

## RAYN FORMATION, A NEW NAME FOR THE PERMIAN KHUFF FORMATION (S. S.) IN SAUDI ARABIA

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*Key Words:* Carboniferous-Permian, Khuff Formation, Rayn Formation, Saudi Arabia, Stratigraphy, Unayzah Formation.

### ABSTRACT

The rank of the Khuff Formation (late Carboniferous-late Permian) in Saudi Arabia is raised to group status and it is divided into Unayzah (late Carboniferous-early Permian) and Rayn (middle-late Permian) Formations. The name Rayn Formation is suggested as a new term to replace the Khuff Formation s. s. of authors, which violates the rules of stratigraphic nomenclature.

### INTRODUCTION

Al-Laboun (1987) introduced the Unayzah Formation (late Carboniferous-early Permian) to include the sandstones, shales and thin beds of argillaceous limestone which form the basal part of the Khuff Formation in Saudi Arabia. Meanwhile, he restricted the name Khuff Formation to the overlying remaining calcareous part. However, the restriction of the Khuff Formation in such way does not conform with the rules of stratigraphic nomenclature. When a unit is divided into two or more of the same rank as the original, the original name should not be used for any of the divisions. Retention of the old name for one of the units precludes use of the name in a term of higher rank. Furthermore, in order to understand an author's meaning, a later reader would have to know about the modification and its date, and whether the author is following the original or the modified usage. For these reasons, the normal practice is to raise the rank of an established unit when units of the same rank are recognized and mapped within it (North American Stratigraphic Code, 1983, Article 19, Remark g). Accordingly, it is suggested to raise the rank of the Khuff Formation, as originally defined by Steineke 1937 (in Powers *et al.*, 1966, and Powers, 1968), to a group status, and to divide it into two formations: the

Unayzah Formation which includes the basal sandstones and shales, and the Rayn Formation which is suggested here as a new name to replace the term Khuff Formation in its restricted sense which includes the overlying calcareous part, and which does not conform with the rules of stratigraphic nomenclature.

## BIOSTRATIGRAPHY OF THE RAYN FORMATION

### **Definition:**

The Rayn Formation is introduced as a new name to replace the term Khuff Formation in its restricted sense as it violates the rules of stratigraphic nomenclature. It includes the alternating limestones, marls and shales which form the upper part of the Khuff Group. It is underlain by the Unayzah Formation and overlain by the Sudair Formation, It is named for Wadi ar Rayn where the type section is located.

The alternating hard, dense limestones and light colored, limestones, marls and shales which form the upper part of the reference section of the "Khuff Formation" as measured and described by Bramkamp and others, 1945 (in Powers *et al.*, 1966) near Wadi ar Rayn, are chosen to be the type section of the Rayn Formation. The Rayn Formation as here defined includes the sequence of the reference section of the "Khuff Formation" excluding the basal unit of sandstones and varicolored shales.

**Type section details:** (after Powers *et al.*, 1966, and Powers, 1968).

**Location:** Compositated from several sections between Wadi ar Rayn (Lat. 23° 32' 45" N., Long. 45° 34' 30" E.) and Jabal ath Thuwayr (Lat. 23° 43' 00" N., Long. 45° 42' 00" E.), (Figure 1).

**Thickness: 160m.**

**Lithology:** The type section is divided into four informal units (Figure 2), from bottom to top these are:

1. Dolomite and shale, dominantly tan to white, rubbly weathering dolomite, subordinate tan to gray fine-grained limestone with poorly exposed olive-green gypsiferous shale units in the middle part (27m);
2. Dolomite and limestone, cream, impure dolomite with common interbeds of aphanitic limestone, well cemented oolite and coquina (33.7 m);
3. Aphanitic limestone, gray, white and brown, with poorly exposed shale near the middle and at the base (71.1 m);
4. Aphanitic and calcarenitic limestone, yellow and white, commonly marly and

fossiliferous; brown dolomite and oolite cap sequence (28.2 m).

