

# **Human impact in geomorphic processes since Paleolithic times in the Middle East- The Israeli case**

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The Mediterranean-type climate region is an inherently unstable earth-surface system.

Human impact is a major factor in land degradation in the Mediterranean region. It starts with the appearance of Man in Israel about 1.5 million years ago, but the major effects on landscape modification occurred in historic times

Seven phases of land degradation are recognized, since the first one covering the Paleolithic period until the present one, covering the last three decades.

# **I The first phase**

covers a long period since first appearance of Man in the Jordan Valley- about 1.4 million y. until the Mousterian age, about 0.1My. covering the Lower Paleolithic period. The Levant was the main route of dispersal from Africa to Eurasia. During this phase human activity was hunting and food gathering and the impact on the environment was insignificant.

## **II The second phase**

Started with the use of fire. Natural forest fires are rare in the Eastern Mediterranean because lightening occurs in the winter wet period. The oldest site where the use of fire has been dated is in the Petralonia cave in northern Greece on a layer about one million years old at its lower level to half a million years old at its upper level. Fire was mastered by the Neanderthaloides about 60,000 years ago, and they used it to open dense forests (Perless, 1977). Recently new evidences of early use of fire at a site dated 780 ky were found in the Gesher Benot Yaakov excavations (Goren-Inbar et al, 2002)

### III The third phase

started with the agricultural revolution, the beginning of agriculture and pastoral livestock husbandry, at the beginning of the Neolithic period around 11,000 years ago. The Eastern Mediterranean areas were probably the first sites of cereal cultivation and domestication. The first cereals were wild wheat, the large-grained *Triticum dicoccoides*, the direct ancestor of the emmer wheat *Tridicum*, the wild, small grained *T. aegilopoides*, ancestor of einkorn *T. monoccoccus*, and the wild ancestor of domesticated barley (*Hordeum spontaneum*) (Butzer, 1964). The first domesticated animals were the dog (*Canis familiaris*), the goat ( *Capra haraus*) descending from the *Capra aegagrus*, the sheep (*Ovis aries*) descended probably from the urial (*ovis orientalis*), and cattle (*Bos taurus*) descended from the wild *Bos primigenius*.

One explanation for the agricultural revolution is that over-gathering and over-hunting led to the “prehistoric food crisis” and the need to shift to cultivation and domestication ( Cohen, 1977). This period had a major impact in the lowlands, due to the clearing of forests for agricultural purposes.

## **IV The fourth phase**

Started around 5000 years ago and lasted until the end of the Byzantine period in the 7<sup>th</sup> century AD. It was the period with the greatest development of the agro-pastoral economy in the eastern Mediterranean, with land clearance in the mountainous areas, promoting soil erosion; terraces were built to minimize erosion and gain agricultural land. One of the first examples of land degradation is evident in agricultural crops of ancient Mesopotamia: the increase of salinity affected the growth of wheat, which is salt sensitive, and it was replaced by barley. The proportions of wheat and barley were equal 3500 years BC; 1000 years later wheat was 20% and 1500 years later only 2%, being abandoned by the year 1700 BC. In ancient Israel the population reached its largest numbers- about five million people, as against only 200,000 to 300,000 at the beginning of the 19<sup>th</sup> century . Deforestation caused the almost complete extinction of the famous cedars of Lebanon, large but slow-growing trees, used in historical times for construction and shipbuilding. Now they exist only in scattered stands, protected as religious places and forest reserves.

## **V The fifth phase**

started with the Moslem conquest of the region and the decline of its economy and agriculture. The pastoral nomadism of the Arab tribes replaced the developed hill lands and irrigation ditches, promoting erosion and the creation of swamps in the lower valleys due to the silting of the river channels. This concept is controversial, the argument being that the developed Hellenistic-Roman civilization had a more disastrous impact due to large population and pressure on the natural resources . There is no doubt that a larger population has a greater impact on natural resources, but under controlled use the impact is minimized. On the other hand, centuries of overgrazing and deforestation degraded most of the region and destroyed resources in periods of political instability.

