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**Prospectivity of volcanic basins: Examples from the
North Atlantic and Western India**

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Summary

Volcanic basins are here defined as sedimentary basins significantly affected with flood basalt volcanism and associated intrusive activity. Hydrocarbon exploration has traditionally avoided basins dominated by volcanics and igneous intrusions mainly because of the inability to see below basalts on seismic data and the perceived detrimental effect of volcanic activity on the petroleum system. However, increasing depletion of hydrocarbon reserves in traditional European heartlands such as the North Sea shifted focus toward more volcanic basins such as the nearby northeast Atlantic margin. Recent seismic advances focusing on low frequencies have significantly enhanced structural imaging, but not the seismic resolution. Currently, the sub-basalt play is mainly a structural play. On the North Atlantic margin, success has been booked with the discovery of the sub-basalt anticlinal Corrib gas field, offshore Ireland. However, not all sub-basalt anticlines observed on seismic data are valid prospects because some of them are located directly above large igneous complexes, displaying highly overmature and overcompacted sedimentary sections with little porosity. Use of filtered gravity and magnetic data and potentially seismic velocity analysis can easily delineate and subsequently de-risk these prospects. Sill intrusion can generate subtle anticlinal traps that might be valid prospects because the thermal effect of sills is relatively limited. Thus, there is less chance of generating an overmature prospect, unless the sills occur in high numbers. Filtered gravity and magnetic data sets, in combination with local geology, can be used in the early stages of sub-basalt exploration to low-grade regions with a high amount of large intrusives. This approach is highlighted for the North Atlantic volcanic province and offshore western India. Potentially, the most prospective regions of volcanic basins are where flood basalts simply blanket sedimentary basins without intrusives in the direct subsurface. In this case, basalt thickness estimation and associated burial depth become an important parameter to estimate prospectivity. Seismic modeling suggests that it might be difficult to constrain basalt thickness from seismic sections without reliable calibration. Although an increase in volcanism in sedimentary basins generally tends to increase risks, proper integration of geophysical and geological data should be able to better evaluate volcanic basins.