Open Access Journal of Waste Management & Xenobiotics
ISSN: 2640-2718

Waste Desalination Streams, Pre-Salt and Energy Genesis, Replenishing Oil, Gas Salt Diapirs in “Salt Mirror Petroleum Formations" - 40 Years in Retrospect, and Ancient Qanat Karez Mineral Salt Leaching Technology

David Bloch*

MR Bloch Salt Archive, Israel

***Corresponding author:** David Bloch, MR Bloch Salt Archive, M.R. Bloch Salt Archive 198a Ben Yehuda Str T-A Israel, Email: commonsalt@outlook.com

Review Article

Volume 2 Issue 4

Received Date: September 20, 2019

Published Date: November 08, 2019

DOI: 10.23880/oajwx-16000131

Abstract

The Geology Of “Salt Mirrors” as the Responsible Hydraulic Mechanisms Enabling the Disappearance of Heavy Saline Waste Fluids, and Other Waste Toxic Sediments into Deep Land and Ocean Aquifers. A hydraulic mechanism which dissolves salt to form so-called “salt mirrors” results in exceptionally flat geological expanses of wetland, for example, suitable for solar evaporation pans. Whether initially in the form of evaporates, eutectic deposits, domes or other rock salt diapirs, the mechanism is proposed to be responsible for transporting most waste organic and inorganic debris into very deep aquifers in the water table: Specifically the interface of fresh water and heavy saturated brines in the water table initiates powerful horizontal and vertical liquid streams which are capable of collecting most sediment waste material and concentrating it into heavy gradient saline pools. Based on observations made in 1953 and presented to the 4th Salt Symposium Ohio USA by M.R.Bloch, it is also proposed that this mechanism is responsible for the slurry concentrating function of huge quantities of decomposed biodiversity waste and transporting it to such subterranean reservoirs where it subsequently is transformed into crude petroleum. Historically this mechanism became nature's process of recycling waste to very great depths in the Earth's aquifers. It could also become the obvious destination for toxic RO reject brine. During mankind’s short industrial timeline, raw chemical and even nuclear waste has been added to the equation and it is estimated that as this very deep interface of water and saturated brine rises together with the water table, and that it may percolate up through these same aquifers. This will be particularly true in the event that the water table raises due to predicted increased eustatic sea levels. Salt-driven wetlands and other historical saline concentrations and salt deposits are an integral part of the process in this mechanism and therefore careful control of these saline streams at their point of evolution must become a priority to sustaining such wetland sub oceanic ecosystems.

Keywords: Mineral Salt; Oceanic Ecosystems; Heavy Saline Streams; Recycling

Introduction

The technology for handling and redirecting the heavy saline streams such as RO reject brines, is now developing in the form of Aqua harvesting amongst others, of Halophilic algae cultivations such as Dunaliella and which we consider to be the prime raw material used by nature in the natural production of proteins, lipids and crude oil. The technology of collecting systems used in the production of energy and heating systems developed in gradient solar ponds is also well advanced, and includes the even older technologies used in the evaporation ponds of ancient salt making needed to produce the required extremophile environment. To ensure the sustainability of wetlands, both control of dangerous waste streams and their processing in the form of recycling is required. “Salt mirrors” evolve from rock salt diapers or salt deposits, into the familiar very flat expanses we recognize as wetlands. Salt precipitation in solar evaporation ecosystems occurs in shallow flat ponds. Static brines in Bardawil Sabkha type lagoons or collecting basins of sea water or below springs producing highly saline solutions are normal occurrences and are mostly due to the relatively small volumes of brine exposed to solar energy. Where the brine is replenished concentration may reach saturation and super saturation, and huge quantities of salt may be precipitated and laid down on the bottom of these basins but this in itself does not result in the familiar flatness. Over a relative period of time these vast expanses of salt crusting are observed to re-form into very precise flat ‘’mirrors’’. The impression of a leveling of the basin floor is given, with the precipitated salt as filler lining the lagoon or lake bed. A typical example, the Bonneville Salt Flats might be used to show the resulting smooth and very flat salt crust stretching for miles in the Utah valley. The seismic cross-section of the salt lake bed is evidence of the layers of precipitation through the seasons, culminating in a so-called salt mirror. Measurements have demonstrated the flatness of Bonneville to a slope of 1:9000 as has its continued use by those seeking to improve world land speed records l. At a 1973 -4th World Symposium of Salt, [M.R.Bloch** “Salt Mirror and Petroleum formation”] transformed the accepted thinking of existing ancient finite Oil deposits and gas. The salt mirror technology consisting of pre-salt aquifer hydraulic streams of heavy brine have revealed a natural cycle of replenishing crude petroleum deposits. Since gas is the by-product of petroleum formation but is far less polluting, it is proposed here that the crude oil is left in-situ and that only the gas be considered of use as a “renewable” source of energy. Similar formations of natural pre-salt deposits of rare earth and sub-florescent soil elements needed for future industrial uses appear to become limited in supply and are threatening to create monopoly conditions for the chemical industry. “Pre-Salt” mirror technology enabling continuous leaching of these deposits, by employing an ancient Qanat system technology of solution mining are in danger of attempts to create yet another potential monopoly and should be of concern.

