CONTRIBUTION TO THE AGE OF THE BAUXTITE-BEARING KARST DEPOSITS, WESTERN DESERT, IRAQ

Khalidoun S. Al-Bassam
S. Co. of Geological Survey and Mining

ABSTRACT

Many conflicting opinions were put forward on the age of the bauxite-bearing karst-fill deposits in the Western Desert area. The proposed ideas are mostly based on indirect approaches and many of them lack evidence or do not fit the geological facts and features of these deposits and the area in general.

In the present paper the problem is discussed on the basis of all available facts, which were found related to the problem. The paper concludes that the karst-fill deposits are most probably Aptian in age and the subsequent bauxitization took place shortly after; most likely within the Aptian-Albian boundary, under wet and warm climatic conditions.

INTRODUCTION

The bauxite-bearing karst deposits are located in the Western Desert of Iraq and were discovered in 1990 (Mustafa, 1991). The Karsts are found in the Ubaid Formation carbonates (Liassic). They are fossil karsts, mostly of the sinkhole type, and are as deep as 105 m (Mustafa et al., 1994). They occasionally penetrate the whole thickness of the Ubaid Formation and well within the underlying Zor Hauran Formation (Late Triassic).

The karst-fill deposits consist of several fining upward cycles of quartzose sandstone and kaolinitic clay with bauxite and bauxitic flint clay lenses in the middle. Plant remains are frequent in the upper part of the karst-fill succession (Mustafa et al., 1994). There are characteristic orthoquartzite bodies at a higher level above the kars sequence, having a wider but semi-continuous extension, and overlie formations from Permian to Early Cretaceous in age (Qasir et al., 1992, Mustafa et al., 1994 and Al-Azzawi et al., 1996).

The age of the karst-fill deposits was considered as Early Jurassic by Al-Atia and Sadallah (1995), Cretaceous by Mustafa et al. (1994), Early Cretaceous by Mustafa et al. (1996) and Eocene by Al-Rawi et al. (1996).

The Early Cretaceous age, proposed by Mustafa and co-workers was not based on evidence, except that the whole area was exposed by the end of the Jurassic and beginning of the Cretaceous due to the Kimmeridian Orogeny, which facilitated karstification processes under wet climate.

BASIC FACTS AND OBSERVATIONS

The conclusions reached at the end of this paper are based on a number of observations and facts which were found by previous workers, and are listed below:

1. Karstification is a widespread phenomenon in the exposed carbonate units of all formations in the Western Desert, from Late Triassic to Late Jurassic, and this phenomenon is not restricted to the Ubaid Formation only (Qasir et al., 1992 and Al-Azzawi et al., 1996).

2. The intensity of karstification is controlled by lithology (carbonates) and density of fault and fracture-intersections (Al-Amiri, 1978, Qasir et al., 1992, Mustafa et al., 1994 and Al-Azzawi et al., 1996).

3. Karstification in the Ubaid Formation is mainly demonstrated in the exposed parts of the formation. The presence of such karstification was rarely proved in the several hundreds boreholes drilled from the top of the overlying Hussainiyat Formation and reached

4. The bedding of the karst-fill deposits generally conform with the morphology of the karst, and hence they are generally concave upward, including the bauxite lenses enclosed within these deposits (Mustafa et al., 1994).

5. There is a depositional break in the Western Desert of Iraq (Rutta-Km 160-Wadi Horan area) and in neighboring areas in Saudi Arabia (Zubir area) that lasted from the end of the Jurassic to the Albain in the former (Al-Azzawi et al., 1996) and to the Aptian in the latter (Bowden, 1981). The Albain rocks are represented in Iraq by the Nahr Umr and Mauddud Formations, whereas the Aptian rocks are represented in Saudi Arabia by the Biadi Formation.

6. The orthoquartzite bodies overlying the karst-fill deposits are silicified fluvial sandstone channel deposits, with large tree trunks. They are stratigraphically younger than the karst-fill deposits, and were considered as age-equivalent to the Nahr Umr Formation (Albian) by Al-Azzawi et al., (1996).


8. The Zabira stratiform bauxite deposit in Northern Saudi Arabia is dated as Aptian-Albian on the basis of index fossils and palynomorphs in the rocks directly underlying the bauxite profile (Biadi Formation-Aptian) and those directly overlying the bauxite profile (lower part of the Wasia Formation-Albian), (Norris, 1980, Bowden, 1981 and Black et al., 1982).

DISCUSSION

The discussion will follow the sequence of facts and observations listed above.

The wide spread karstification in the carbonate units from Late Triassic to Late Jurassic, and the near absence of such karstification in the Ubaid Formation, where it is covered by the Hussainiyat Formation suggest that karstification in those units took place after the Jurassic and all the carbonate units exposed at that time (Jurassic-Cretaceous boundary) were affected by this phenomenon.

The higher intensity of karstification in the bauxite area is merely due to the higher density of fault- and fracture-intersection in this area, as shown by the LANDSAT image interpretation (Al-Amiri, 1978).

The conformity of the karst-fill bedding with the morphology of the karst and the concave-upward shape of the beds inside the karsts, including the bauxite lenses, indicate that karstification and filling were conjunctive events and bauxitization took place contemporaneously or shortly after. Consequently, the age of the karst-fill deposits and the enclosed bauxites are younger than Jurassic. On the other hand, the correlation of the orthoquartzite bodies, above the karst-sequence, with Nahr Umr Formation indicates that the karst-fill deposits are older than Albain.

The sharp change in clay-mineral assemblages from kaolinite in the Permian-Albian rock units to smectite-palygorskite in the younger sequences is obviously related to regional climatic changes. The kaolinite reflects warm and humid conditions, whereas smectite reflects semi-arid conditions (Blatt et al., 1980) and palygorskite reflects arid conditions (Shafdan and Dixon, 1984 and Shafdan and Hussein, 1985), where low-alumina and high magnesia immature clay minerals may form respectively by pedogenesis.
Hence, the climatic conditions from Late Cretaceous onward were not suitable for bauxitization and bauxite formation in the Iraqi Western Desert.

The bauxitization event in Northern Saudi Arabia (Zabira) suggests a very wet period that lasted for 2-3 million years (Aptian-Albian boundary) in an area that is closely related, geographically and physiographically, to the Western Desert of Iraq (Fig. 1). Such climatic conditions may have induced the bauxitization of the kaolinites in the karst-fill deposits of the Iraqi Western Desert.

CONCLUSION

The age of the karst-fill deposits enclosed in the exposed parts of the Ubaid Formation in the Iraqi Western Desert can be assigned to the Aptian, and these deposits can be correlated with the Biadh Formation of Northern Saudi Arabia (Zabira area) both in age and lithology (Fig. 2). The bauxitization of the karst-fill kaolinitic deposits may have taken place at the Aptian-Albian boundary, as an equivalent event to the bauxite profile at Zabira, and under similar climatic conditions.

Fig.(1): Location map
Fig.(2): Correlation diagram
REFERENCES


