

KHASHM FORMATION, A NEW LITHOSTRATIGRAPHIC UNIT WITHIN THE CRETACEOUS WASIA GROUP OF ARABIA

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ABSTRACT

The Khashm Formation is introduced as a new lithostratigraphic unit to include the sandstones and shale interbeds which constitute the upper part of the Cretaceous Wasia Group (*s. l.*) outcropping in central Arabia. It replaces the name Wasia Formation (*s. s.*) of authors which does not conform with the rules of the stratigraphic nomenclature. The Khashm Sandstone is equated with the Wara, Ahmadi and Magwa Formations (Cenomanian, Turonian) in the subsurface of eastern Arabia.

INTRODUCTION

Beds now assigned to the Wasia were first included by Koch and Brown, 1934 (in Powers *et al.*, 1966) in their unnamed clastic series of presumed Cretaceous age. In 1935, Burchfiel and Hoover (in Powers *et al.*, *op. cit.*) applied the name "Nubian Sandstone" to this unit due to its similarity to the Cretaceous section in Lebanon. However, Steineke, 1938 (in Powers *et al.*, 1966) pointed out that the "Nubian Sandstone" is primarily a facies term with no stratigraphical significance. It had been used in Egypt, Sinai, Palestine and Lebanon as a "catch - all" for arenaceous sediments of widely differing ages. The Arabian sandstone, on the other hand, occupied a definite stratigraphical position and could only be correlative with the upper part of the succession in Egypt. For that reason, the loose term "Nubian Sandstone" was replaced by the name Wasia Formation. The Wasia was bracketed at the top by the limestone of the Aruma "Formation" and at the base by the limestone that is now Buwaib Formation. This rock unit was named after Khashm Wasia, in Saudi Arabia where a complete section is exposed. Such definition of the Wasia was first published by Steineke and Bramkamp (1952), (cf. Powers *et al.*, 1966).

Truncation and overlap within the Wasia as first defined had long been recognized. The exact surface of unconformity was pinpointed by detailed field and aerial photomapping. With these data, it could be demonstrated that the Wasia contained two sand units separated by a major unconformity. Consequently, in 1952 Bramkamp (in Powers *et al.*, 1966) tentatively removed the beds below the unconformity from the Wasia and assigned them to a new formation, the Biyadh Sandstone. The Biyadh Formation, because of its considered Lower Cretaceous or Neocomian age, was attached to the top of the Thamama Group. The beds remaining above the unconformity were assigned to the Wasia (restricted), (cf. Powers *et al.*, 1966). The restricted usage of the Wasia was adopted by Thralls and Hasson (1956), Steineke *et al.* (1958), Powers *et al.* (1966), Powers (1968), Moshrif (1980 a, b), and Moshrif and Kelling (1984). Other authors e.g. Fox (1956, 1957). Owen and Nasr (1958), van Bellen *et al.* (1959) followed by most recent workers, raised the Wasia to group status, but continued to use it in the restricted sense. El-Naggar and Al-Rifa'iy (1972) However, rejected the restricted usage of the Wasia and called for a return back to its original definition. Those two authors treated the Wasia as a group divisible into a lower Biyadh Sandstone and an upper Sakaka Sandstone (= Wasia *s. s.*) including the whole sequence between the top of the Buwaib Limestone and the base of the Aruma Group. However, on the basis of field studies and lithostratigraphical relationships, Sharief and Moshrif (1983) questioned the correlation of the Sakaka Formation with the Wasia Formation (*s. s.*). Furthermore those two authors referred to the occurrence of pollen assemblage in the subsurface Sakaka Formation at al-Jawf area (north west Saudi Arabia) which suggested a probable Late Devonian - Early Carboniferous age for that formation. Accordingly, the correlation of the upper part of the Wasia Group with the Sakaka Formation is here rejected.