## VI The sixth phase

covered the 20<sup>th</sup> century, with a population increase of two to ten times in most areas of the eastern Mediterranean. Mechanization was introduced in agriculture and irrigation schemes were developed. These involved many changes in the landscape, as draining of swamps, diverting spring water and drying of channels, monoculture in agriculture and forests, introduction of exotic plants, and the use of fertilizers and pesticides. Classical olive culture gave way to export fruits like citrus.

Major ecological changes in the region included the effects of the Suez Canal, construction of the Aswan High Dam on the Nile, which retains the river sediments, and large-scale water diversions and damming in Anatolia, on the Mesopotamian rivers, and in the Jordan basin.

The introduction of new species, such as *Eucalyptus* and *Acacia* from Australia and *Pinus radiata* from California, caused major changes in the ecosystem.





## **VII The seventh phase**

is the present one. The process of land degradation has been aggravated by population increase, deterioration of water resources, salinization and soil pollution, urbanization of forest and agricultural land, and marine and coastal pollution. Impact on the environment differ in developed and under-developed regions. In Israel there has been a sharp decline in the use of firewood and the number of grazing animals. Protected areas in nature reserves have been enlarged and reforestation has been conducted on a large scale.

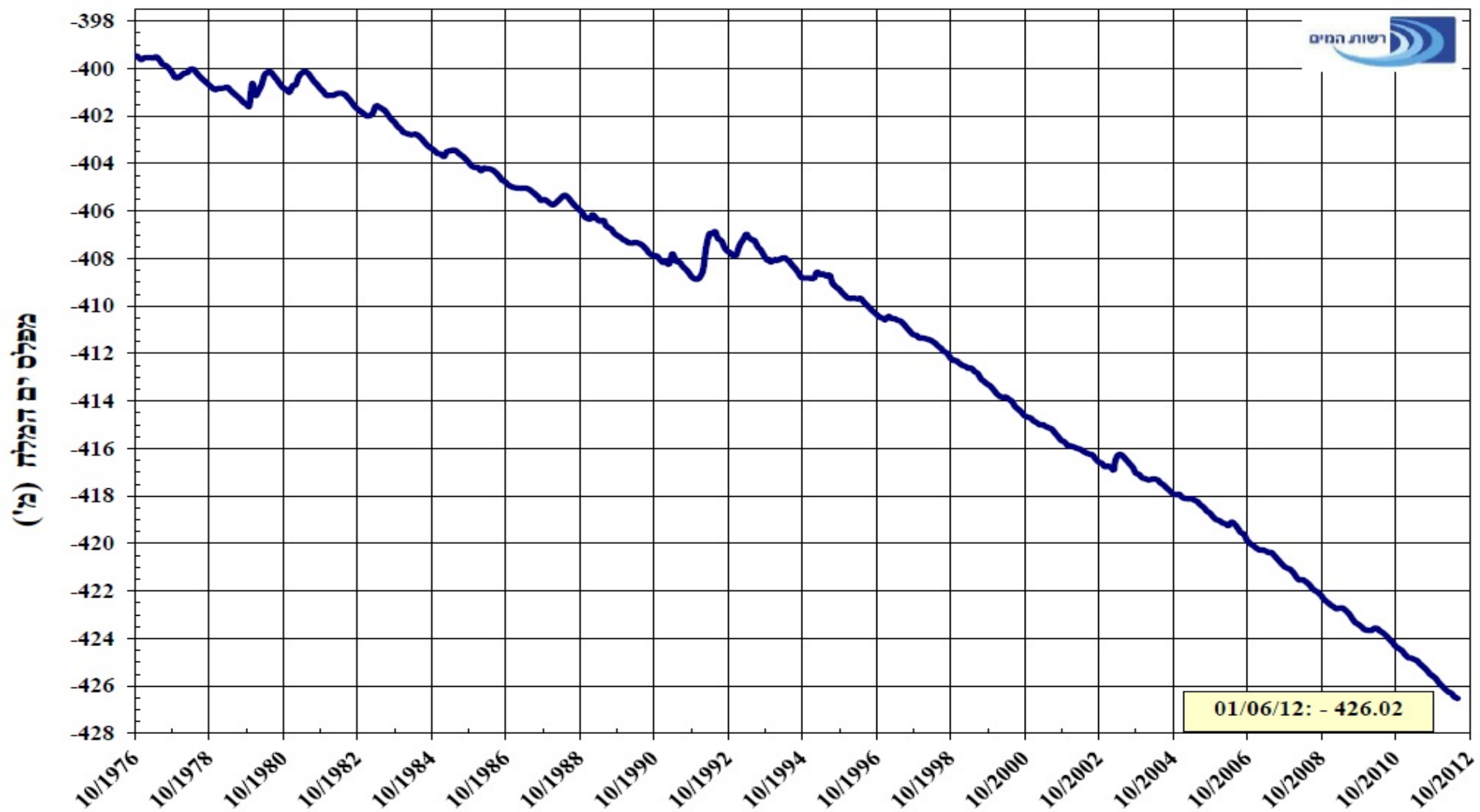
# ENVIRONMENTAL IMPACT of the DEAD SEA LOWERING LEVEL, LOWEST POINT ON EARTH- 426 m BELOW SEA LEVEL



