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The Sedimentation Hiatus of the Hercynian Unconformity (Hu) Across the Arabian Plate: Implications for Exploration

Michael H. Stephenson[1]

[1]Stephenson Geoscience Consulting Ltd

Abstract

The Hercynian Unconformity (HU) is the most important influence on Palaeozoic stratigraphy across the Arabian Plate, affecting the occurrence of source and reservoir rock. The palynostratigraphy of the strata above and below the HU across the Arabian Plate from Jordan in the north through western Iraq, Saudi Arabia, the Gulf States, and Oman, indicates the range of its associated hiatus, due to either non-deposition or erosion (or both). As expected, the succession spanning the HU is most complete in basinal areas, for example in the Faydah-Jafurah and Nafud-Ma'aniya basins (Fig. 1).

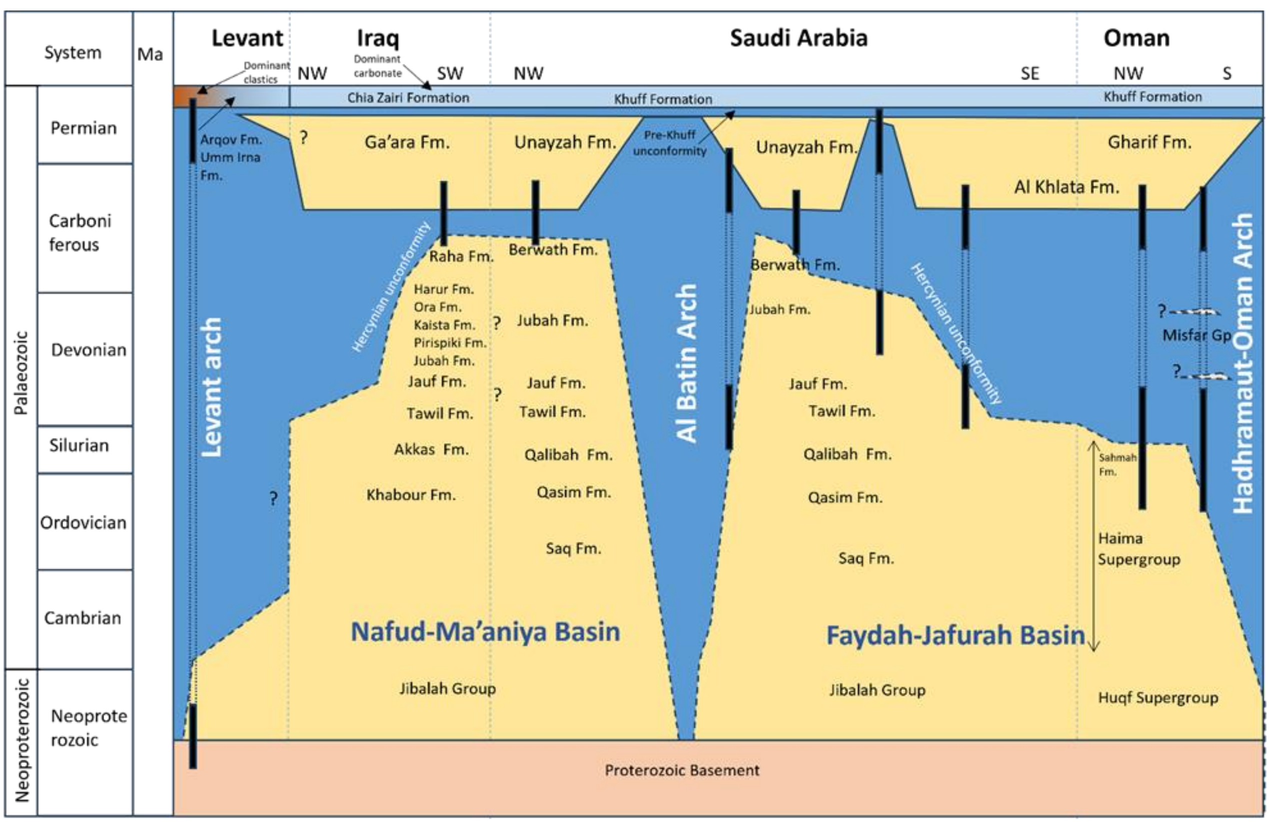

Fig. 1. Time-stratigraphy of the Hercynian Unconformity (HU) across the Arabian Plate

The well with the shortest hiatus corresponding approximately to a maximum duration of part of the Serpukhovian and Bashkirian (Carboniferous), appears to be KH-5/1, in western Iraq, close to the axis of the Nafud-Ma'aniya Basin. This contrasts with the very large hiatus 500 km to the SW in Jordan where latest Permian (Changhsingian) rocks rest on Cambrian and Precambrian in the Levant Arch (Fig. 2; Stephenson, 2024).