From the above mentioned review it appears that the Wasia Formation was subdivided into two formations a lower Biyadh and an upper Wasia (*s. s.*). Also, the removal of the Biyadh Formation from the Wasia, and its attachment to the top of the Thamama Group was based on age consideration only which violates the rules of the stratigraphical nomenclature as the lithostratigraphic units are distinguished on the basis of their lithic characteristics regardless of time boundaries (North American Stratigraphic Code, 1983, Article 22). Similarly, 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). Following these

rules, it is here suggested to treat the Wasia within its original definition (as published by Steineke and Bramkamp, 1952), as a group including two formations a lower Biyadh and an upper Khashm. The latter formation is introduced as a new lithostratigraphic unit to accommodate the upper part of the Wasia Group. It is synonymous to the Wasia Formation (*s. s.*) of previous workers.

STRATIGRAPHY OF THE KHASHM FORMATION

Definition

The Khashm Formation is here suggested as a new rock unit to include the sandstones and shale interbeds which form the upper part of the Wasia Group (*s. l.*), and lie between the Biyadh Formation below and the Aruma Group above. It replaces the Wasia Formation (*s. s.*) of authors which does not conform with the rules of the stratigraphic nomenclature. Consequently, all the stratigraphical characteristics of this new formation including its type section, lithology, thickness, contacts, occurrence ... etc., would be those of the Wasia Formation (*s. s.*) of previous workers. The Khashm Formation is named after the Khashm Wasi' in central Arabia where a complete section is exposed (Text-fig. 1).

Details of the type section of the Khashm Formation: (mainly after Powers *et al.*, 1966 and Powers, 1968)

Location. In the lower slope of Al Aramah escarpment (at Lat. 24° 23' 04" N., Long. 47° 5' 12" E.) southeast to low hills near Wasi (Lat. 24° 22' 38" N., Long. 47° 45' 49" E.) (Text-Fig. 1).

Thickness. 42.0 m.

Lithology. Sandstone, brown-to black-weathering with red and green shale interbeds in the lower part (Text-Fig. 2).

Fossils. *Neolobites vibrayanus* (d'Orbigny).

Age. Cenomanian - Turonian at the type locality and elsewhere on the outcrop as well as in the subsurface sections.

Lower contact. The contact between the Khashm Formation and the underlying Biyadh Formation is placed at the change from varicolored, fine-grained sandstone and siltstone above to light-colored, coarse-grained locally pebbly sandstone below. Powers *et al.* (1966) and Powers (1968) considered this contact on the outcrop as being unconformable and they mentioned that the magnitude of the unconformity increases northwards. Also, they added that the unconformity so obvious at the surface, cannot be identified even in nearby subsurface sections where it is lost in a monotonous sequence of nonmarine sandstone. Presumably it decreases in magnitude towards the east to disappear altogether or have at its

subsurface equivalent a slight erosional unconformity. However, Moshrif and Kelling (1984) questioned the presence of such unconformity and described the contact between these two rock units as concordant and gradational displaying little evidence of an abrupt break in sedimentation. Those authors mentioned that strong similarities between the lithology, depositional environments, paleocurrent directions and provenance of these two formations provide additional evidence for continuity of sedimentation, and therefore suggest that no major time break existed between them. Moshrif and Kelling (*op. cit.*) also mentioned that they failed to confirm the presence of the unconformity which Powers *et al.* (1966) and Powers (1968) described, except possibly at one locality (locality 4, figs. 6, 12, 13, Moshrif and Kelling, 1984) where a conspicuous erosional surface is present. They described this surface as probably resulted from some local changes and brief time break of the type to be anticipated in fluvial sequence.

On the basis of the above mentioned review, the lower contact of the Khashm Formation at its type locality, is considered here to be conformable with the possibility of the occurrence of unconformity northwards at the outcrop.

Upper contact. The upper contact with the Aruma Group is disconformable. It lies at the sharp change from sandstone below to red-brown dolomite above.

Surface and subsurface relationships.

The Khashm Formation on the outcrop is equated with the Wara, Ahmadi and Magwa Formations in the subsurface of eastern Arabia. The relation between the Wasia Group on the outcrop and its equivalents in the subsurface is summarized as follows.

