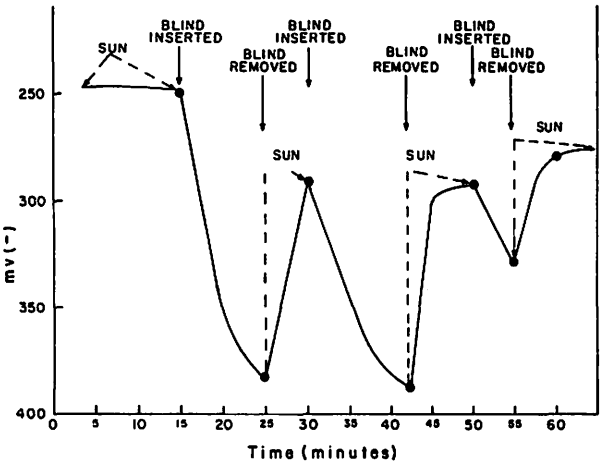

Fig. 2. Rapid effect of changes of illumination on the redox potential of water covering algal mats. In this experiment, a blind was periodically introduced to shield algal mats from sunlight. Measurements employed Ag/AgCl - platinum electrode pair. Algal mats and water from the Solar Pool.

produce large quantities of H_2S. This H_2S production appears to offset the CO_2 production which in Oppenheimer and Master's experiments caused pH fluctuations of up to 2 pH units. H_2 production typically occurs under the anaerobic conditions present in *thick* algal mats. It must, therefore, be concluded that in the type of geological setting studied, the reason for carbonate deposition is not due to pH changes caused by algal photosynthesis.

References

Friedman, G.M., 1980. Review of depositional environments in evaporite deposits and the role of evaporites in hydrocarbon accumulation. *Cent. Rech. Explor., Bull.*, vol. 4, pp. 589-608.

Friedman, G.M. and Sanders, J.E., 1978. *Principles of Sedimentology*. New York, Wiley, 792 p.

Oppenheimer, C.H. and Master, M., 1965. On the solution of quartz and the precipitation of dolomite in sea-water during photosynthesis and respiration. *Ziets. Allg. Mikrobiologie*, vol. 5, pp. 48-51.

* * *

POTENTIAL TERTIARY SOURCE ROCKS IN THE ISRAELI COASTAL PLAIN AND THE GULF OF SUEZ: A COMPARISON

Amos Bein and Ora Amit

The Tertiary section along the Israeli coastal plain is comprised of shales, marls and chalks which tentatively might be considered good source rocks. However, no oil has yet been found in this section. On the other hand, in the Gulf of Suez a considerable amount of oil was generated in Tertiary source rocks and is found in Tertiary reservoirs. In order to explain the lack of oil in the Tertiary sequence of the Israeli coastal plain versus its abundance in the Gulf of Suez, parameters identifying and qualifying source rock were evaluated. These parameters, which are discussed in Tissot and Welte (1978), claim to answer whether sufficient organic matter of the right type is present in a basin and whether the organic matter was exposed to temperature appropriate for generating oil.

Twelve core samples of the Israeli coastal plain, representing the Beit Guvrin, Ziqim, Mavqiim and Yafo Formations, taken from depths of 590 to 1950 m and ten core samples from two wells in the Suez area of lower and Middle Miocene taken from depths of 2060 to 2500 m were examined.

The organic carbon content in most of the samples is above 0.5%, indicating the presence of sufficient organic matter to generate oil.

In the Suez samples the *n*-alkanes in the C_{15}+ range fall mostly between *n*-C_{15-24} with a maximum at *n*-C_{17-19}; higher *n*-alkanes are very faint and do not show any preference. In the Israeli sequence there seem to be two *n*-alkane distribution patterns; in the first group only the relatively lighter *n*-alkanes (*n*-C_{14-22}) with a maxima at *n*-C_{15-17} were recorded. In the second group *n*-alkane up to *n*-C_{31} were recovered with a pronounced odd over even preference in the *n*-C_{25-31} range. In both groups the *n*-C_{22} is usually predominant over its adjacent *n*-alkanes. The lack of odd over even predominance in the *n*-alkane distribution patterns may either reflect maturation or may indicate lack of terrestrial derived organic matter. In the Suez area samples and the Israeli samples which do not show odd over even preference, the distribution pattern indicates marine derived organic matter rather than maturation as will later be discussed. In the Israeli samples which do show

odd over even preference, it seems that organic matter from marine as well as terrestrial source is present. It is difficult to evauate the contribution proportion of each source; kerogen which is currently being separated and analysed is expected to give more information regarding this. In any case, the rocks of both areas contain marine derived organic matter and are thus potential good source rocks.