Further south, palynostratigraphy shows the variability of strata below the unconformity, which is affected by the amount of Hercynian tectonic activity including faulting and uplift in basinal areas like Ghawar and the offshore Gulf, and proximity to the flanks of arches. This has resulted in a complex local pre-HU subcrop where even small geographic differences in drilling location affect the formation penetrated below the HU, from Carboniferous, to Devonian, Silurian and Cambro-Ordovician.

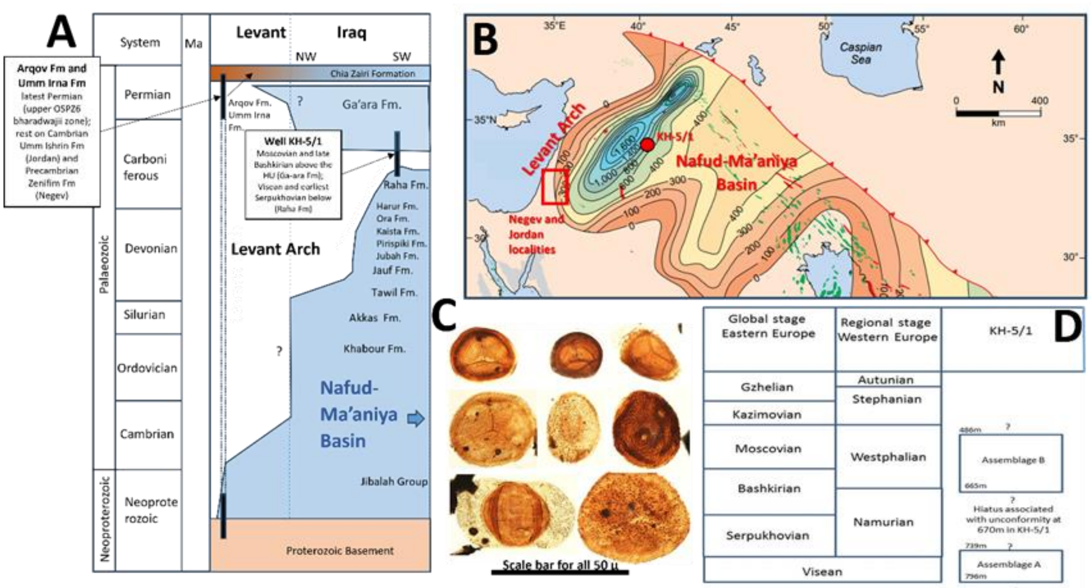

Fig. 2. Comparison of stratigraphy of the HU over the Levant Arch and Nafud-Ma'aniya Basin. A = stratigraphy; B = localities (modified from Faqira et al., 2009); C = Palynomorphs of KH-5/1 associated with the HU; D = HU hiatus of well KH-5/1 in western Iraq; position of KH-5/1 approximate; see Stephenson (2024) for details.

Reworking into barren strata above the HU, sometimes makes the HU hard to pinpoint in the absence of clear distinction on logs or seismic, however the distribution of reworked palynomorphs of Devonian age into Oman post-HU Al Khlata Formation strata, could be useful in the reconstruction of the distribution of Devonian strata to the east on the Huqf high. The oldest strata above the HU across the Arabian Plate also indicate systematic variation, probably due to palaeoclimate.

Conclusions

Palynostratigraphy indicates that the HU hiatus varies considerably across the Arabian Plate depending on the position of the succession in relation to the three main highs or arches (the Levant, Al Batin, and Oman-Hadhramaut arches), Hercynian faulting or other uplift in basinal regions, contemporaneous salt dissolution and withdrawal, and deposition on erosional features caused by the Permo-Carboniferous glaciation.

Acknowledgements

This paper contains only public domain information from published papers.

References

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