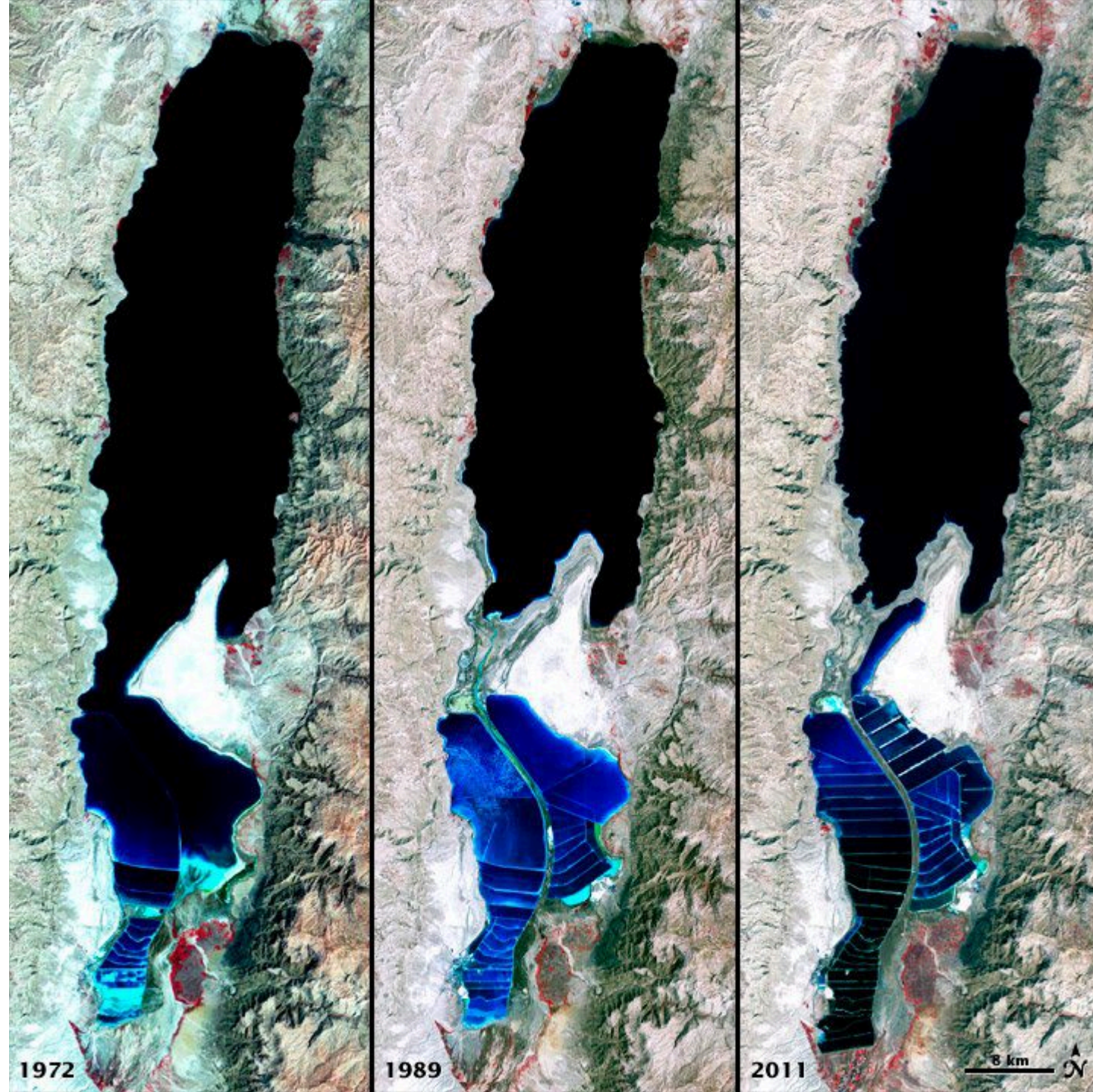
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# DEAD SEA 1976 - 2012

