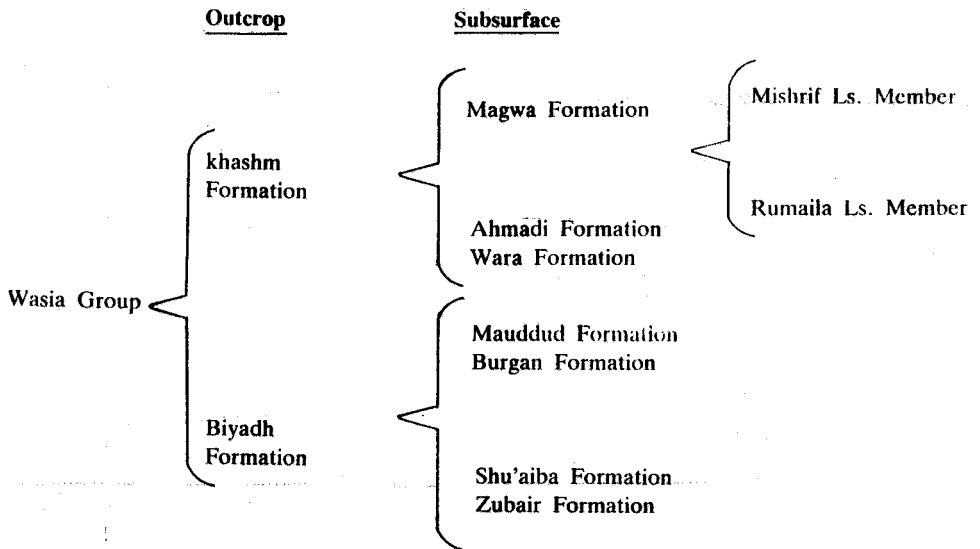
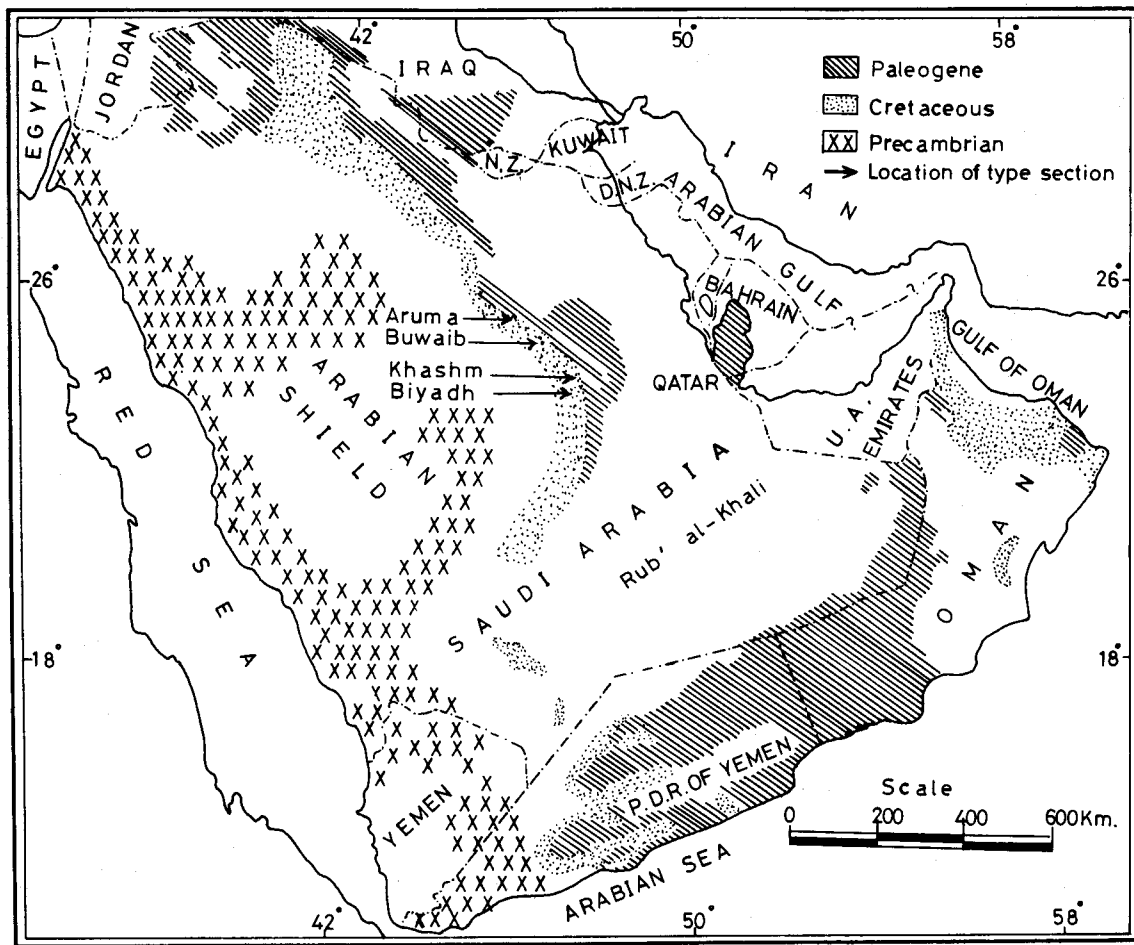


