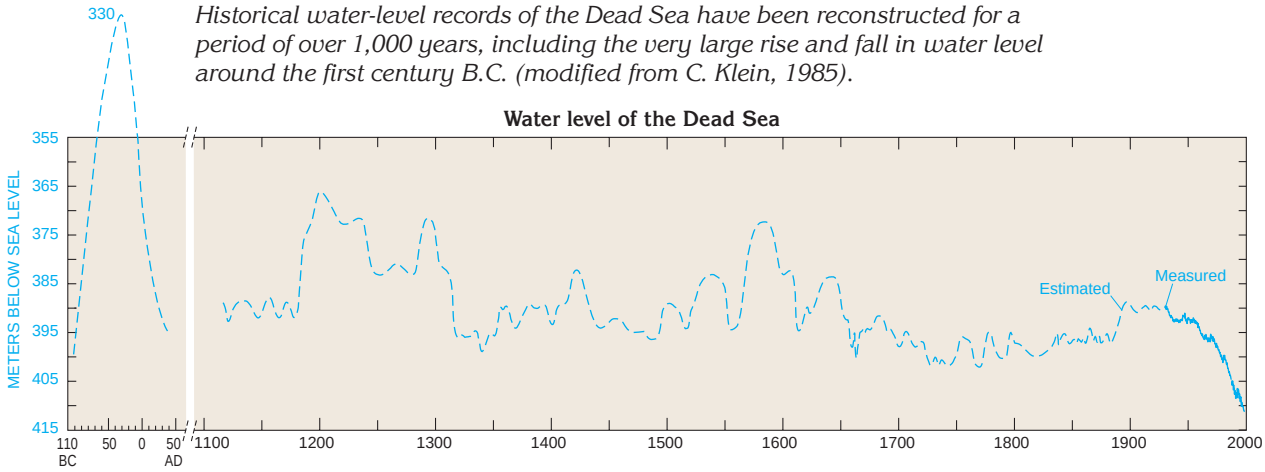


Historical water-level records of the Dead Sea have been reconstructed for a period of over 1,000 years, including the very large rise and fall in water level around the first century B.C. (modified from C. Klein, 1985).

As shown above, there are many precedents in the historical record of larger, more rapid water-level changes than the 21 m decline over the last seven decades. Furthermore, the historical range of water-level fluctuations is about 83 m, nearly four times the 21 m decline in this century. Should further water-level declines reveal submerged trees, or should traces of historical submergence be found at elevations higher than 330 m below sea level, the historical range would increase.

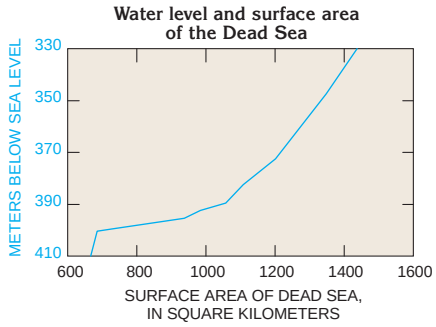
The largest change in water level shown on the estimated historical hydrograph occurred between about 100 B.C. and A.D. 40. Within this period, the water level of the Dead Sea rose some 70 m, from about 400 m to about 330 m below sea level (where Qumran was inundated) in about 67 years; and subsequently fell some 65 m in about 66 years. A

Ruins of Essene community at Qumran on the northwestern shore of the Dead Sea

second large rise, not shown on the graph, occurred between A.D. 900 and 1100 and crested at about 350 m below sea level. Could these extreme changes in stage be explained by climate fluctuations?

To address this question, investigators have made computer simulations of increased rainfall and runoff in the Dead Sea watershed, accounting for evaporation losses. These simulations indicate that rapid water-level changes on the order of 70 m over a 67-year period could occur if inflow increased by 33 to 48% over an average inflow condition. Likewise, persistent years of below average rainfall could cause rapid declines in the water level. Historical references lend weight to this conclusion. There are historical references to abundant harvests during the period of the rising Dead Sea water level prior to about 67 B.C., and there was severe drought during the period of the falling Dead Sea water level recorded by Josephus Flavius for 25–24 B.C. when Herod had to sell his treasures in order to buy corn from Egypt for the population.

The Dead Sea balances increased inflows not only by a rise in water level but also by increased evaporation losses. As the water level of the Dead Sea rises, its surface area increases causing a corresponding increase in the volume of evaporated water. The greater than twofold increase in surface area between the elevations of 410 and 330 m below sea level would increase the annual volume of evaporated water from 1,005 to 2,160 MCM, assuming a constant annual evaporation of 1,500 mm per year. Evaporation during periods of high water level is further accelerated by the dilution of saline waters near the surface, because in reality evaporation is not constant but increases as salinity decreases.



The surface area of the Dead Sea is known to have varied between about 1,440 km^2 at its historical high of about 330 m below sea level, and about 670 km^2 at 410 m below sea level, a greater than twofold difference. There is a corresponding difference in the volume of water lost to evaporation each year.