ציפוס: אגת סקיפי



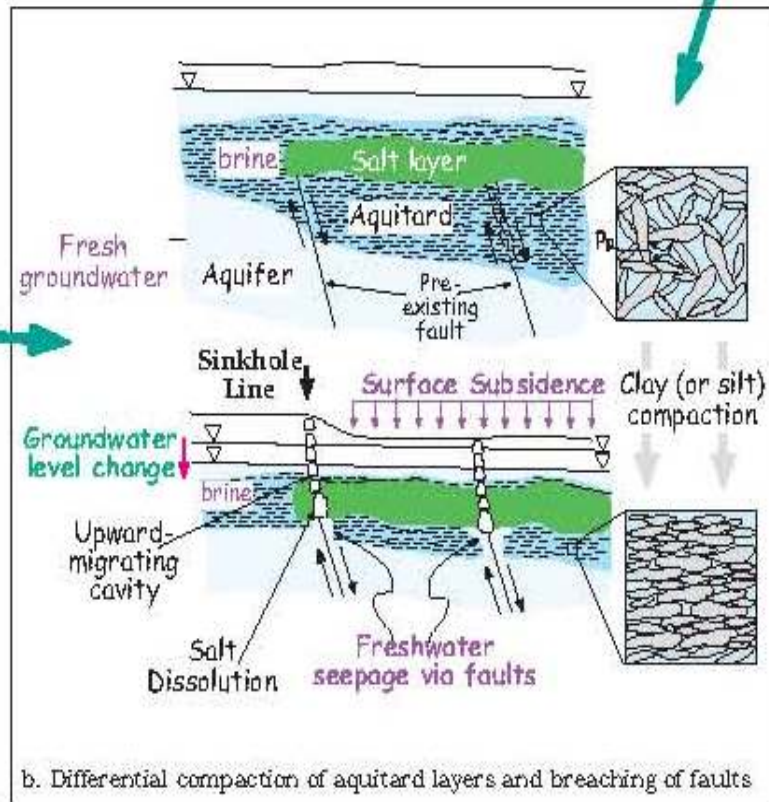




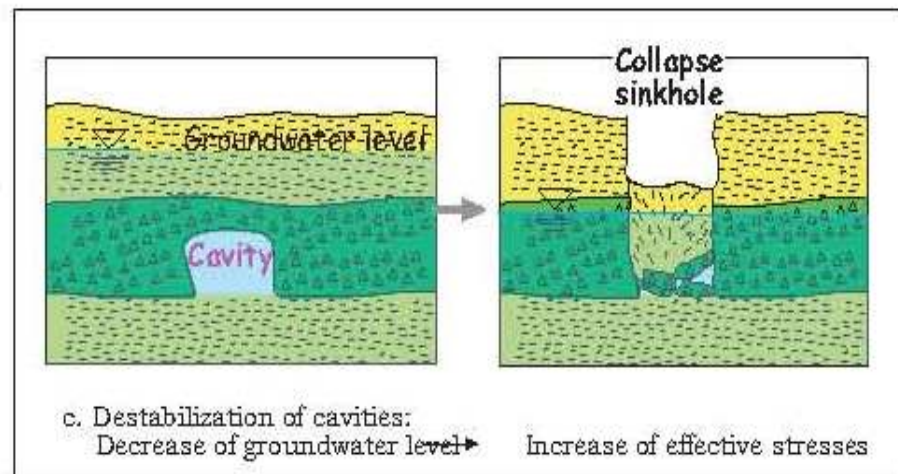
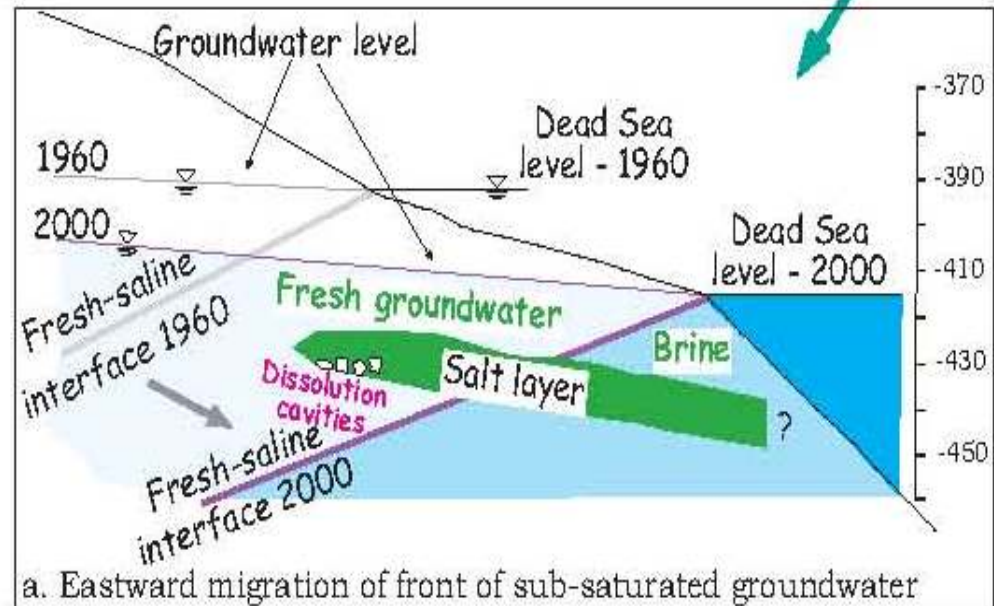




# Mechanism for formation of the Dead Sea sinkholes



