Measurements of in-situ magnetic susceptibility were compiled from mainly Precambrian crystalline basement rocks beneath the Colorado Plateau and ranges in Arizona, Colorado, and New Mexico. The susceptibility meter used measures about 10 cubic centimeters of rock and measures variations in the modal distribution of magnetic minerals that form a minor component volumetrically in these coarsely crystalline granitic to granodioritic rocks. Recent measurements include 50-150 measurements on each outcrop, and show that the distribution of magnetic susceptibilities is highly variable, multimodal and strongly non-Gaussian so that a mean value has little significance. Rock bodies with the most multimodal distributions generally have complex tectonic histories including metamorphism and multiple tectonic events. Variations between outcrops within the same rock body are large; however, where distributions overlap, measurements appear to fill gaps within modal peaks.

A multiplicative cascade model was used to model the outcrop scale variability of magnetic minerals. Model segment proportion and length parameters resulted in 26,676 models. Distributions at each outcrop were normalized to unity magnetic susceptibility and added to compare all data for a rock body. The main common property of the best fitting models is that there is generally one long and two shorter segments in the generator and a single large proportion relative to the other two. However, there is no consistent relation between the long segment and the large proportion. Possibility functions derived from the histogram of measurements are a better representation of the magnetic susceptibility distribution for a given rock body than mean and standard deviation.