

## **Multi-phase Thermal History of Palaeozoic Basins in NW-Africa (Algeria, Morocco) and its Impact on Hydrocarbon System Development**

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### **ABSTRACT**

A comprehensive study on basin development and hydrocarbon potential of the Palaeozoic of the Reggane Basin (southern Algeria) was performed along a 150km transect from the eastern basin margin into the basin. This included also a detailed maturation study of this part of the basin. Palynostratigraphic analysis enabled detailed correlations along this transect, showing continuous deposition from the Silurian to the Lower Carboniferous with some differences between proximal and distal wells. The uppermost Lower Carboniferous is missing in all studied wells, related to a first phase of basin uplift. In distal wells it is followed by Namurian strata, whereas in proximal wells it is overlain by Westphalian strata. This indicates a complex basin development in the Upper Carboniferous, limited by the Hercynian Unconformity at the top and overlain by Mesozoic to Cenozoic strata. All wells are penetrated by magmatic intrusions related to the Latest Triassic CAMP volcanism, but the number, frequency and stratigraphical position of the dykes differ significantly between the wells. Therefore, different lithological units are affected by magmatic intrusions, with different effects on the activation of the potential hydrocarbon systems in this area. Additionally, one well was studied in the Tindouf Basin of Morocco. The correlation with the wells from the eastern Reggane basin showed generally similar developments. However in greater detail, some differences are observed particularly in the upper part of the Carboniferous. In contrast to the eastern Reggane basin the uppermost Visean is present, but the middle Visean is missing in this well in the Tindouf basin. Also, no Upper Carboniferous was observed, showing a different effect of the Variscan orogeny in the Tindouf basin compared to the Reggane basin. Stratigraphically controlled subsidence history and integrated organic maturation analysis decipher the thermal history and provide new insights in hydrocarbon generation within the Eastern Reggane Basin. It indicates a two-phased thermal history, showing very different effect on hydrocarbon system development of these two phases. Continuous burial until the top of the Lower Carboniferous led to middle - upper gas window maturation of Silurian source rocks in all wells, activating the Silurian-Lower Devonian hydrocarbon system, which is commonly found all over NW-Africa. Late Triassic CAMP related magmatic dykes led to locally intense secondary heating, but no widespread general thermal overprint of the entire basin. In one well magmatic intrusions penetrate the Upper Devonian source rocks, which led to a significant increase in maturation of this source unit and the activation of an additional second Upper Devonian-Lower Carboniferous gas play, which is only locally observed in NW-Africa. In the Tindouf Basin (Morocco) CAMP related magmatic intrusions are known, but in the studied well no intrusions are recorded from both well report and available cores. This is a major difference to the wells studied in the Reggane basin and gives the chance to improve the knowledge of the effect of CAMP intrusions on the maturation development. The well in the Tindouf Basin shows a continuous increase in maturation from Lower Carboniferous to the Silurian, from upper oil- to upper gas window / over mature conditions. No secondary thermal events are observed. This puts up an additional target for future exploration, particularly gas plays, focused on settings of less mature potential gas-prone source rocks, which get heated up to the upper gas window due to massive penetration by magmatic intrusions.