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# $D_2$ AND $^{18}O_2$ ABUNDANCES IN THE GULF WATERS OF QATAR

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## ABSTRACT

Ten water samples from the Gulf were analyzed for their $D_2$ content and three samples were analyzed for their $^{18}O_2$ content. Results of the analysis indicat that the Arabian Gulf Water, are highely so enriched in both isotopes compared with normal oceanic waters , particularly so in the area of Salwa Bay. This high concentration may have resulted due to differential evaporation. The high concentration reported in Salwa Bay area is comprable to values reported from the Dead Sea and some Tropical lakes ; where $D_2$ is being extracted commercially. However it is recommended that further studies be conducted before final evaluation of this resource could be made.

## INTRODUCTION

The Arabian Gulf is a very shallow semi-enclosed basin with an area of about 240,000 sq. km and an average depth of only 35 m. It connects with the Gulf of Oman through the narrow strait of Hormuz, which has a maximum depth of 100 m.

The Gulf is the drainage basin for almost the whole of Arabia, Iraq and a large part of Syria, Turkey and Iran. Most of these areas are very arid and small amounts of fresh water flow into the Gulf at Shatt Al-Arab, where the Tigris, Euphrates and Karun Rivers discharge their waters. Rain-fall onto the Gulf, very seldom, exceeds three inches/years. Evaporation from the Gulf is much greater than the fresh water influx; about 50 inches/year. Thus there is a net flow of water, from the Indian Ocean into the Gulf through the strait of Hurmoz (sugden, 1965). Several authors have given values and distribution maps of salinity and temperature in the Arabion Gulf (schott, 1908; Schulz, 1914 and Emery, 1956). Emery (1956) prepared the first adequate maps from data obtaind in August 1948.

Because of the high rate of evarportion in the Gulf, it might be expected that some sort of difrential removl of light water mollecules into the vapour form, leaving heavier molecules to be concentrated in the Gulf waters. Thus it is expected that the isotopic ratios in the Gulf water may be different from normal oceanic water.

The presnt study involves the determination of ratios of hydrogen isatope

($D_2$) and oxygen istope $^{18}O_2$ in some samples collected from the Gulf area around Qatar peninsula.

## SAMPLES COLECTION AND METHODS OF ANALYSIS

Water samples were collected during the period Nov. 1979, Feb. 1980,using an insulated plexiglass water sampler. Samples used for the present study were mainly surface samples, except sample No 14 that was a near bottom sample (Figure 1 shows the location of sampleing stations).

Analysis of the stable isotope ratios $^{18}O$ / $^{16}O$ and $D_2$ / $H_2$ were perfomed at A and F consultants, Cambridge England. The Measurement procedure included:

1- For $^{18}O$ / $^{16}O$ equilibration of the oxygen in the sample with carbon dioxide under controlled condition.

2- For D/H separetion of the hydrogen in the sample under conditions which give as near as possible 100% separation efficiency.

A VG Micromass Spectrometer Type 602 C was used for stable isotope measurements.

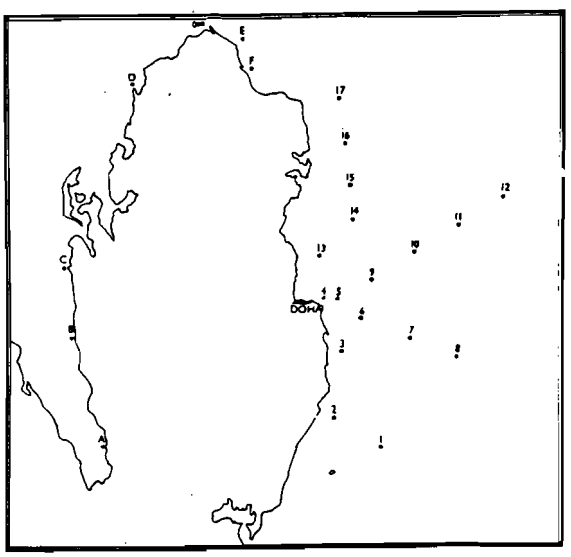


Fig. (1)
Location of sampling stations.

The measurements were taken in camparison with the laboratory working standards for $^{18}O$ / $^{16}O$ and $D_2$ / $H_2$ measurements; Hendred Brorehole and Vienna SMOW respectively. Both of these standard are calibrated interms of the international standard NBS-1. The results are expressed in terms of differnce from NBS-1 standard according to the relationship

$$^{18}O\ ‰ = [(^{18}O / ^{16}O)\ \text{sample} / (^{18}O / ^{16}O)_{NBS-1}] - 1 \times 1000$$

and similarly for $D_2$.

## RESULTS AND DISCUSSION

The result of the analysis are give in Table 1 and are shown on Figure 2.

As can be seen from the Table 9 samples out of the 10 samples analysed have high positive $D_2$ / $H_2$ ratios. The values increase as we come close to the shore, and it is minimum (+6) near the open water of the Gulf. The samples collected from the Bay of Salwa, which is highly isolated and exchange of water with the Gulf is almost restricted, had a very high $D_2$ / $H_2$ ratio which is very close to the value reported for the Dead Sea and the African tropical Lakes.

The high salinity of the Bay of Salwa results form excessive evaporation

TABLE 1
Results of Isotope Analysis.

| St.n | $\delta$ 18 (± 0.2°/oo) | $\delta$ D (± 2°/oo) |
|---|---|---|
| A | + 4.5 | + 23 |
| 2 | | + 11 |
| 5 | | + 10 |
| 7 | + 2.0 | + 9 |
| 9 | | + 11 |
| 11 | | + 8 |
| 12 | | + 8 |
| 13 | + 2.0 | + 9 |
| 14 | | - 17 |
| 17 | | + 6 |

Fig. (2)
Salinity distribution.

and almost lack of fresh water input. Not only the D/H ratio in this area was very high, but also $^{18}O/O_{16}$ is relatively high compared to other parts of the area.

Samples along the easterm coast of Qater had high D/H ratios that increased in the shore direction and in WS direction. This trend may also be correlated with the salinity distribution in the area (Beltagy, 1983) where there can be observed an increase in salinity going shore ward, and also WS direction (Figure 3).

The - ve D/H was only observed at station 14 near the bottom. This may be explained as due to ground water influx in the area which is also reflected in the lower salinity at this station near the bottom.

Fig. (3)
$D_2$ and $^{18}O_2$ concentrations at
different stations.
[ $D_2$ * $^{18}O_2$ ]

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