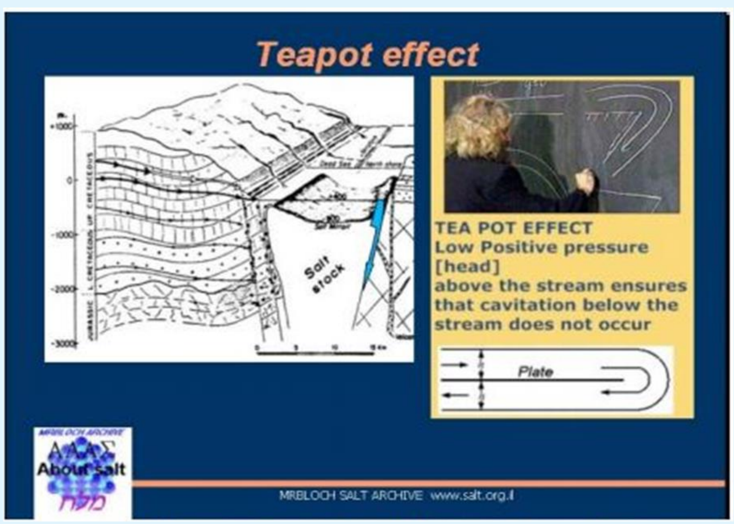

Figure 1: Teapot effect-on a typical salt stock at the dead sea-Adhering brine along the falnks of the salt protects the stock from further dissolving.

Petroleum deposits, found in geological structures and aquifers of the Mesozoic and Cenozoic ages, are wrongly thought to be millions of years old and therefore considered limited with finite availability. The reason was, and it still is assumed that the oil found in these structures is of the same age as the surrounding rocks. Isotopic methods comparable to carbon dating have shown that this is not the case. The natural process of how these petroleum deposits made their way into ancient vacant aquifers, has demonstrated that in retrospect a hypothesis of 40 years ago, confirms not only how petroleum oil is formed, but more importantly that nature is continuously ensuring that it is being replenished. It therefore could be considered renewable (Figure 1).

“The genesis of mineral oil energy is described as a process in which a salt diapir is dissolved by surface water forming a brackish lake with the salt mirror of the salt diapir as the bottom. During the dissolution of the salt mirror, algae and other organisms are continuously living (assimilating solar energy) and dying near the surface of the brackish water lake. Organic matter, specifically the algae known as Dunaliella Parva, a halophilic alga sink as debris to the bottom of the saline basin where they are decomposed by anaerobic microbes to soluble organic compounds and H2S originating from the gypsum in the diapir. The resulting solution sinks along the flanks of the diapir to great depths whereby geothermal sources heat the organic compounds which are decarboxylated and hydrogenated with the help of H2S. The hydrocarbons formed collects in droplets which become lighter than the water of the aquifer. They rise in the supernatant aquifer and are trapped in suitable "structures" as "mineral oil." The carbon dioxide formed simultaneously facilitates the migration of the oil drops through karst formation in the "source rock" [Bloch 1973]” Those drops which find difficulty in filtering the karst remain as shale. Brine streams which originate from the dissolution of massive evaporite deposits which were forced up isostatically from a great depth in the form of salt diapirs perforating overlying rock. When these rising salt bodies are eventually covered by free or vadose freshwater bodies, they are dissolved from above, forming the so-called "salt mirrors." The mechanism of this dissolution from the top has been described and investigated in some detail, and M. Reiner demonstrated its very distinctive way of working which he called the "teapot effect" [1-3]. When a salt body projects into fresh water or into a diluted salt solution, a saline stream is induced which runs down the flanks of the salt body. The stream curtains the surface against attack by adjacent fresh water as long as the flanks remain off the horizontal axis. The saline streams emanating from the horizontal surfaces of the salt-body, the salt mirror, overflows its edge saturated with salt. The volume velocity is proportional to the length of the edge and to the difference of the specific weight of the stream and the specific weight of the dissolving solution. Essentially only horizontal surfaces are dissolved and are lowered parallel to themselves with a speed which depends on the length of their circumference and on the supply of dissolving water (Figure 2).