The triple effect of the Dead Sea shrinkage forming the collapse sinkholes







XciteFun.Net



XoiteFun.NET



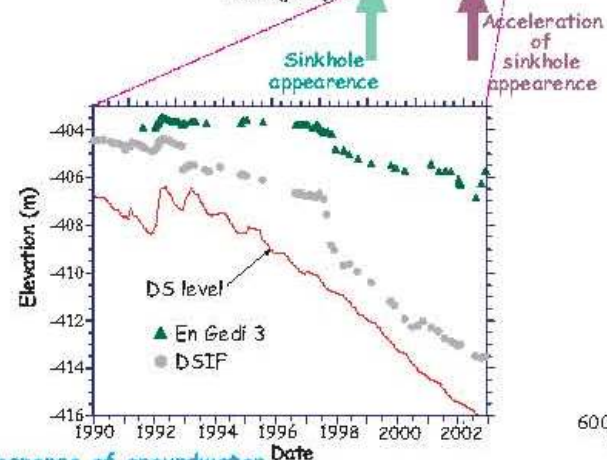
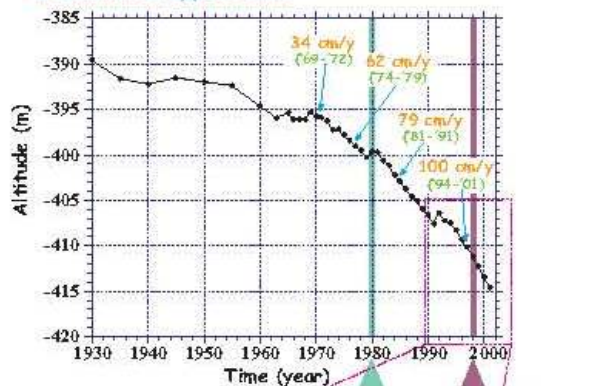




