PRELIMINARY GEOPHYSICAL INVESTIGATIONS OF THE SHIP ROCK DIATREME, NAVAJO NATION, NEW MEXICO

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Magnetic and gravity data were collected at the Ship Rock minette neck and dikes, part of the Navajo volcanic field in the central Colorado Plateau, to investigate their subsurface structure. The deep root system of Ship Rock, an exhumed Oligocene maar-diatreme complex, has not been resolved. The diatreme is largely composed of minette tuff-breccia with a large wallrock fraction, whereas the dikes are composed of hypabyssal minette. The country rock is the Upper Cretaceous Mancos Shale. Density and magnetic contrasts between the igneous rock and surrounding shale suggest that the buried structure of Ship Rock can be imaged. Preliminary geophysical investigations were carried out in order to test this hypothesis.

We collected magnetic and gravitational data along four lines selected to transect the major south and northeast dikes and to partly encircle the diatreme. Modeling differently sized, oriented, and shaped intrusions, we created theoretical Free air anomaly curves to try to match the two clearest anomalies. Modeling necessitates (i) that the major north-south dike dips west and (ii) the presence of a high-density, deep body near the diatreme. The Free Air anomaly curves show that smaller dikes might not be detected from gravity data; however, they are necessary to determine the presence of large, dense bodies. Although not modeled, the magnetics curves show that smaller dikes can easily be detected. Our study results are promising, and we plan a more thorough investigation in the future which will produce a magnetic map to determine if further buried dikes exist in the vicinity, and measure gravity along additional profiles to better constrain the location of the dense body at depth.