Very sporadic vitrinite reflectance measurements conducted in the Suez area samples show values ranging between 0.26 and 0.38%R and indicate immaturity. In the Israeli sequence only one sample was measured and its value was 0.42%R. However, vitrinite reflectance measured in Lower Cretaceous formations underlying the Tertiary formations in the Israeli coastal plain still indicate immaturity (Amit, 1978; Amit *et al.*, 1978; Kisch, 1978). Hence these Tertiary rocks can only be evaluated as immature. The low maturation is evidenced by the pronounced odd preference in the *n*-alkane fraction.

It seems that both areas, the Suez and the coastal plain of Israel, contain sufficient organic matter of the type appropriate for oil generation, however all the samples studied are immature and none generate oil. In the Suez area the formations studied are occasionally buried deeper thus they were exposed to higher temperatures and generated oil whereas in the Israeli coastal plain the Tertiary formations are buried at a depth at which the temperature was not high enough for oil generation.

References

Amit, O., 1978. Organochemical evaluation of Gevar'am shales (Lower Cretaceous), Israel, as possible oil source rock. *Am. Assoc. Pet. Geol., Bull.*, vol. 62, pp. 827-836.

Amit, O., Aizenshtat, Z. and Pinski, I., 1979. The role of kerogen constituents in oil generation in the Gevar'am Formation (Lower Cretaceous), Israel. *Org. Geochem.*, vol. 1, pp. 237-241.

Kisch, H.J., 1978. Coal ranks in Jurassic and lower Cretaceous clastic rocks of the northern Negev and the southern coastal plain of Israel; Interpretation and implications for the maturity of potential petroleum source rocks. *Isr. J. Earth Sci.*, vol. 27, pp. 23-35.

Tissot, B. and Welte, D.H., 1978. *Petroleum Formation and Occurrences.* Heidelberg, Springer, 538 p.

RECENT INVESTIGATIONS OF THE GEOTHERMAL POTENTIAL OF DEEP AQUIFERS

Dov Levitte and Avraham Olshina

Introduction

The Geological Survey of Israel has been involved in the exploration and evaluation of Isreal's geothermal resources for about a decade (Eckstein, 1976). Although the areas which were initially considered to be promising (the Jordan Valley Rift) did not prove to have high reserves of high-enthalpy geothermal waters, a large reservoir of low-enthalpy geothermal water has been discovered in recent years. This reservoir, which is located in Israel's southern coastal plain (Levitte and Olshina, 1978), is probably about 1000 km^2 in area, at a conservative estimate, and its upper boundary is located at a depth of about 2000 m coinciding approximately with the Jurassic Brur calcarenite. Although no detailed study on the geothermal aquifer characteristics of underlying strata has been undertaken as yet, there is reason to believe that suitable aquifers extend to depths in the order of hundreds of meters below the upper boundary mentioned above.

Since Israel has not been blessed with over-large energy resources, the writers believe that greater emphasis on the utilization of the available sources of energy, including low-enthalpy geothermal systems, will prove to be rewarding.

Geothermal Potential of the Southern Coastal Plain

As a first step in the evaluation of the geothermal potential of Israel's southern coastal plain, a number of deep abandoned oil wells located in the area of interest, were examined. It was found that, assuming a normal temperature gradient, temperatures of 90 ± 20° C could be expected at depths of about 2000 m. This coincides with a well known aquifer, the Brur Formation which, because of its permeability and other characteristics, was and still is a target of petroleum exploration. This aquifer was mapped and block diagrams and isopach