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Original article

# Palynological assemblages across the Hercynian unconformity in Western Iraq

## *Assemblages palynologiques à travers la discordance hercynienne en Irak occidental*

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**Abstract**

Recent study of samples from borehole KH-5/1 has allowed an assessment of the duration of the hiatus associated with the so-called Hercynian unconformity (also known as the 'Late Carboniferous unconformity' or 'pre-Unayzah unconformity') in western Iraq. KH-5/1 was drilled as a deep water well and fully cored to TD at 1620 m. The well section spans the unconformity at 670 m depth with the Raha Formation below and the Ga'ara Formation above. The unconformity appears to be associated with non-deposition or erosion of rocks corresponding approximately in age to part of the Serpukhovian and Bashkirian (latest Mississippian to early Pennsylvanian), similar to the duration associated with the same unconformity in well ST-8 situated to the south of KH-5/1 in northern Saudi Arabia. The Ga'ara Formation assemblages above the unconformity in KH-5/1 are similar in character to those described from 4620 to 4200 feet in ST-8. The age of these assemblages in both KH-5/1 and ST-8 is considered in this paper to be Westphalian. The composition of the Ga'ara Formation assemblages in KH-5/1 also shows some similarity to glacigene post-unconformity beds of the 2165 Biozone of the Al Khlata Formation of Oman.


*Keywords:* Carboniferous; Palynology; Iraq; Hercynian unconformity

**Résumé**

Récemment, l'analyse des échantillons du forage KH-5/1 a permis l'évaluation de la durée du hiatus associé à la discordance hercynienne (connue aussi comme la discordance du Carbonifère supérieur) en Irak occidental. Le forage KH-5/1 atteint la profondeur terminale de 1620 m. Il traverse la discordance à une profondeur de 670 m avec la Formation Raha au-dessous et la Formation Ga'ara au-dessus. Vraisemblablement, la discordance est associée à un intervalle de non-dépôt ou d'érosion des roches d'un âge Serpukhovien et Bashkirien (Mississippien supérieur–Pennsylvanien inférieur), de durée équivalente à la discordance reconnue dans le forage ST-8 au nord de L'Arabie saoudite. Les assemblages de la Formation de Ga'ara au-dessus de la discordance dans le forage KH-5/1 sont similaires aux assemblages décrites dans l'intervalle 4620–4200 ft du sondage ST-8. L'étude actuelle propose un âge Westphalien pour les deux assemblages de KH-5/1 et ST-8. La composition des assemblages de la Formation Ga'ara en KH-5/1 montre des similitudes avec des dépôts glaciogéniques, formés après la discordance. Ils correspondent à la Biozone 2165 de La Formation Al Khlata en Oman.


*Mots clés :* Carbonifère ; Palynologie ; Irak ; Discordance hercynienne

## 1. Introduction

Across the Arabian Plate, a stratigraphic gap is present within the Carboniferous. In the southern Arabian Peninsula, the rocks above and below are typically distinguished not only by age

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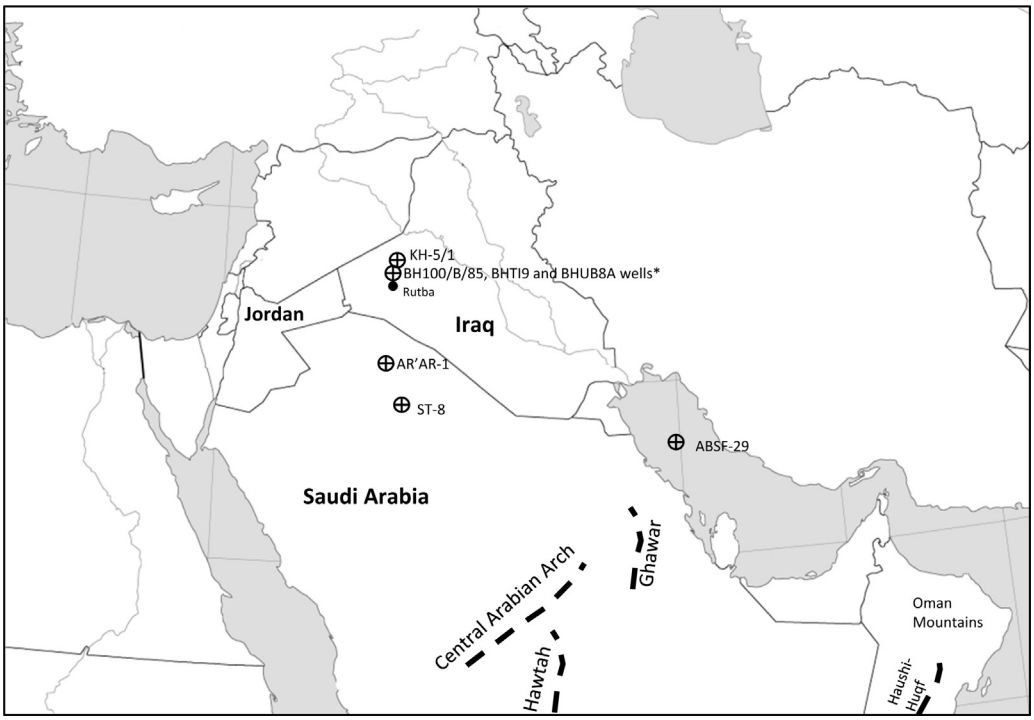


