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ENVIRONMENTAL ISOTOPES AND THEIR APPLICATION ON THE GROUNDWATER AQUIFERS OF WADI WATIR BASIN, SOUTH SINAI, EGYPT

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Wadi Watir basin (3440km^2) is one of the main hydrographic basins of Gulf of Aqaba drainage system. It is bounded by longituds 34° 00̂ and 34° 30̂ E and latitudes 29° 00̂ and 29° 20̂ N Fig.(1). Its main channel runs in N-S for about 40 Km and then bends slightly NNW-SSE direction for about 25 km, where it debouches its load in the Gulf of Aqaba. The surface of Wadi Watir is covered by sedimentary Paleozoic and Cretaceous rocks particularly in its middle and upper parts while in its down part, it is occupied by highly fractured basement rocks (granites and granodiorite) traversed by some dykes. The alluvial deposites form a delta at its connection with the Gulf of Aqaba. The purpose of this study is to use the environmental isotopes to assess the recharge sources of the aquifers in both Wadi Watir main channel and its delta. Twenty three water samples were collected from piezometers, dug wells and drilled wells, as well as two springs in addition to one sample from Gulf of Aqaba (Fig. (2)). The δD vs δ^{18} 0 diagram which illustrates the isotopic composition of the collected groundwater samples in the studied area besides local paleowater, rainwater and marine water of Gulf of Aqaba is shown in Fig. (3). The global meteoric water line G.M.W.L (Craig, 1961) and the corresponding lines for Mediterranean sea precipitation line M.S.P.L (Gat & Carmi, 1970)and paleowater line P.W.L (Sonntag etal.,1980) are drawn in the same figure as reference lines. Most of the studied groundwater samples (≅ 70 %) are plotted between the G.M.W.L and P.W.L and the other samples (≅ 30%) between G.M.W.L and M.S.P.L . Therefore, these samples show a wide range of isotope composition +1.79 ‰ to - 6.5‰ for δ^{18} O values and +5.1‰ to - 45.3‰ for δD. This wide variation reflecting the multitude origins and mechanisms of replenishment. Samples No.1,13,14 and 19 appear to be of meteoric origin where their geographic setting near the mouth of Wadis suggesting recharge by floods flows which originate on the mountains.