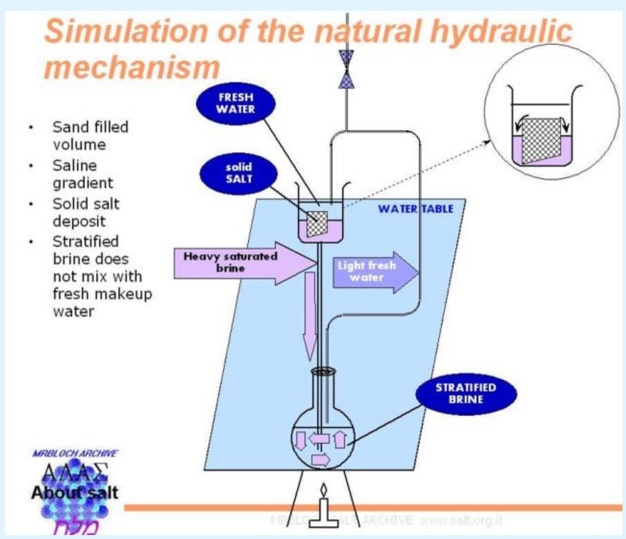

Figure 2: Laboratory cycling of brine in a simulated geothermal saline pool.

This experiment was used to develop a hypothesis for the genesis of the Dead Sea as a sinkhole [4]. This publication describes the earlier experiments with dissolving salt; and geological data combined with the results of these experiments to show how the salts of the Freshwater Salt solution of a diapir are carried to a great depth by the sinking of saturated salt brine along the flanks of the diapir, thus protecting its flanks against the attack of adjacent fresh water aquifers. According to this hypothesis the bottom of the present Dead Sea is a salt mirror. In the same paper it was suggested that the salt mirror formation might be connected with the formation of mineral oil. Such oil is formed under the set circumstances from brackish water flora and fauna living in the fresh or brackish water body (lake) above a dissolving salt mirror [5,6]. It may be assumed that in a brackish lake algae and related organisms create organic matter through photo-synthesis at a rate of about one gram carbon per square meter per day [7]. If the bottom of the brackish lake is a salt mirror this organic matter sinks, as debris, into the concentrated salt solution which has formed on the surface of the dissolving salt mirror. There the organic debris is decomposed by sulphate-(gypsum)-reducing anaerobic microorganisms [8]. This solution consists of H2S, consisting of aliphatic and aromatic acids, aldehydes, amines etc. in the stagnant salt brine covering the salt mirror. This brine with its load of dissolved organic material and H 2S continuously overflows the edge of the salt mirror to a great depth. A salt mirror underlying a brackish water lake of 300 km2 would release to a great depth some 100 km' of saturated salt brine in less than 10 years, carrying 108 tons of carbon compounds to a depth of thousands of meters. When this brine including organic matter displaces fresh water in the surrounding aquifers, springs replenish the brackish water lake and a stratified deep salt brine aquifer underlies the remaining fresh water. An example of such a basin might be the East end of the Mediterranean where fresh Nile River water continuously displaces the brines lying over the "Mediterranean Salt Giant" (Figure 3).

