

Various Hydrocarbon Systems

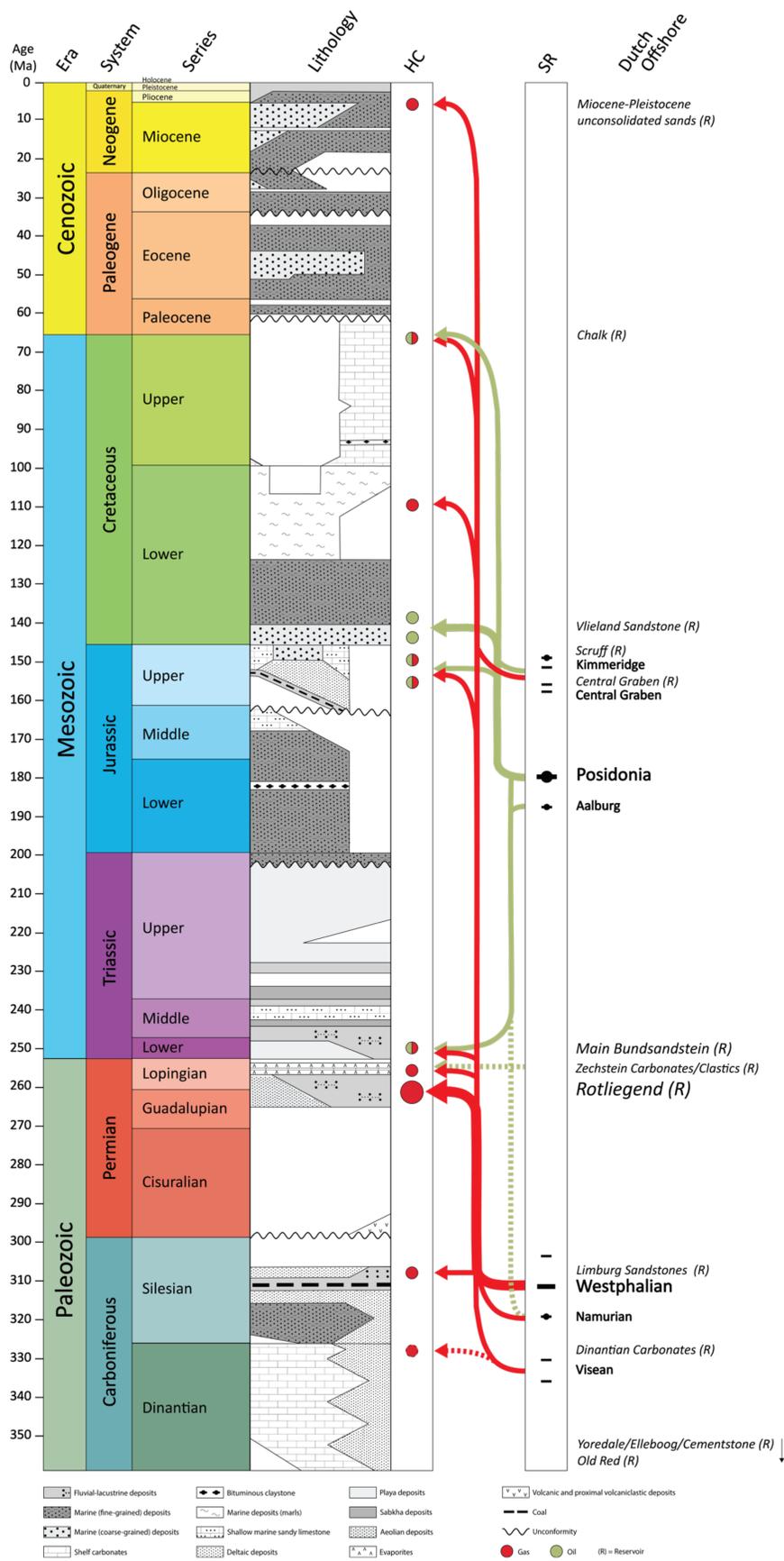


Figure 1. Hydrocarbon systems in the Dutch subsurface. The arrows show hydrocarbon migration into the main reservoir units (modified after de Jager & Geluk, 2007; Adrichem Boogaert & Kouwe, 1993-1997 and the Southern Permian Basin Atlas by Doornenbal and Stevenson, 2007).

