

3. Exploration for Oil and Gas

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1. Introduction

Exploration for oil began with drilling the first oil wells in 1858 in Wietze/Germany or 1859 in Titusville, USA, and other places of the world. Since nothing was known about the genesis of oil nor its origin, the tar pit areas were soon probed with wells in an effort to find more. The early wells were positioned on a rather trial-and-error basis and did not reach deeper than 30--40 m, so that exploration success was deemed random.

Today exploration in the exploration and production (E&P) industry still means searching for oil and gas in the unknown, but the requirements are known. Prerequisites for successful (conventional) oil and gas exploration are the possibilities in sedimentary basins for the generation of hydrocarbons, the migration into a trap, and the accumulation in a reservoir, i.e.

- The sequence of geologic formations in the sedimentary basin must contain source rocks which have generated oil and gas

- The sequence must contain porous and permeable reservoir rocks like sandstones or carbonates accessible to hydrocarbons expelled from the source rocks
- The sedimentary basin must have suitable traps with a sufficiently thick sealing formations of, for example, shale, marl, or salt under which the hydrocarbons can accumulate.

For unconventional oil shale, shale oil, and shale gas exploration the existence of source rocks is sufficient.

Providing evidence for the existence of these possibilities and identifying and evaluating leads and prospects for exploration drilling is at the core of oil and gas exploration. The methodologies to achieve this objective are very diverse and include almost every discipline of applied geosciences. The interpretation of satellite images and aerial photographs may give first information regarding the structure of unexplored sedimentary basins and provide evidence of hydrocarbon leaks, even