The U. S. Geological Survey’s Assessment Techniques for Concealed Mineral Resources Project is developing a number of quantitative tools to aid in the estimation of concealed lithology. Lithologic estimation techniques are based on measures of anomalies from Earth’s total field magnetic data, both airborne and ground-acquired. Groups of anomalies are treated as textures and several textural measures are known to be important for quantitatively describing lithologies. Estimation of concealed lithology is based on matching textural descriptive measures between known exposed lithologies and candidate concealed lithologies.

Descriptive statistics that are important include: 1) number of peaks per distance along the profile; 2) Euclidean vector signal length over distance along the profile; 3) mean peak height; 4) mean peak half-width; 5) signal variance; 6) signal range; and, sometimes, 7) signal mean. In addition, the power spectra and multifractal (Legendre) spectra of magnetic data usually suggest boundary conditions that are useful for the estimation of concealed lithology.

Possibility theory is a general theory of the likelihood of occurrence of events in the presence of both uncertainty and incomplete knowledge. Possibility functions can be computed for magnetic survey data from the appropriate mathematical transformation using, for example, a histogram of anomaly amplitudes. This procedure creates estimates that are objective, appropriate, and automatically include uncertainty. These functions are a parameter free characterization of the data and have been successfully applied to the estimation of concealed lithology in several survey areas in southern Arizona, U.S. If available, gravity and electrical survey data could be similarly applied.