Fig. 1. Location of wells described in the text. Structural features. *Positions approximate.
After Al-Husseini (2004).

but also by their facies, in that beds above the unconformity are glacial in sedimentological character and contain palynomorphs that suggest cold climates, while those below do not show glacial or particular cold climate character palynomorphs. Further north in the Arabian Peninsula this facies distinction is not always so clear. The unconformity is known variously as the pre-Unayzah unconformity (e.g. Al-Husseini, 2004), the Late Carboniferous unconformity (Aqrawi et al., 2010), and the Hercynian unconformity (e.g. Al-Hajri and Owens, 2000; terminology used here). The areal extent of the unconformity and the hiatus it represents are important economically because typical Arabian source and reservoir rocks are often not present because of erosion related to the unconformity.

The duration of the stratigraphic gap associated with the Hercynian unconformity (HU) varies considerably across the Arabian plate. Well sections provide very important evidence as to the biostratigraphy of the unconformity. Northern well sections containing stratigraphy that is useful in defining the unconformity include those in ABSF-29 (offshore Arabian Gulf; Fig. 1) and ST-8 (northern Saudi Arabia). These latter have stratigraphic coverage of both the oldest post-unconformity beds and the youngest pre-unconformity beds, and have been used to most narrowly constrain the age of the event that caused either the non-deposition or erosion associated with the stratigraphic gap. Al-Husseini (2004) used these well sections to suggest an approximate Namurian – early Westphalian (Serpukhovian – Bashkirian; 327–311 Ma; see Fig. 2 for stratigraphic nomenclature) compressional tectonic event.

In Saudi Arabia, the youngest pre-unconformity beds belong to the Berwath Formation. Al-Husseini (2004) commented on the rarity of this formation in Arabian stratigraphy, pointing out its complete absence from the surface and its rarity in the subsurface, and attributed this to it being the 'uppermost pre-tectonism' rock unit and therefore prone to removal by erosion. Al-Husseini (2004) suggested that the event affected extensive north-south trending fault blocks (e.g. the Hawtah and Ghawar structures, Fig. 1), and was expressed in open folds in the Oman Mountains, and may have included further uplift of pre-existing highs such as the Central Arabian Arch and the Haushi-Huqf high in Oman.

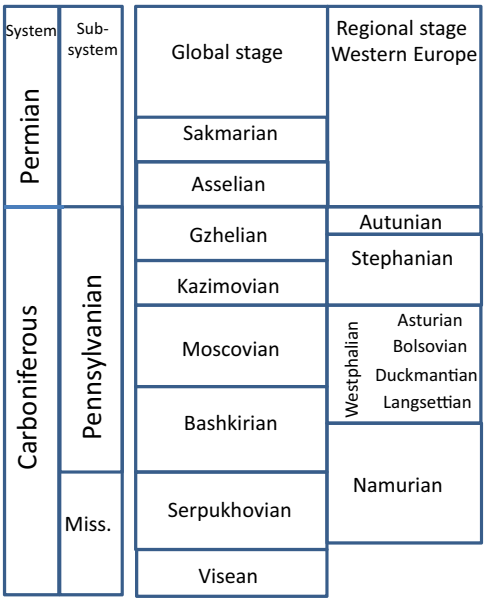


Fig. 2. Carboniferous nomenclature used in this paper.
After Heckel and Clayton (2006) and Richards (2013).

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