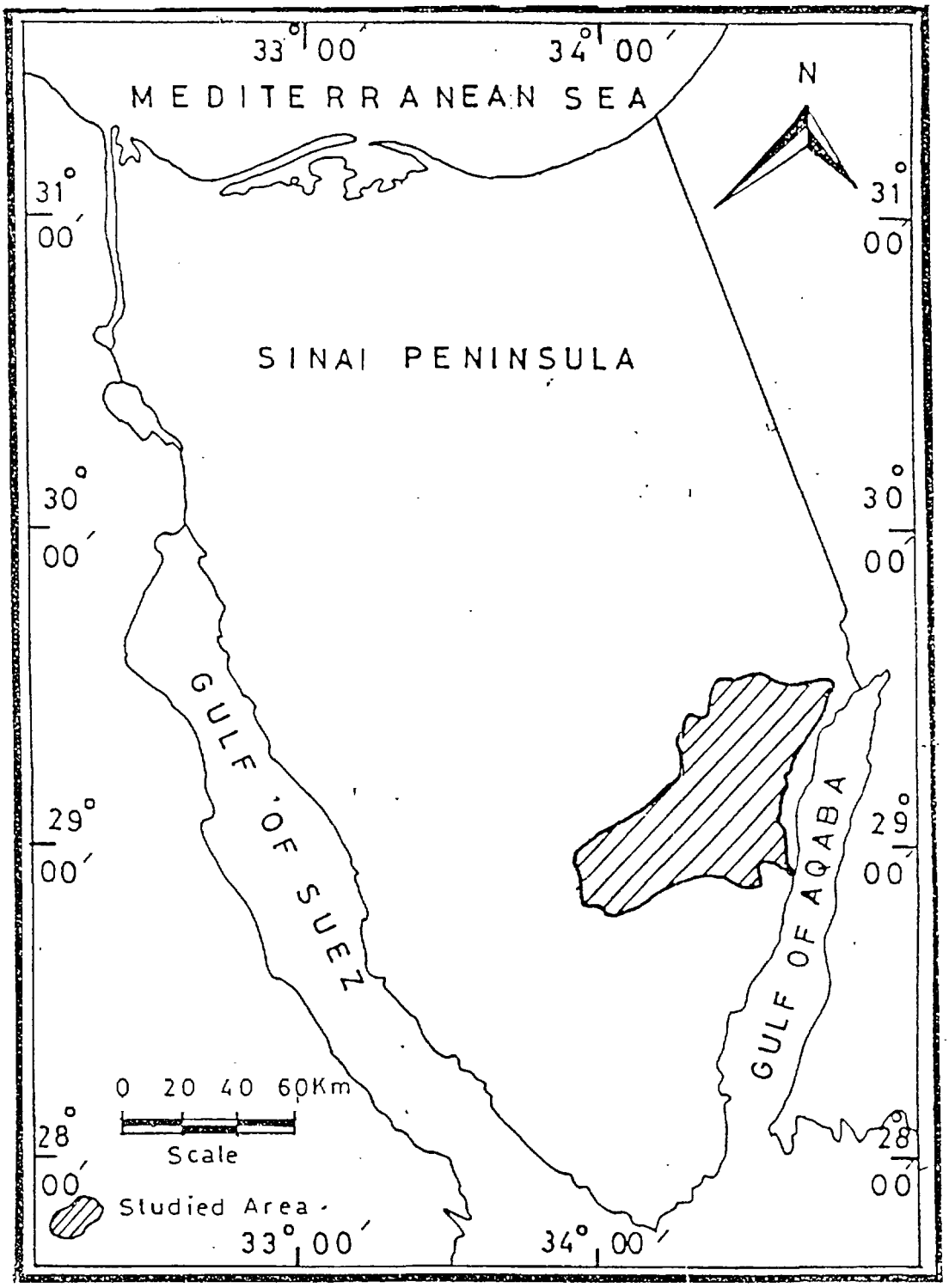
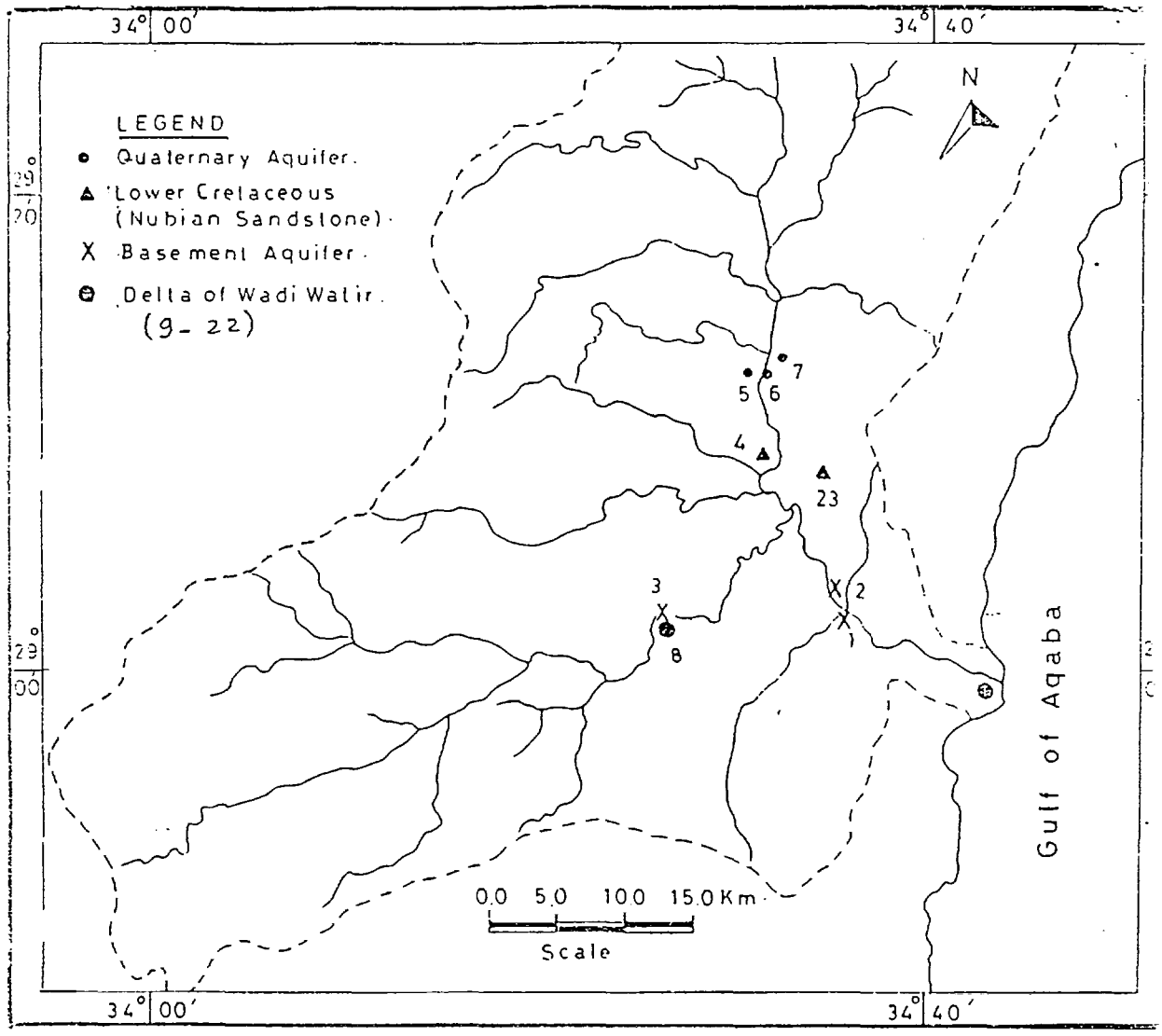
