

NEW POTASSIUM/ARGON AGES FOR THE VOLCANIC ROCKS OF HALUL ISLAND (QATAR)

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ABSTRACT

The only rocks of igneous origin known to be exposed in Qatar are those of Halul and Shra'Auh Islands. They occur within a salt diapir and the age of these rocks is uncertain. They have generally been assigned to the Hormuz Formation; approximately Middle Cambrian age. A few unreliable isotopic ages were obtained earlier and led to inconclusive results. In this paper, new K/Ar ages obtained by the writer are presented and discussed. They indicate a tectono-thermal event which took place some 33 million years ago, although the rocks themselves are considered to be much older.

INTRODUCTION

Halul Island is one of the main Qatari offshore islands and is situated almost a hundred kilometres in an ENE direction from Doha. It is oval in shape, extending approximately 1.7 km north-south by 1.3 km east-west, with a total area of about 1.48 km². Its relief is moderate with its highest point 60 metres above sea level (Light House Hill).

The literature on the geology of the island is scanty. Pilgrim (1908 - p.140/141) published a general geological description of the island. The interest of his description is both historical and general.

During the years 1964-1966, some general geological studies were made by S.C.Q. (Shell Company). The main results of this study were the construction of a geological map for the island, scale 1:10,000 (Fig. 1) and a general description of the main rock units present (unpublished report, 1967).

Later, Cavelier (1970 - p.35/37) in his geological description of the Qatar peninsula gave a short account on the geology of the offshore islands of Qatar including Halul Island.

Brief reference was made in the above-mentioned publications to the presence of some minor volcanic intrusions on the Island. These, together with supposedly similar ones on Shra'Auh Island (some 63 Km NE of Umm Said) are the only rocks of igneous origin known to be exposed in Qatar. Fairly similar volcanics are known to occur in Yas island, United Arab Emirates (Personal communication with G. Prost.).

The age of these volcanic rocks is as yet uncertain. In this paper some new potassium argon ages are reported. This is part of a detailed petrological and geochronological study currently being carried out by the present writer.

GENERAL GEOLOGY

Geologically, Halul Island represents a small surface piercement dome of deep salt diapir origin of the Hormuz plug type. Subsurface salt diapirs are common in the Arabian Gulf, especially to the east of Qatar and are detectable from seismic data (Warsi, 1986). Evidence suggests the Halul dome to be slightly elongated in a north-south direction. It shows up as a marked gravity negative on the Bouguer map (S.C.Q. report, 1967).

Four main rock types are exposed in the island, namely:

1. dolomitic limestones and dolomites
2. gypsum and anhydrite
3. volcanic rocks
4. beach deposits.

Rock types 1-3 were considered to belong to the Hormuz Formation. There is a clear angular unconformity existing between these and the overlying Quaternary deposits. The deposits of the Hormuz Formation appear highly disordered, cut by faults and fractures with numerous breccias and breccia fill. The dips of the hard rocks (dolomites) vary but evaporites are generally steep and near to vertical. The rocks are mainly of sedimentary origin, but also, numerous volcanic intrusions of andesitic types as well as localized deposits of hydrothermal origin are observed. The 'volcanic' rocks appear as brecciated blocks rather than well defined sheets or intrusions. A fair iron mineralization is found, most probably related to the volcanic activity.

It should be noted that the volcanic rocks belong to more than one petrographic variety, the andesitic types being more dominant. These volcanic rocks are situated mainly in the northern parts of the Island (Fig. 1).

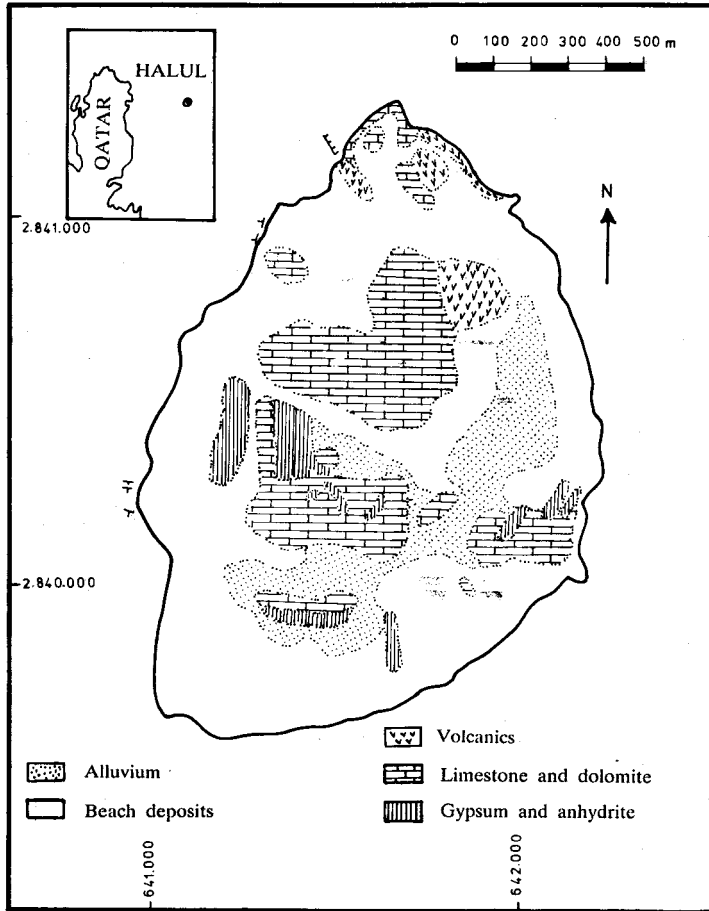


Fig. 1: Geological Map of Halul Island (After S.C.Q, 1964)

THE AGE OF THE VOLCANIC ROCKS

Rock types 1-3 belong to the halokinetic suite. They are highly contorted into wedges and by litho-comparison with the Hormuz series they are thought to be of Middle Cambrian age. The extrusives are thought to be of approximately the same age as the gypsum tuffaceous layers and the platy dolomitic limestones, i.e. probably Middle Cambrian or Infra Cambrian.