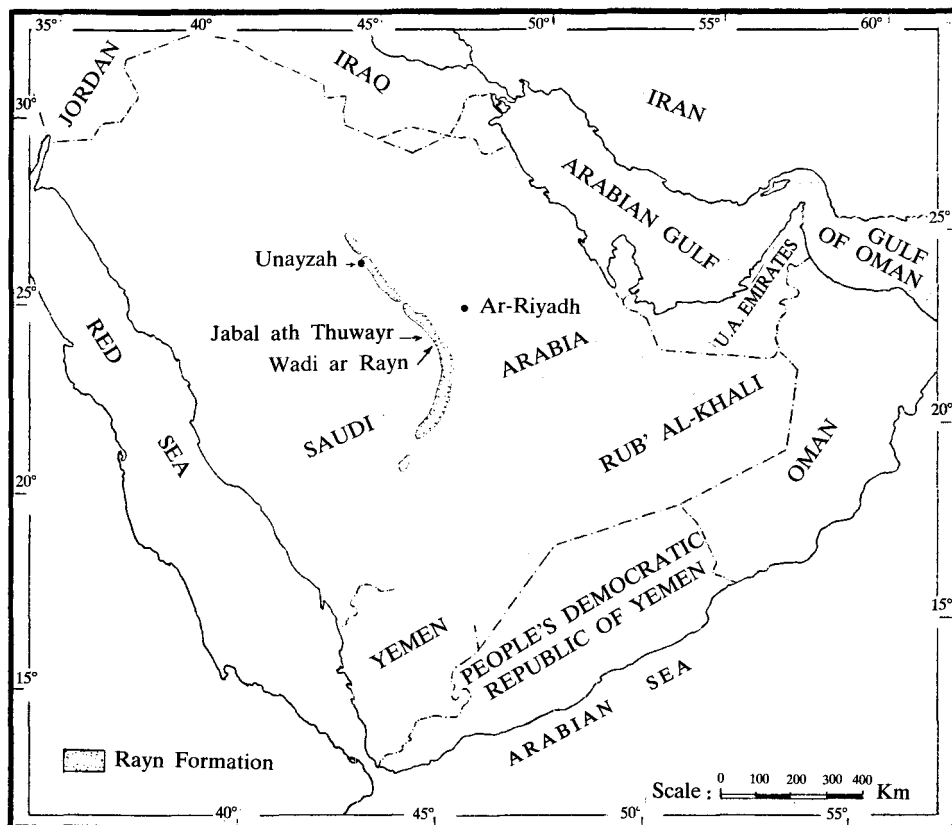


Fig. 1: Index map showing the location of the type section and outcrops of Rayn Formation (after the Geological Map of the Arabian Peninsula, 1963).

**Fossils:** The recorded fossils include: *Colaniella parva?* (Colani), *Crurithyris?* sp., *Derbyia* sp. cf. *D. cymbula*, *Derbyia* spp., *Meekella?* sp., *Schuchertella?* sp., *Analisis* sp., *Aviculopecten* spp., *Bellerophon* spp., *Botulus?* sp., *Cardinia?* sp., *Circulopecten* sp., *Coelogastroceras* sp. aff. *C. mexicanum* (Girty), *Cympolia* "Dentalium" sp., *Dimyopsis* sp., *Foordiceras transitorium* (Waagen)?, *Hyolihes* sp., *Nautilus* spp., *Oxytoma?* sp., *Pleuromya?* sp., *Pleurotomaria* sp., *Taenioceras?* sp., *Dadoxylon indicum*, *Lepidodendron* sp., algal remains and the following spores: *Vittatina*, *Potonieispoites*, *Hamiapollenites*, *Protohaploxypinus*, and *Nuskoisporites*.

**Age:** On the basis of the above mentioned fossils, both Powers *et al.*, 1966, and Powers, 1968, assigned the present rock unit to the late Permian. However, as most

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Location				
Lat. 23° 32' 45" to 23° 42' 00" N. Long. 45° 34' 30" 45° 42' 00" E.				
GROUP	Formation	Generalized lithology	Diagnostic fossils	Age
—	Sudair	Covered	Hoffmeisterites microdens Lueckisporites, Wilsonastrum.	Early Triassic Late Permian
KHUFF	Rayn	Aphanitic and calcarenitic limestone (28.2 m)	Derbyia aff. D. cymbula Schuchertella?  Dadoxylon indicum Antalis, Aviculopecten, Coelogastroceras aff. C. mexicanum, Foordiceras transitorium Aviculopecten, Derbyia?	Middle—Late Permian
		Aphanitic limestone (71.1 m)		
		Dolomite and limestone (33.7 m)		
		Dolomite and shale (27 m)		
	Unayzah	Shale, sand and conglomerate	Annularia stellata, Raistrikiya pistillata, Crassispora kosankei, Tholisporites foveolats	Early Permian Late Carbonif.
	Basement Complex			Precambrian

Fig. 2: Rayn Formation type section (after Bramkamp *et al.*, 1945, In: Powers *et al.*, 1966; age modified according to the results of the present study).

of those fossils were identified with uncertainty and to the generic level only, the suggested age (late Permian) may be not accurate. Therefore, the use of the stratigraphic position of this part of the Khuff Group may lead to a more accurate age assignment.

The Rayn Formation is conformably underlain and overlain by the Unayzah and the Sudair Formations, respectively. On the basis of the occurrence of fossil plants, the Unayzah Formation was assigned to the late Carboniferous-early Permian (al-Laboun, 1987), whereas the Sudair Formation was assigned to the late Permian-early Triassic (Powers *et al.*, 1966, and Powers, 1968). Accordingly, the age of the Rayn Formation is considered to be middle-late Permian.

**Lower contact:** The lower contact with the Unayzah Formation is conformable. It is picked at the base of the lowest well-developed limestone bed of the Rayn Formation, overlying the clastics of the Unayzah Formation (al-Laboun, 1987).

**Upper contact:** The contact with the overlying Sudair Formation is conformable. It is placed at change from dolomite below to red and green gypsiferous shale above (Powers *et al.*, 1966, and Powers, 1968).

**Other localities:** The exposures of the Rayn Formation can be traced from Bani Khatmah (Lat. 18° 00' N.) to An Nafud (Lat. 28° 10' N.) a distance of more than 1200 km (Figure 1). This formation has been encountered in wells at Khurais and Dammam oil fields, and bore holes at Al 'Ubaylah (Lat. 21° 59' N., Long. 50° 57' E.,) around the margin of the Rub' al-Khali and at Wadi aba ar Ruwath (Lat. 29° 53' N., Long. 41° 55' E.).

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## متكون الرين ، اسم جديد لمتكون الخف (البرمي) بمفهومه المحدود في المملكة العربية السعودية

حامد حمد النخال

رُفعت رتبة متكون الخف ( الكربوني المتأخر - البرمي المتأخر ) في المملكة العربية السعودية ، إلى مجموعة التي قُسمت إلى متكوني العنيزة ( الكربوني المتأخر - البرمي المبكر ) ، والرين ( البرمي المتوسط والمتأخر ) . ويقترح اسم متكون الرين كمصطلح جديد ليحل محل متكون الخُف ، بمفهومه المحدود ، الذي استخدمه الباحثون السابقون والذي يخالف قوانين التسمية التطبيقية .