Fig. 1



Khashm Formation, a New Lithostratigraphic Unit.

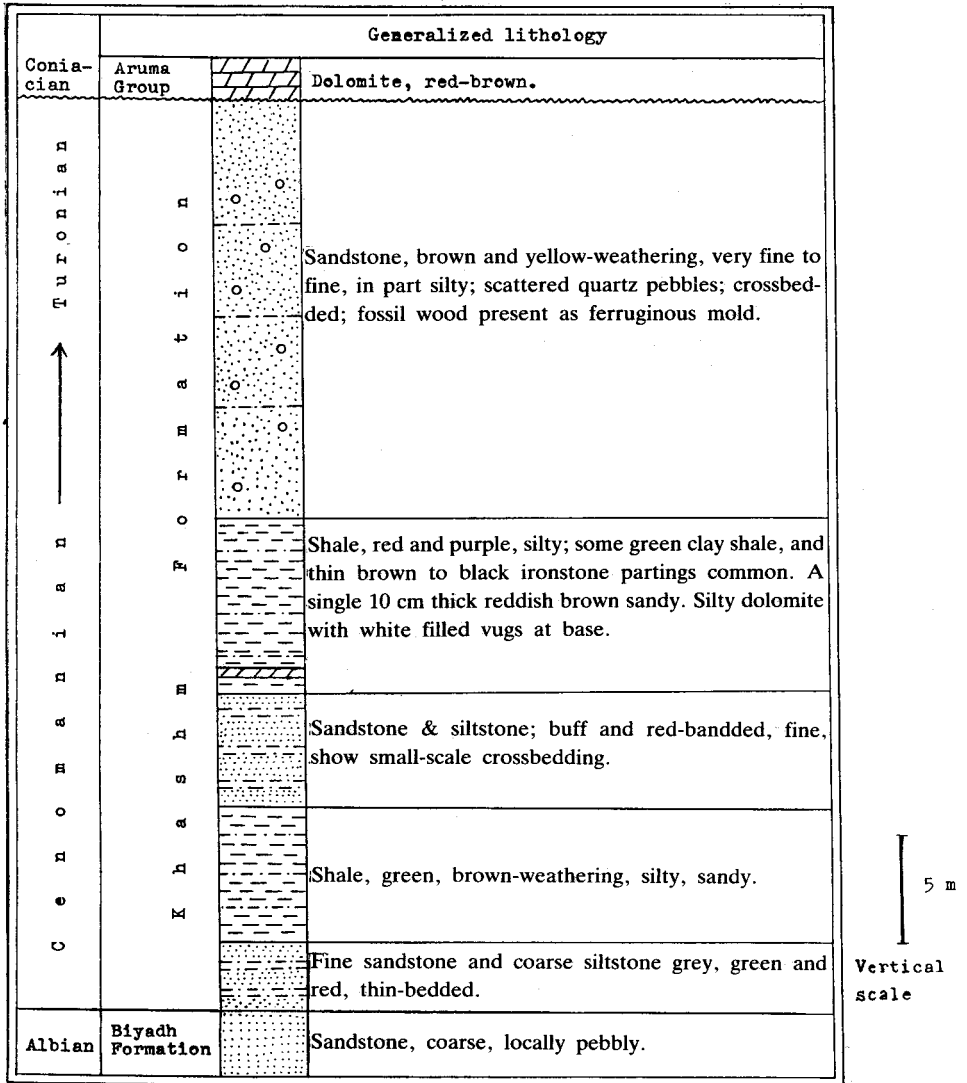


Fig. 2

REFERENCES

- EL-Naggar, Z. R. and Al-Rifa'iy, I. A. 1972.** Microfacies analysis of the type Magwa Formation of Kuwait, Arabia. Arab Petrol. Congr. 8th, Algeria, 1 - 101.
- Fox, A. F. 1956.** Oil occurrences in Kuwait. Symposium sobre yacimientos de petroleo y gas, Internat. Geol. Congr. 20th, Mexico, 2, 131 - 158.
- Fox, A. F. 1957.** A short history of exploration in Kuwait. World Petrol. Dept., 94 - 102.
- Moshrif, M. A. 1980 a.** Recognition of fluvial environments in the Biyadh-Wasia Sandstones (Lower-Middle Cretaceous) as revealed by textural analysis. Journal of Sedimentary Petrology, 50, 603 - 612.
- Moshrif, M. A. 1980 b.** Cementation, diagenesis and paragenetic sequence in the Biyadh-Wasi Sandstones (Lower-Middle Cretaceous) of central Saudi Arabia. Journal of the University of Kuwait (Science), 7, 245 - 262.
- Moshrif, M. A. and Kelling, G. 1984.** Stratigraphy and sedimentary history of upper-Lower and Middle Cretaceous rocks, central Saudi Arabia. Mineral Resources Bulletin (Jiddah), 28, 1 - 28.
- North American Commission on Stratigraphic Nomenclature 1983.** North American Stratigraphic Code. The Am. Assoc. Petrol. Geol. Bull., 67, 841 - 875.
- Owen, R. M. and Nasr, S. N. 1958.** Stratigraphy of the Kuwait - Basra area. Habitat of Oil, Symposium, Am. Assoc. Petrol. Geol., 1252 - 1278.
- Powers, R. W. 1968.** Lexique Stratigraphique International, v. 3, Asie, Fasciule 10 b 1, Arabie Saoudite, 1 - 177.