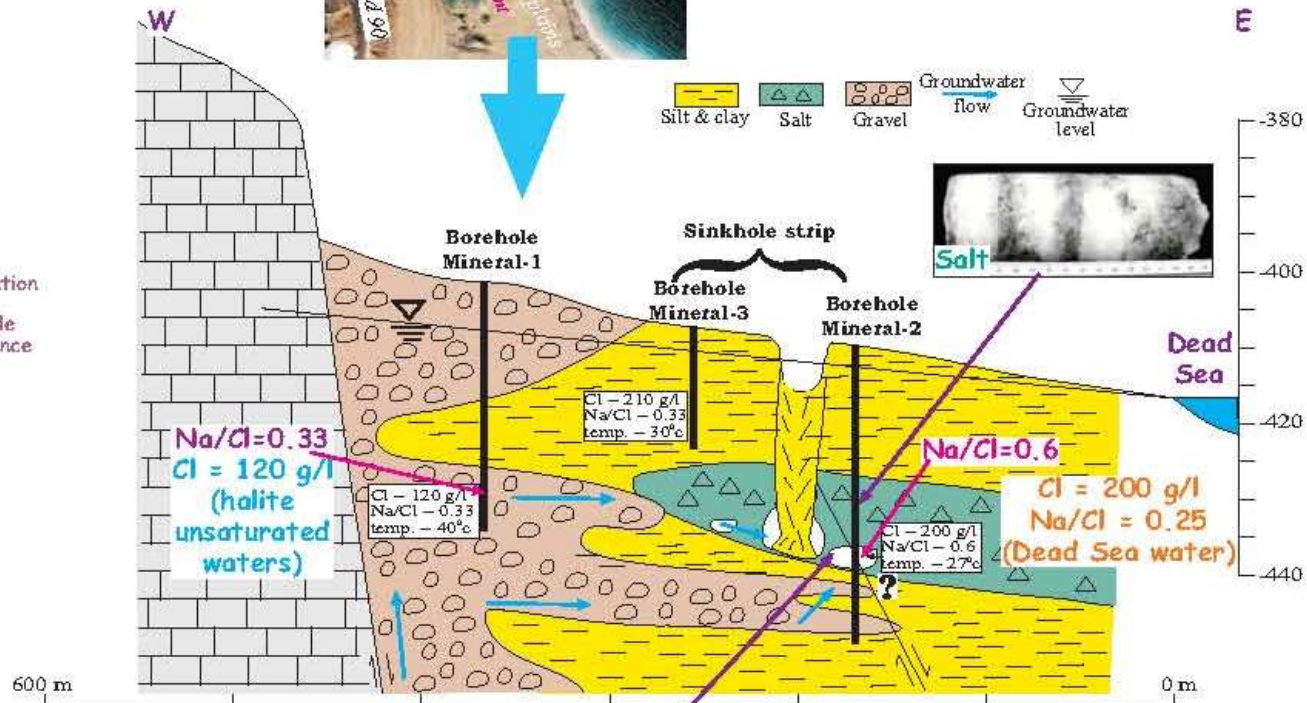


# Hydrogeology: findings from boreholes

Decline of Dead Sea level  
& sinkholes appearance



Response of groundwater  
level to Dead Sea level drop



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Photograph from borehole  
encountered a cavity