Tertiary

Shallow gas

- Bright spots often indicative of shallow gas presence
- High production rates

Upper Cretaceous

Chalk

- One of the most important oil reservoirs
- Large variability in reservoir characteristics (porosity and permeability)
- Potential for intra-Chalk structural or stratigraphic traps

Jurassic

- Underexplored
- Kimmeridge Clay and Posidonia Shale Formation are mature source rocks for oil
- Good reservoir quality in the Scruff Group and Central Graben Subgroup

Triassic

- Volumetrically the second largest proven gas play in The Netherlands and with significant remaining hydrocarbon potential
- Overlooked reservoir potential of northerly sources Volpriehausen Sst Member sands in local depocentres in the northern offshore

Rotliegend

- Volumetrically the largest proven gas play in The Netherlands
- New subplay concepts recently identified and proven - e.g. Ruby and Cygnus plays
- Underexplored in regions of poor seismic imaging below Zechstein salt

Carboniferous

Upper Carboniferous

- Underexplored and known to be an important gas play
- Westphalian coals are the main source rock for gas and are present in large parts of the Dutch subsurface

Lower Carboniferous

- Virtually untested and underexplored in the entire Dutch offshore
- At least 20 structures identified on the Base Permian Unconformity (BPU) depth map - all 4-way dip or fault dip closures
- Visean and Namurian rocks have significant hydrocarbon generating potential
- Lower Carboniferous Scremerston coals are the most promising source rocks in the northern offshore

Dinantian Carbonates

- Underexplored and unproven play
- Recently became the target of exploration for both hydrocarbons and geothermal energy in The Netherlands
- Several prospects and leads identified, currently being pursued

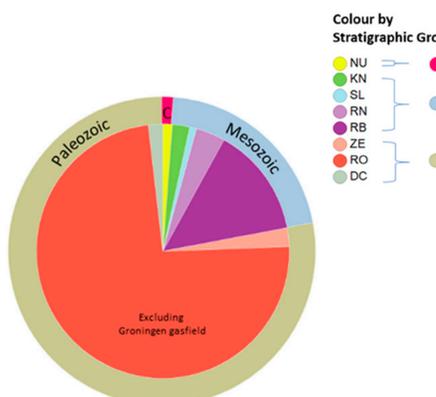


Figure 2. Relative portion of hydrocarbon resources (UR bcm) identified per stratigraphic group in The Netherlands (on- and offshore).

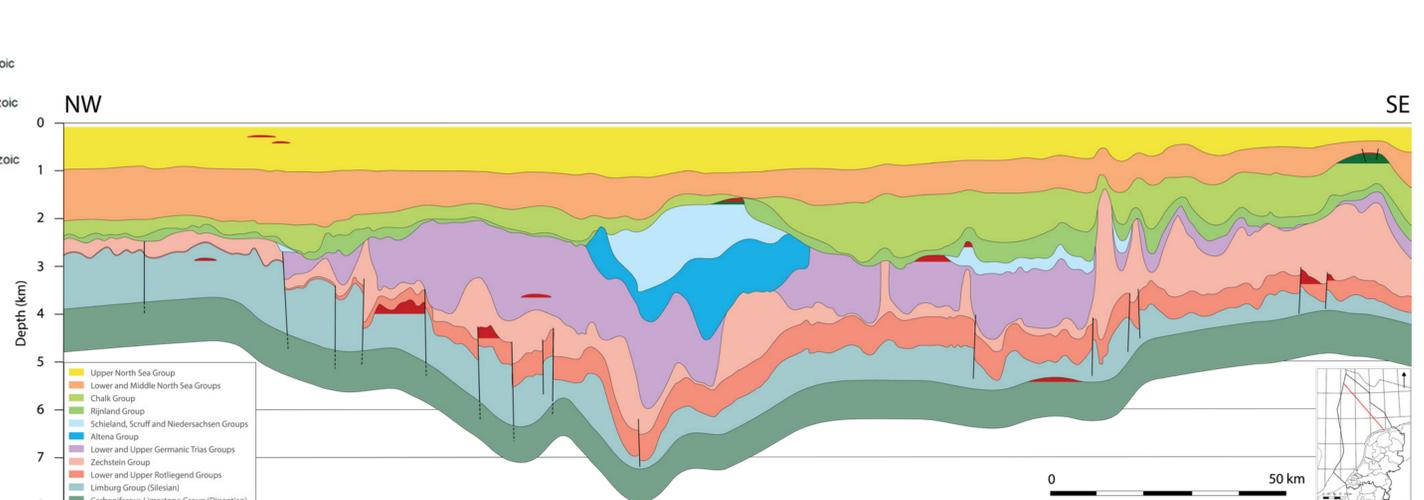


Figure 3. Schematic cross section through the northern Dutch offshore (modified after Duin et al., 2006).