Earlier attempts were made to determine the age of the halokinetic rock sequence, through isotopic age dating of extrusive rocks. The investigation of the volcanic rocks' samples yielded inconclusive results concerning their age. On different

occasions the following ages were determined for whole rock samples of the extrusives (S.C.Q. report, 1967):

1. K-Ar method: age: 9 ± 3 Ma
(1966) (Upper Miocene-Pliocene)
2. Rb-Sr method: age: 180 ± 80 Ma
(1964) (Probably Upper Triassic-Lower Jurassic)
3. K-Ar method: age: 22 ± 4 Ma
(1965) (Miocene)

N. D. Smith Jr. from Houston, who carried out these age determinations commented rightly that "In view of the known high temperature history, very little reliance should be placed on the evidence from single samples". It was then concluded that the original age can probably no longer be determined because of the alteration of the rocks by a thermal event in relatively younger times.

The present writer, whilst agreeing in general with that conclusion, is attempting here to determine the age of the thermal event whose widespread impact is well recognized. For this purpose, the potassium-argon method of age determination, which is considered as best suited, has been used in this work.

RESULTS

Several samples were collected on three field excursions from the main volcanic exposures in the northerly part of the Island. It should be noted that the selection of suitable samples for isotopic age dating of these rocks is not an easy task, due to brecciation and weathering. Thin section study was carried out prior to age dating to ensure the best possible selection.

Four whole rock potassium/argon measurements were carried out by the writer at the Federal Geological Survey in Hannover, West Germany, during a summer leave kindly provided by the Alexander Von Humboldt Stiftung. Potassium content was measured by an automatized and digitized Corning - 455 - double channel flame photometer with lithium as internal standard. Argon was obtained by single conventional total fusion static mass spectrometer. The results obtained are presented in Table 1.

DISCUSSION

The accuracy and reliability of the analytical results are clearly demonstrated by the close similarity of the ages obtained in this work. They range between 33 Ma and 29 Ma indicating an Oligocene age. As expected, this is obviously not the original age of the volcanic rocks in view of the strong impact of the tectono-thermal event to

Table 1
New K/Ar ages of Halul volcanic rocks

Sample	Atmos. Ar CC STP/g×10 ⁷	Radiog. Ar CC STP/g×10 ⁷	K Wt%	Age (Ma)
H ₁	28.1	35.8	2.739	33.3 ± 1.2
(W.R.)	± 0.7	± 1.0	± 0.06	
H ₂	28.4	34.5	2.739	32.2 ± 1.1
(W.R.)	± 0.6	± 0.9	± 0.06	
H ₃	28.5	34.7	2.938	30.2 ± 0.8
(W.R.)	± 0.7	± 0.7	± 0.06	
H ₄	26.6	33.5	2.929	29.2 ± 0.8
(W.R.)	± 0.6	± 0.6	± 0.06	

- Constants: $\lambda_B = 4.962 \times 10^{-10}/y$
 $\lambda_e = 0.581 \times 10^{-10}/y$
 $K^{40}/K = 0.1167$ atomic %
- Errors on the 95% level of interlaboratory confidence
- W.R. = Whole Rock

which they were subjected and by which they were re-activated in association with salt movement. It is known that the salt movements, especially to the east of Qatar, in the eastern salt basin, have been intermittent since at least the late Paleozoic. Surface geology on Halul Island and bathymetric surveys over the Bul Hanine structure suggest that salt movements are still active (Schlumberger, 1981). The consistency of the results obtained suggest that they reflect a main thermal event which took place in association with salt movement around 33 million years ago. However, in view of the possibility of some argon loss, these ages are considered as potentially low ages and thus end Eocene-early Oligocene age for that tectono-thermal event is indicated. This period coincides with the period of uplift which affected the whole of Qatar at that time.

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نتائج جديدة بطريقة البوتاسيوم/ أرجون لعمر الصخور البركانية بجزيرة حالول - قطر

محمد يسري منيسي

تتواجد في جزيرتي حالول وشراعوه بعض الصخور البركانية هي الصخور الوحيدة من أصل ناري الموجودة على السطح في قطر . ويتناول هذا البحث عمر الصخور البركانية بجزيرة حالول كجزء أولي من دراسة بترولوجية تفصيلية لهذه الصخور - وقد سبقت محاولات قليلة لتحديد عمر هذه الصخور بطرق النظائر المشعة ولم تصل إلى نتائج يُعتمد عليها - وفي هذا البحث تم الحصول على نتائج جديدة بطريقة البوتاسيوم/أرجون - تتراوح بين ٢٩ - ٢٣ مليون سنة وتم مناقشتها في ضوء المعلومات الجيولوجية المتاحة عن هذه الصخور .