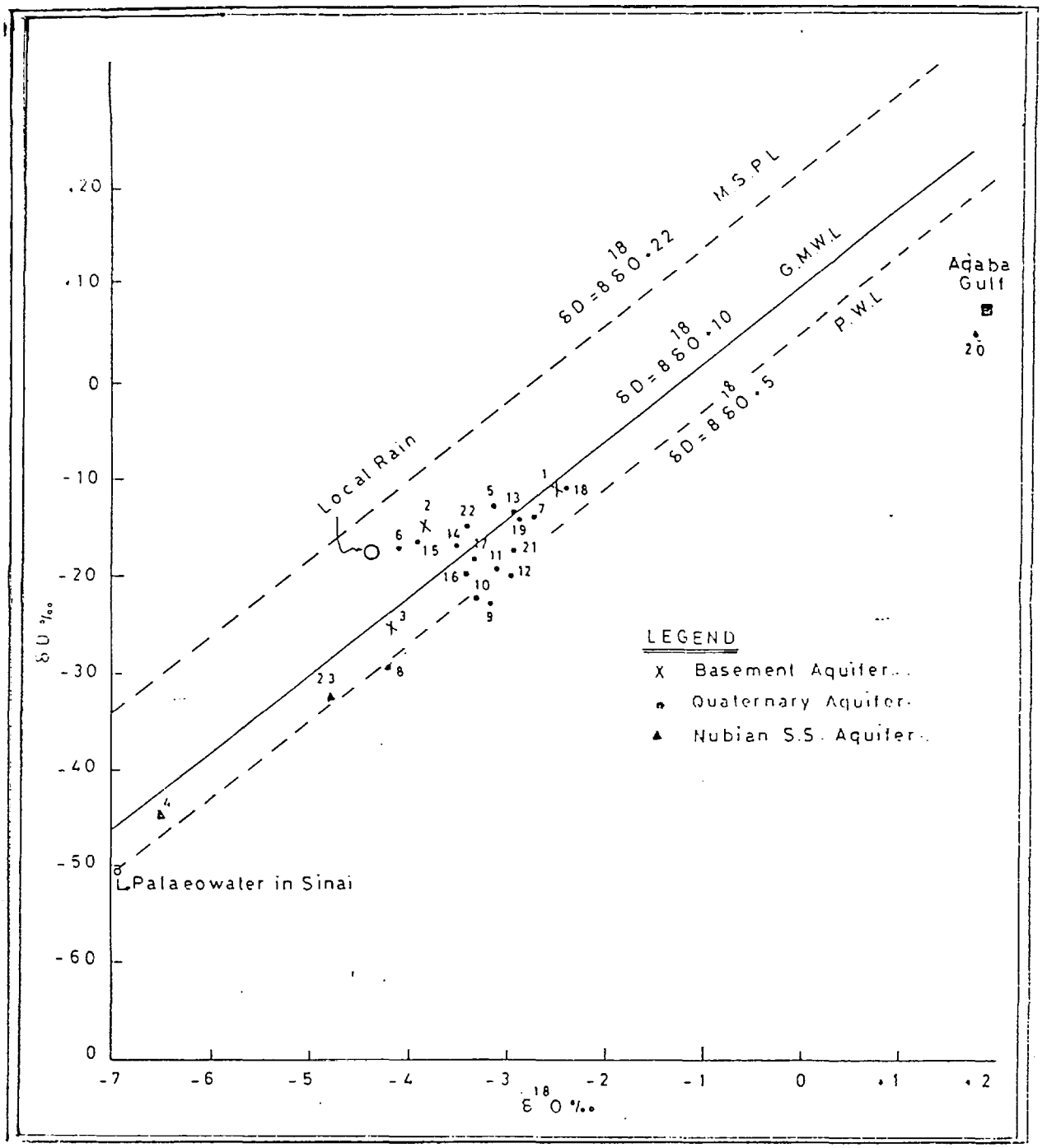

