

## **Night-time Hunting for Furtive Animals: Data Availability Challenges in International Exploration for Partially Understood Shale Resource Plays**

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The recent success of shale resource plays in North America has given rise to an interest in these plays around the world. Europe has seen an almost feverish rush towards securing acreage and large tracts of land have been contracted out for shale exploration in Poland, France, Germany and elsewhere. Unfortunately, the exploration results from these licenses are not equally fast forthcoming and, thus far, have not been very positive. Recently, critical voices have suggested that development of shale resources in Europe may happen at a significantly lower pace than has been the case in the US for a combination of geological, environmental, economical and regulatory reasons.

Outside Europe, shale gas expectations have advanced furthest in China, where a shale gas production target for 2020 already has been defined. Also in this country, the expectations are not yet supported by a sufficient number of positive well results, although several projects are being initiated.

One of the challenges in early phase exploration for shale resources is the limited amount of relevant data that is generally available. There are three high-level aspects of shale resource plays that one tries to evaluate: charge, reservoir and production potential. Of these, only the first can usually be properly addressed as this falls under the header of traditional source rock analysis. The most commonly available data types are TOC (total organic carbon) and Rock Eval pyrolysis for evaluation of richness and kerogen type, while the maturity level can be deduced from vitrinite reflectance measurements, Rock Eval Tmax or similar.

The reservoir properties of shales (porosity, permeability, water/oil/gas saturations) have traditionally not been analysed, partly due to the difficulty of carrying out such analyses in very tight rocks. Although analytical methods have been developed to better handle fine-grained rocks, this is of limited help when analyzing existing wells. The analyses should preferably be done on core material and this is generally not available for shales. In frontier exploration settings, reservoir properties of shales are usually best estimated from wireline logs, although modern logs often are in limited supply. Note, that a good petrophysical model requires calibration to laboratory data, which closes the circle as this is dependent on the availability of core samples.

Finally, the production potential of the shale needs to be addressed. The main aspect of this is the so-called fracability. This is a rather elusive property and is influenced by parameters such as mineralogy (high proportion of quartz or carbonate, low proportion of clay), formation (over)pressure, rock strength and the geological stress field. Most of these parameters are not commonly available in frontier settings.

Even if all or most of the above data types would be available, it could still be challenging to assess the production potential of a shale resource system. This is due to the fact that no clear set of boundary conditions exists, which defines an effective shale gas system. Several threshold values have been proposed for TOC, maturity, clay content, thickness, porosity, permeability, etc, but there is no consensus on the actual values to be used. Maybe this is for the better as it leaves ample room for the explorationists to perform the artistry, which is part of our reputation – for better or for worse.