- Powers, R. W., Ramirez, L. F., Redmond, C. D. and Elberg, E. L., Jr. 1966.** Geology of the Arabian Peninsula. U. S. Geol. Survey Prof. Paper 560 - D, 1 - 147.
- Sharief, F. A. and Moshrif, M. A. 1983.** Age of the Sakaka Sandstone, al-Jawf area, Saudi Arabia. Proceedings of the First Jordanian Geol. Conf. (Amman, 1982), 223 - 230.
- Steineke, M. and Bramkamp, R. A. 1952.** Mesozoic rocks of eastern Saudi Arabia (abstract). Am. Assoc. Petrol. Geol., Bull., 63, 909.
- Steineke, M., Bramkamp, R. and Sander, N. J. 1958.** Stratigraphic relations of Arabian Jurassic oil. Habitat of Oil, Symposium, Am. Assoc. Petrol Geol., 1294 - 1329.

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- Thralls, W. H. and Hasson, R. C. 1956.** Geology and oil resources of eastern Saudi Arabia. Symposium on the geological occurrence of oil and gas. Internat. Geol. Congr. 20th, Mexico, Proc., v. 2, Asia y Oceano, 9 - 32.
- Van Bellen, R. C., Dunnington, H. V., Wetzels, R. and Morton, D. M. 1959.** Lexique Stratigraphique International, v. 3, Asie, Fascicule 10 a, Iraq, 1 - 333.

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يُقترح متكون الخشم كوحدة صخرية جديدة ليحتوي الصخور الرملية والطينية الصفحية ، التي تكون الجزء العلوي من مجموعة الوسيح (بمفهومها الواسع) ، والتي تظهر على السطح في أواسط الجزيرة العربية ، إن هذا المتكون يحل محل متكون الوسيح (بمفهومه المحدود) الذي استخدمه الباحثون السابقون والذي لا يتفق وقوانين تسمية الطبقات ، لقد ضُوهي متكون الخشم بمتكونات وارة والأحمدي والمقوع ، التي تتواجد تحت السطح شرقي الجزيرة العربية والتي تمتد في عمرها الجيولوجي ما بين العصرين السينوماني والتيروني .