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Geometry, Structure, and Concealed Lithology of the San Rafael Basin, Southeastern Arizona

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Abstract

The contiguous United States has been well explored for exposed conventional mineral deposits. Therefore, it is likely that many economically viable and strategically significant conventional undiscovered mineral deposits will be found in bedrock concealed beneath basin sediments. Mineral resource assessments must incorporate an understanding of the geometry, structure, and concealed lithology of basins in order to be accurate. This report presents an analysis of the basin geometry and structure of the San Rafael basin in southeastern Arizona. In addition, a new methodology for inferring concealed lithology is presented and applied in the San Rafael basin.

Gravity data is used to model the geometry of the basin using recent models of sediment density vs. depth developed in the region. This modeling indicates that the basin has a maximum depth of approximately 1.05 km plus or minus 0.10 km. In the southern portion, the basin can be modeled as an asymmetric graben faulted on the western margin. The northern portion of the basin is structurally more complex and may have high angle faults on the western, northern, and eastern margin. Near-ground closely spaced Earth's total intensity magnetic field data is used to locate concealed faults within the basin. This data is also used to infer lithology concealed by shallow basin sediments. Airborne Earth's total intensity magnetic field data is used to help infer concealed lithology in deep portions of the basin. The product of integrating all data and interpretations is a map which presents the geometry of the basin, faults and contacts concealed by basin

sediments, and an estimate of the bedrock lithology concealed by basin sediment.

Based on basin geometry and concealed lithology, the San Rafael basin has a high potential for concealed mineral deposits on its western and northern margin. In particular, a newly discovered magnetic anomaly in the northern portion of the basin can be modeled as a granitic intrusion with highly altered margins and may represent a potential mineral resource target. Based on the permeability and porosity of upper basin fill found in nearby basins, the San Rafael basin may contain an aquifer up to 300 meters thick over a substantial area of the basin.

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