33° 00′
34° 00′
MEDITERRANEAN SEA
N
31° 00′
SINAI PENINSULA
30° 00′
29° 00′
GULF OF SUEZ
GULF OF AQABA
0 20 40 60Km
Scale
28° 00′
Studied Area
33° 00′
34° 00′

Fig.(1) Key map.



Fig(2) Sampling sites in Wadi Watir for isotopic analysis.



Fig(3)δ Oxygen-18 vs δ Deuterium diagram.

We can notice an evaporate enrichment of heavy isotopes and chloride content of sample No. 20. This means an extreme case of evaporation process. Samples No. 4 and 23 which represent the exposed Nubian sandstone aquifer in the study area are depleted in heavy isotopes much more than present day meteoric water of the region, with isotopic composition quite resembles the paleowater of Sinai * (δ^{18} 0 = - 7.2‰ & δD = - 52‰) with some eveporation as well as mixing with other water (e.g.sample N0. 23) . Samples Nos,7,9,10,11,12,16,17,18 and 21 are Located in alluvium Wadi fill deposits. Its isotopic composition suggests meteoric origin with some evaporated water seeped from the existed aquifers. Asimilar mechanism for samples No.3 and possibly also No.8 which receive a considerable amount of evaporated paleowater. Remaining Samples No. 2,5,6,15 and 22 which seem to have been recharged from both continental and Mediterramean precipitation.

* Originally rechared during wet climatic peroid probably during the pleistocene aquifer.

References

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Gat, J.R., and Carmi, I. (1970): " Evaluation of the isotopic composition of atmospheric waters in the Mediterranean Sea area " J.Geophys. Res. 75,PP.3039-3048.

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