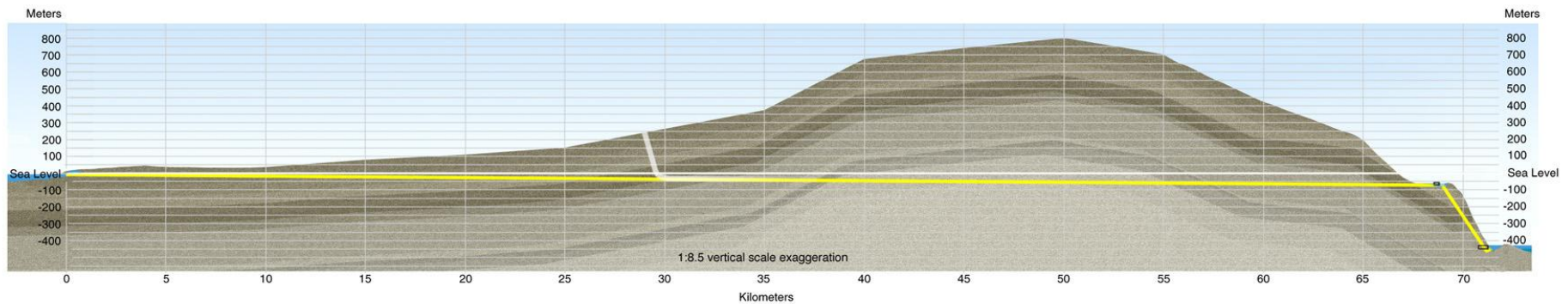


## Dead Sea Power Project Overview



Tunnel Route

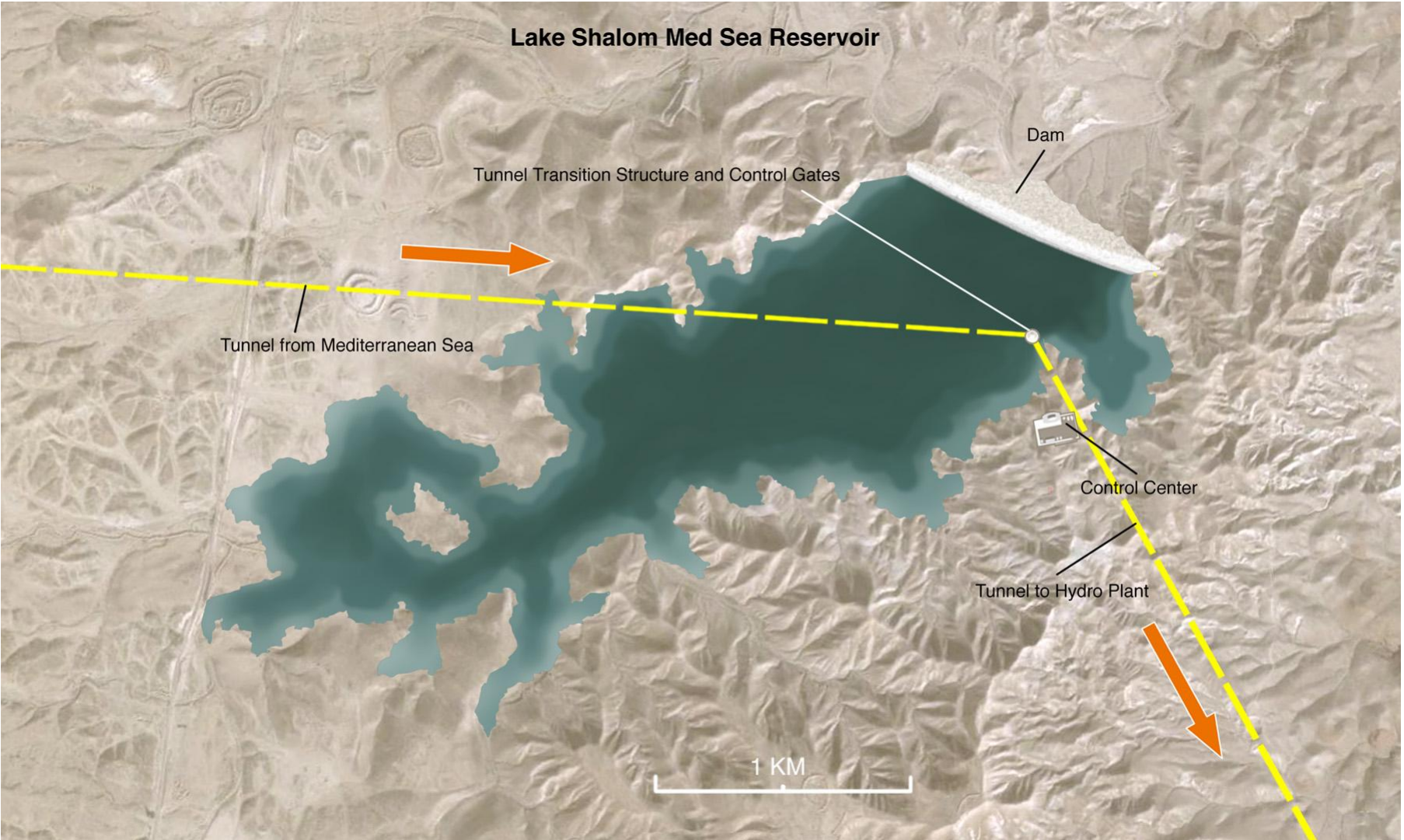
## Dead Sea Power Project Overview



Tunnel and Penstock Profile