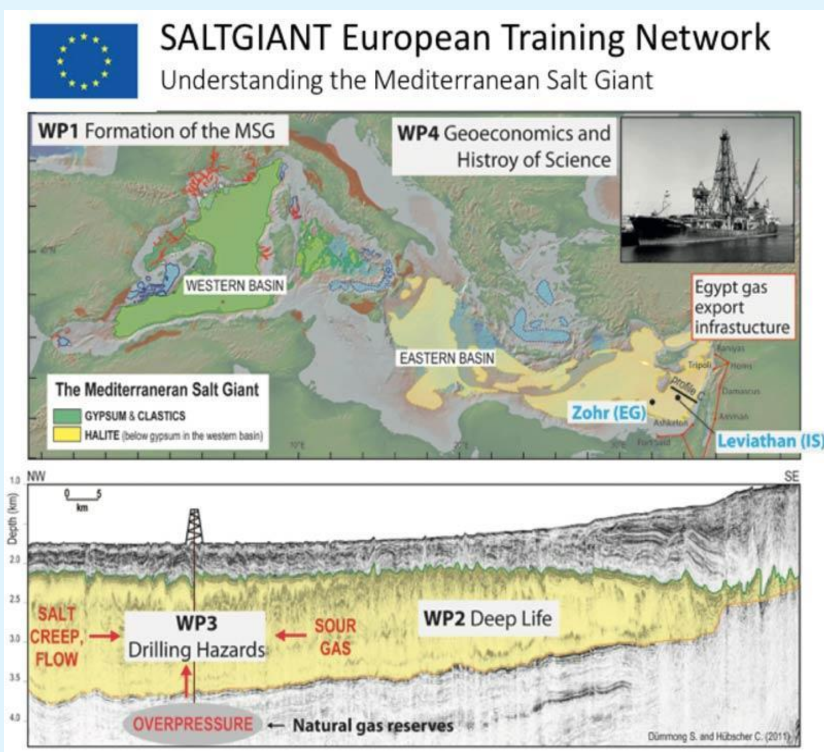

Figure 3: Example Salt mirror "Salt Giant" Eastern Mediterranean basin.

This brine, lying at a depth of several thousand meters and loaded with dissolved H_2S and organic acids etc., is now heated well above 100°C by geothermal energy. However it cannot rise, because even when hot, it still remains much heavier than the overlaying colder fresh water. The heating of this stratified "geothermal pool" starts decomposing the dissolved organic matter. Acids lose their carboxylic groups, CO_2, H_2O, and hydrocarbons are formed. The H_2S present hydrogenated double bonds and replaces OH groups. The resulting SO^{-4} replaces part of the limestone usually present above diapir forming salt and gypsum. The CO_2 now formed combines with the water to make the limestone porous, thus forming a Ca-bicarbonate solution. In this way the brine makes its own "karst" formation where the hydrocarbons are generated as an "organic liquid" insoluble in salt water. CH_4 methane becomes the predominant gas and collects in the fissures of the karst formation. Oil collects in the form of droplets which rise in the salt water and being so light, even in freshwater. If during their progress upwards in the aquifer, these oil drops meet an obstructing "structure" they collect and form a hydrocarbon reservoir, always underlaid by water "contaminated" with salt, which was carried up with the rising drops" (Figure 4).

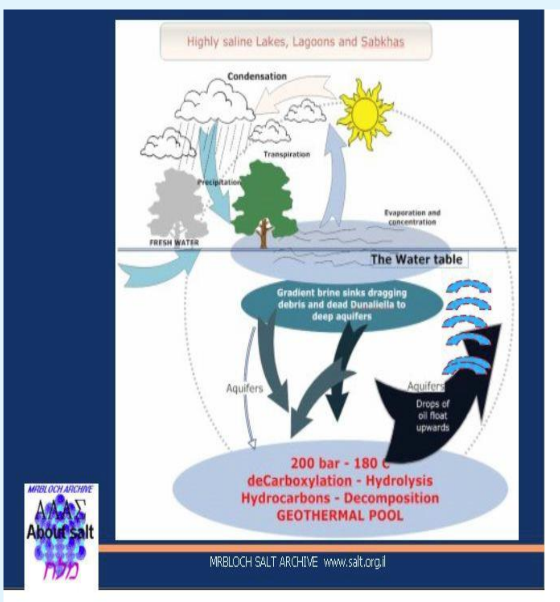

Figure 4: Geothermal pool scheme.

The beneficiation of Lithium carbonates from "salt mirror" deposits for battery energy, is as secretive as the original Qanat Karez leaching technology invented some 3500 years ago. The central Asian deserts where alluvial sub-florescent soils harboured minerals in a very similar process, were a highly monopolised source of salt crust for the Silk Road trade at a time world famine (Figure 5).

