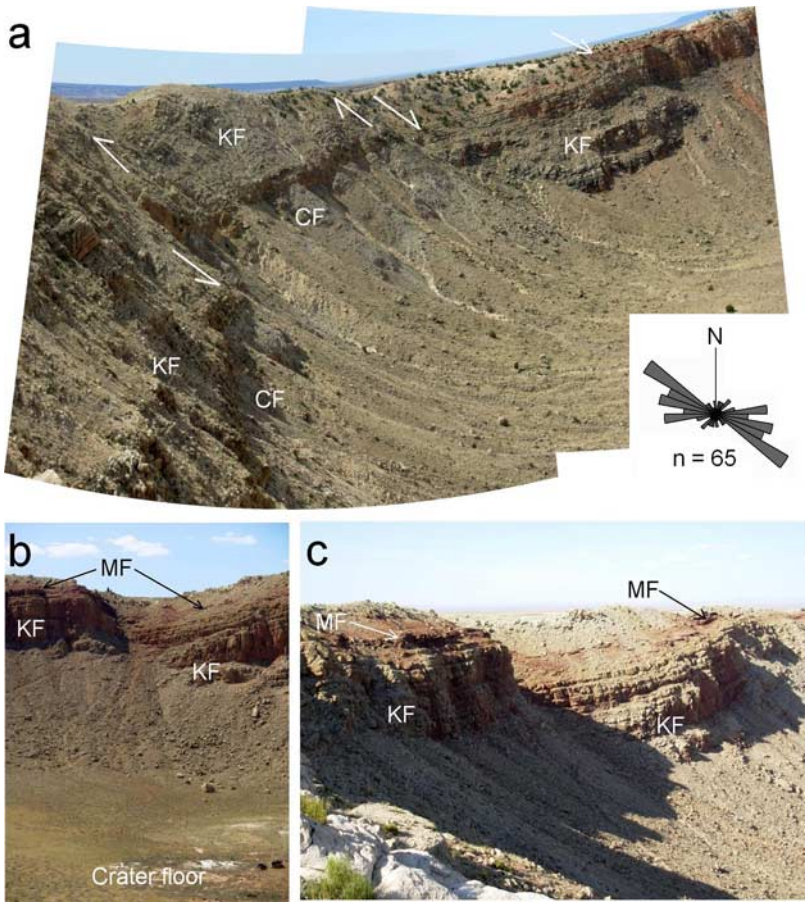

Figure 9. The major tear faults (a) in the southeastern crater wall and (b and c) in the southwestern crater wall. MF, Moenkopi Formation; KF, Kaibab Formation; and CF, Coconino Formation. A bidirectional rose diagram shows the orientations of tear faults exposed on the upper crater wall (see also Figure 2a).

fractures by bringing their host sedimentary bedding planes to a preimpact horizontal plane. This calculation was done using the mean strike/dip values of the bedding planes in each tectonic block. When the crater rim is restored to a preimpact condition, the geometries of radial and concentric fractures resemble preimpact fracture populations (Figure 12). For example, the radial fractures maintain their preferred orientations (NNW-SSE and ENE-WSW) after the crater rim restoration. Interestingly, the NNW-SSE set of fractures in the crater walls are similar in orientation to a preimpact set of fracture, but do not reflect the dominant orientation among preimpact fractures. This may be a consequence of an impact parameter, like trajectory, that is not yet understood. Also, after restoration, the concentric fractures do not show any significant variation and the preferred orientation remains in the direction of ESE-WNW, similar to one of the preimpact fracture orientations. Therefore, it appears the preimpact fracture system controlled the radial and concentric fracture systems and the near-squarish shape of Meteor Crater as surmised previously by *Shoemaker* [1960]. This primary source for the square shape of the crater has been accentuated by preferential erosion along those faults and the authigenic breccia that fill them.

[15] Interestingly, upon rim restoration, the conical fractures acquire a spoke-like geometry, with a slight dominance in NE-SW and NW-SE directions coinciding with the corner zone tear faults (Figure 12). Significantly, the orientations of the conical fractures are dissimilar to those of preimpact fractures and appear to be formed purely by the impact. The near-perfect symmetry of the restored orientations of the conical fractures (Figure 12), compared to the preferred orientations seen in the uplifted crater rim (Figure 8), implies most of the conical fractures formed before the bulk of the structural rim uplift and reactivation of (and potentially the formation of new) radial and concentric fractures.

[16] The radial, concentric, and conical fractures documented above are visible in the existing crater wall. Erosion has cut back into the original crater wall [e.g., *Kring*, 2007], suggesting we are seeing features that extended at least several meters beyond the original crater wall. Geophysical studies have delineated fracture systems beneath the ejecta blanket and the crater floor. For example, a ground-penetrating radar study of bedrock beneath ejecta on the crater rim [*Pilon et al.*, 1991] identified two