# Mapping Magmatic Intrusions Using Magnetic Data: An Example from Saudi Arabia

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## Abstract

Extensive magmatic intrusions occurred during the lower Devonian, Cretaceous and Neogene in Saudi Arabia. These intrusions can play a significant role in transforming organic material into hydrocarbons. In addition, many of them can act as hydrocarbon reservoirs, both as seals or as fractured reservoirs themselves. However, they can also negatively reduce the quality of depth imaging using seismic data. Magmatic intrusions can be easily detected using geophysical data sets including seismic and magnetic, provided the response of igneous bodies are larger than the detection limit (e.g. vertical seismic resolution) of the geophysical techniques. Furthermore, orientation of magmatic bodies has an impact on their detectability in seismic data. In this paper, we investigate the limit of detectability of magmatic intrusions using magnetic data with an example from Saudi Arabia. Our analysis found that dikes and sills can be detected from magnetic data with a reasonable signal to noise ratio. Following the sensitivity analysis, we modelled the magnetic response associated with the interpreted dikes at different locations. Modeling results indicate that the average dike thickness and depth to top are variable. Utilizing magnetic data and modeling has proven robust in constraining the thickness, orientation and depth of seismically undetectable magmatic intrusions. This paper serves as an example of demonstrating the crucial role of integrating potential fields with seismic and well data for better assessment of petroleum systems, particularly those affected by magmatic activities.