**Lake Shalom Med Sea Reservoir**

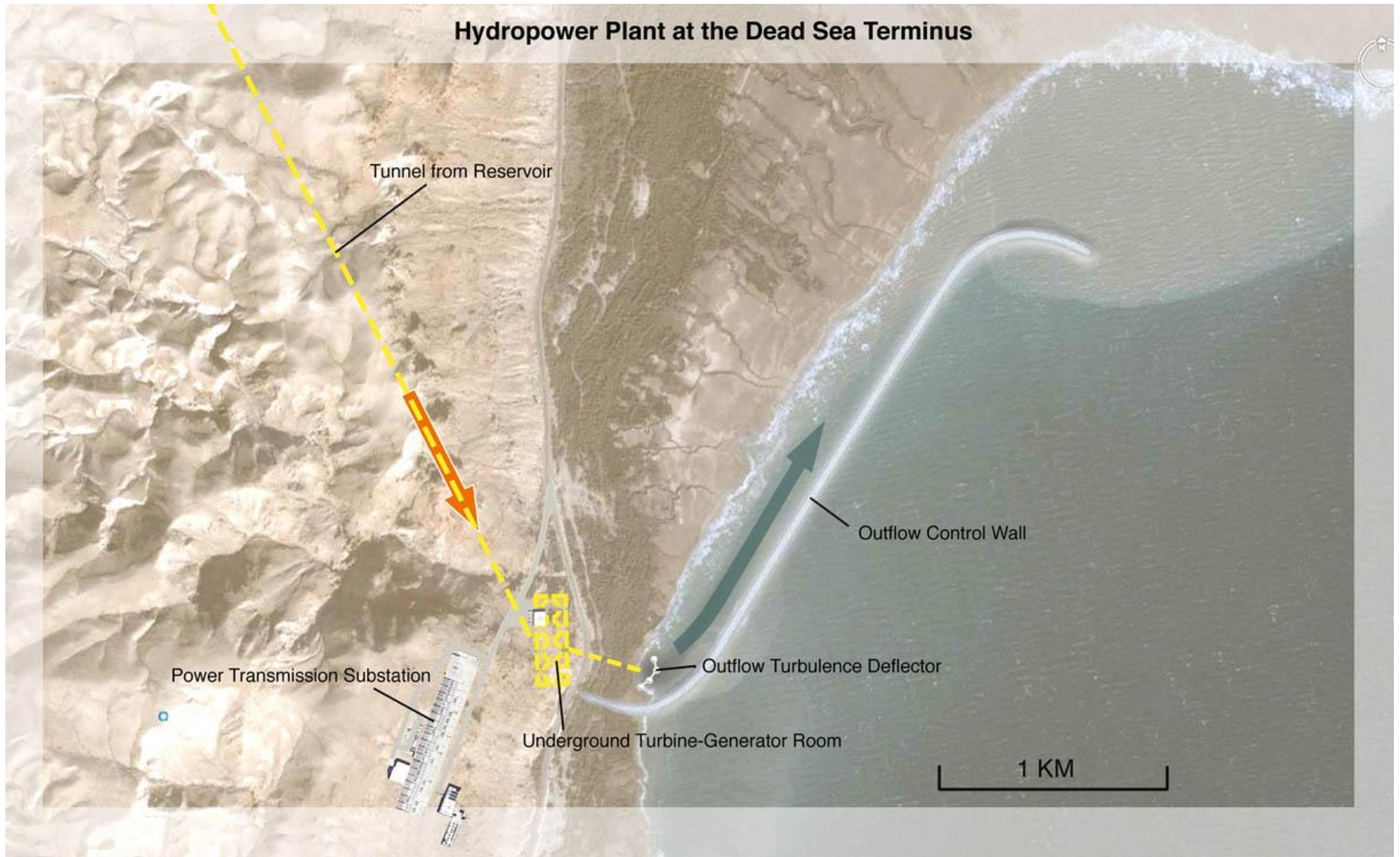


## Tunnel Inlet on the Mediterranean Sea





## Hydropower Plant at the Dead Sea Terminus



## Dead Sea Water Intake for Potash Production Facilities