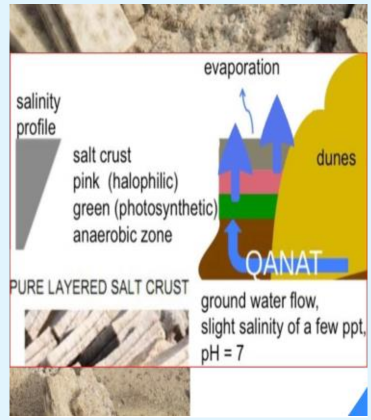

Figure 5: Sub-florescent soil salt leaching by timed surge flooding for salt production.

The Qanat Karez water today is only used for domestic use. However the technology as it was used up to the Islamic agricultural revolution, was based upon the salt mirror streams, to dissolve sub-florescent soil salts for basin precipitation and trading the subsequent slabs of salt along the Silk Road (Figures 6 & 7).

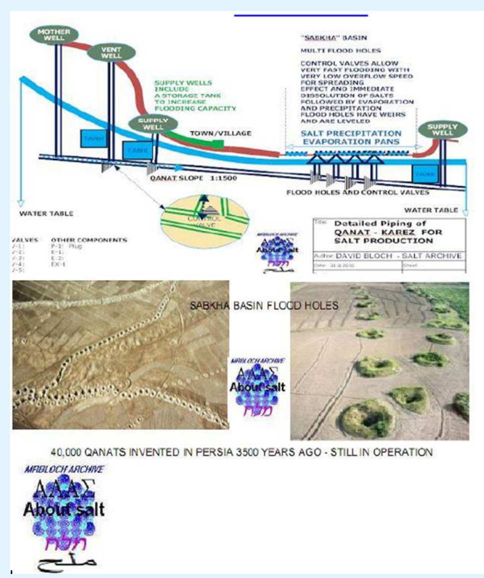

Figure 6: Qanat-karez-aflaj schematic of surge flooding to produce Silk Road slabs of salt.

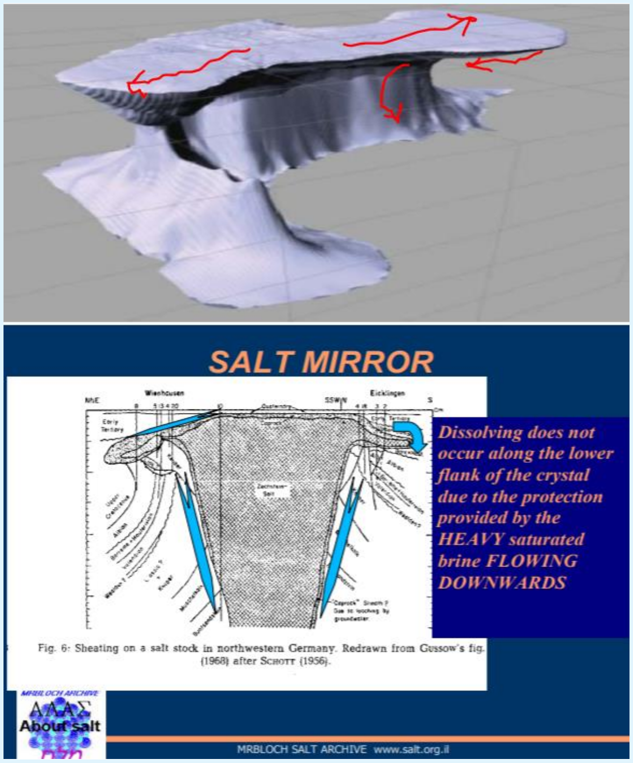

Figure 7: Salt Mirror streams of dissolved salt dragging debris of decomposed organic matter.

Conclusion

New Pre-salt and Post-salt oil exploration in the past two decades has been exceptionally successful. It has been claimed that Petrobras discovered the first Pre-salt oil reserves in the Lula oil field in the Santos Basin in 2006, and drew its first oil from the Jubarte field in the Campos Basin two years later, in 2008. Since then, the pre-salt layer has proven to conceal larger oil reserves, in a series of consecutive discoveries resulting in almost 100% rig success.

