

Geological factors controlling Early Carboniferous carbonate platform development in the Netherlands

Fokko F.N. VAN HULTEN¹ and Edouard POTY²

¹Energie Beheer Nederland B.V. - P.O. Box 6500, 6401JH - Heerlen, The Netherlands, fokko.hulten-van@ebn.nl

²Université de Liège - Paléontologie animale, Bât. B18, Sart Tilman, B-4000 Liège-1, Belgium

The Netherlands is an important hydrocarbon producing province of NW Europe. Exploration of classical Rotliegend and Triassic gas plays in the area is still successful; however, growing maturity of the production facilities makes it important that other plays are investigated. A deep pre-Silesian carbonate play in the country received some renewed attention lately and poses some real challenges to the explorationist.

Underneath the very thick cover of Westphalian and Namurian clastic sediments, which cover almost the entire Netherlands, an undiscovered petroleum system may be present in pre-Silesian, especially Dinantian carbonate reservoirs. Overlying Namurian shales may act as source and seal. To this date, most oil and gas wells in the Dutch offshore and onshore have rarely been drilled deeper than the top part of the Silesian. Seismic definition of targets below the Permian Zechstein salts is often very poor. This lack of control and the significant depth has caused the Pre-Silesian to be under-explored in an area bordered by London-Brabant Massif in the South to the Mid North Sea High in the North.

Because of its depth, targets for this play must be sizeable. Discoveries in the Caspian Sea have shown that during the Dinantian very thick carbonate biohermal build-ups are possible. Such new reservoir models for Dinantian age carbonates, combined with improved seismic definition, have rekindled the interest in pre-Silesian targets. From the geological information and the sparse well control in the Netherlands, the UK, Belgium and Germany, it is likely that thick Dinantian platform carbonates can be present at the northern fringe of the London-Brabant Massif covering a large part of the country. Reservoir prediction of these carbonates can barely be done with the information available in the Netherlands. For the building of a realistic geological model of these carbonate reservoirs, it is important to look to other areas.

The UK Midlands with its comparable structural setting, shows that during the Dinantian deposition developed on blocks and in basins. It is one of the most important areas to use as a model for the Dinantian deposits in the Netherlands, as has been done several times in the past. Build-ups developed in the UK during Upper Tournaisian-Lowermost Viséan (Waulsortian type) and the Upper Viséan (mainly microbialite type).

Another useful area for study is the classical terrain for Dinantian geology, the area south of the London-Brabant Massif, close to the Netherlands in the southern part of Belgium. Here one can find a wealth of detailed Dinantian information, because of the numerous outcrops that can be compared with information from the existing models. Unfortunately the area has been affected by the Variscan orogeny, which sometimes obscures the comparison. The Dinantian age rocks of southern Belgium provide a good model for the understanding of the frequency of the major depositional cycles, the evaporite deposits and their solution collapse, the dolomitization process and erosion and onlap, during the Dinantian and early Namurian and for the Waulsortian mounds growth. But Upper Viséan reefs are unknown here.

Reservoir studies have shown, that significant reef growth on the windward side was an important factor, to understand Dinantian age reservoirs in the Caspian Sea. North of the London-Brabant Massif in the Belgian Campine basin and also in the UK, one can see minor Upper Viséan build-ups on rimmed margins on the windward side, consistent with E-NE paleo trade winds.

Away from the Massif, more accommodation space is expected, comparable to the findings on the south side of the Massif. The trade winds in combination with the increased accommodation suggest that thick Upper Viséan build-ups, or even reefs, can develop in the Dutch Dinantian fringe. South of the London-Brabant Massif, the trade winds predict a lee-side position of the basin, relative to the north. The observed overall ramp setting during the Dinantian there is in agreement with such a dominant wind direction. It gives an explanation for the poor reef growth and makes clear why the southern Belgian area provides not a good model for bioherms in the Netherlands.

Well known biohermal buildups in the southern area, the Waulsortian reefs, with their restricted fauna, are unlikely models for the reefs that can be expected north of the London-Brabant Massif. Presence of Upper Tournaisian Waulsortian mounds in relatively deep-water areas cannot be fully ruled out in the Netherlands, but are unlikely targets for exploration.