Similarly, so too have huge deposits been confirmed in Israel at the Nile delta - Leviathan fields, where fresh water has displaced heavily laden saturated brines - and more recently deposits off the North Korean and China coasts. Lithium, in similar "salt mirror" reserves to become a new primary source of energy. The hypothesis of combined solar energy and geothermal action for the formation of mineral oil is consistent with the fact that oil is always found in association with salt water and brine, that the chemical constitution of all mineral oils is consistent with an origin from plant and animal life of halophilic character [9,10] and that the oil undergoes thermal decomposition under pressure and under reducing conditions at a minimal 150°C [11]. Finally, the frequent occurrence of "circulation loss" when drilling for oil caused by karst at a great depth is known as well as the formation of gypsum and sulfur differing in genesis and age from the so-called source rock gypsum. The migration of organic matter dissolved in salt-brine to a great depth is now clear [12-14]. Variations of CH_4 Methane trapped above the oil in proven fracking fissures of porous limestone are now mainstream; the geothermic decarboxylation and hydrogenation under pressure and at high temperature is now mainstream. The generation of insoluble hydrocarbons in particular a halophilic alga known as DUNALIELLA PARVA rich in carbon and hydrogen, where the proteins are a source of sulphur and nitrogen in saltwater explains the easy upward migration of oil drops and gas in an aquifer, and their eventual accumulation in suitable structures and traps." The handling of RO reject brines, essentially only a "drop in the ocean" could very easily fit into the above natural working process, since salt diapirs are now known to be so numerous particularly in off-shore situations [15-19].

References

1. Farkas L, Litman HL, Bloch MR (1951) The formation of "Salt Tables" in natural and artificial solar pans. Bull of the Res Counc of Israel 1(1-2): 36-39.

2. Bloch R, Reiner M (1952) The mechanism of dissolution of salt crystals; Bull of the Res Counc of Israel 2: 263-265.

3. Reiner M (1952) A Tea-Pot Effect. Bull of the Re & Counc of Israel 2: 265-266.

4. Bloch MR, Picard L (1970) The Dead Sea-a sinkhole? Zeitschrift der deutschen geologischen Gesellschaft, Sanderheft Hydrogeologie, Hydrochemie, pp: 119-128.

5. Engler C (1906) Zur Frage der Entstehung des Ercitiles. Chemisches Zentralblatt 77(11): 1017-1018.

6. Radzisewski B von (1878) Szasop, Towarz aptek 7: 249.

7. Tamiya H (1955) Growing Chlorella for food and feed. Proceedings World Symp on Appl Solar Energy, Phoenix, Arizona.

8. Muller A, Schwarz W (1948) Arch. Mikrobiol 14: 291.

9. Welte DH (1965) Relation between petroleum and source rock. Bull Am. Assoc. of Petroleum Chemistry, 49: 2247-2268.

10. Treibs A (1936) Chlorophyls ec. Angewandte Chemie 49: 579- 585.

11. Galimow EM, Ilev AA, Kuznetsova NG (1970) Geochemistry International 597-603.

12. Bloch D (CEISSA 2009) Proceedings of the 2nd International Conference on the Ecological Importance of Solar Saltworks Merida, Yucatan, Mexico, 26-29 March 2009 120. Heavy Saline Streams In Salt Driven Wetlands, Abandoned Evaporation Pans, Domes And Other Salt Deposits As The Responsible Hydraulic Mechanisms Causing The Disappearance Of Heavy Waste Liquids, and Other Waste Toxic Sediments on Land and in the Oceans D.

13. Bloch MR, Kaplan D, Kertes V, Schnerb J (1966) Ion separation in bursting air bubbles. Nature 209: 802-803.

14. Bloc MR, Luecke W (1970) The origin of fixed nitrogen in the atmosphere. Israel Journal of Earth Sciences 19: 41-49.

15. Bloch MR, Luecke W (1972) Geochemistry of ocean water bubble spray. Journal of Geophysical Research 77(27): 5100-51005.

16. Sugawara K, Kawasaki N (1958) Records of oceanographic works in Japan, Spec Rep Ministry of Education, Tokyo 2: 227.

17. Bloch, Garti, Goldman, Sasson, Ginzburg (1981) Conversion of halophilic algae into extractable oil 2 Pyrolysis of proteins FUEL, February.

18. Preul F (1968) Die Subrosion is Salzstock von Salzgitter. Lebenstedt; Geol Jour, pp: 809-816.

19. Loewengart S (1962) The geochemical evolution of the Dead Sea basin. The Bull of the Res Counc of Israel 11(2): 85-96.