

# CO<sub>2</sub> Storage Opportunities in Israel: Preliminary Assessment



Ran Calvo & Zohar Gvirtzman

Geological Survey of Israel; 30 Malkhei Israel St., Jerusalem, Israel 95501

rani.calvo@gsi.gov.il  
zohar@gsi.gov.il

According to the Israeli Central Bureau of Statistics, the total Israeli emission of CO<sub>2</sub> in 2007 was ~67 Mt (42.5 Mt emitted by the Israeli Electric Company, 6 Mt by the cement industry, and 15 Mt from transportation). Current estimates predict that in the year 2075 the annual Israeli emission will be as high as 190 Mt, and that the accumulated emission (for the period between 2025 and 2075) will be about 7.3 Gt.

Considering these numbers and in light of the decision of the Israeli government to ratify the Kyoto Protocol and to undertake specific actions to reduce emissions of greenhouse gas, our aim was to estimate the geological storage potential and to find suitable storage site(s) for 5.6 Gt of CO<sub>2</sub>, which is the excess CO<sub>2</sub> for the period 2025-2075, relative to 1990 Israeli emission level. All calculations in the current study were based on the formula  $G_{CO_2} = AhpE\phi$  with an effective coefficient factor ( $E$ ) of 4%.

Preliminary considerations indicate that storage in saline aquifers in the subsurface of southern Israel seems feasible. These aquifers are not too far from CO<sub>2</sub> sources, they are in the suitable depth range, and do not threaten fresh water aquifers. The sandy Lower Cretaceous units in southern Israel have an effective storage potential of 1.5 Gt; the Jurassic aquifer have an effective storage potential of 3 Gt; and the deeper porous units of Cambrian to Triassic ages have an effective storage potential of 2.7 Gt.

Preliminary estimates of several depleted oil and gas fields show additional storage capacity of up to 160 Mt (6.5 Mt in Heletz-Kokhav oil-field, and 153 Mt in Zohar gas-field).

Large basalt units in northern Israel could also be used for subsurface storage. However, since these units are exposed, we only considered the storage at depths of more than 400 meters, which reach 16 Mt. In addition, surface mineral fixation with basaltic raw material may increase the storage potential by a few additional Mt of CO<sub>2</sub>.

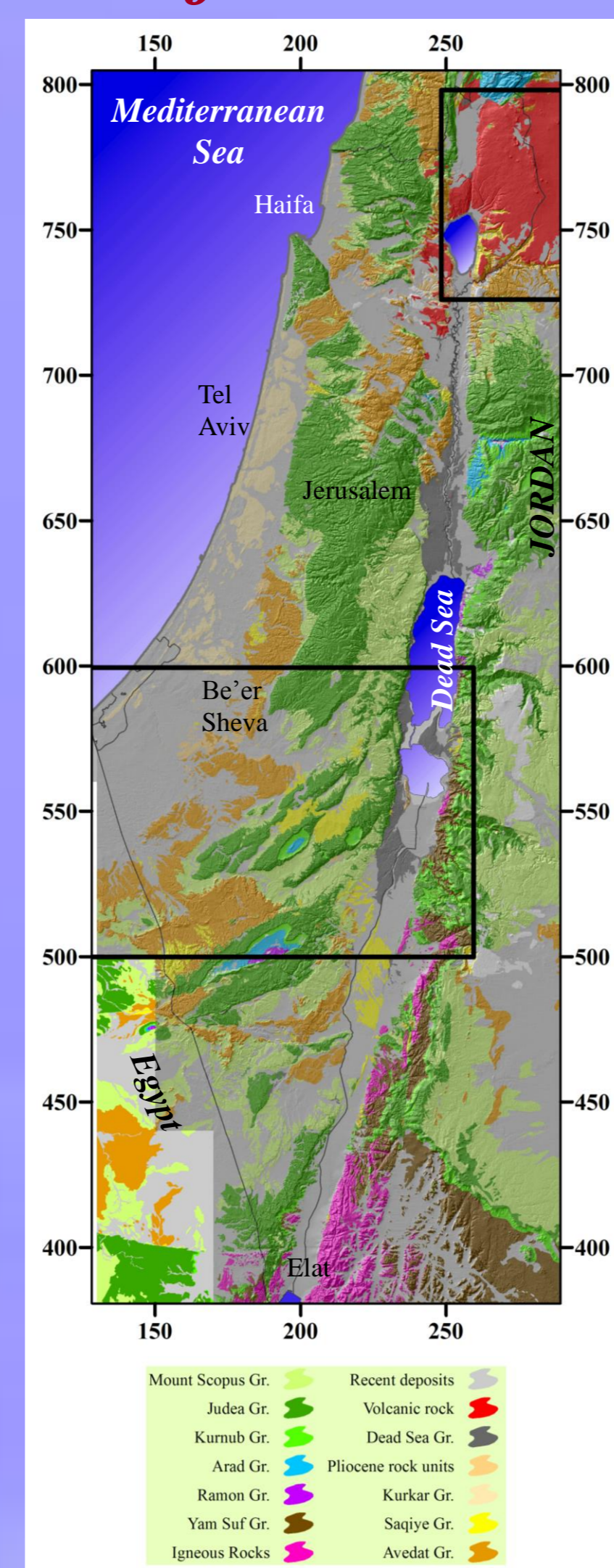
Enhanced coal-bed methane (ECBM) sequestration is not an option in Israel, due to the absence of coal seams in the geological column.

As a whole, our preliminary assessment of several storage sites show that Israel has the capability to store more than 7.4 Gt of CO<sub>2</sub>, much more than the 5.6 Gt that will be emitted in the period between 2025 and 2075. These sites will also be sufficient for more extended periods. In the next few years we plan to better understand the geological storage opportunities in Israel, focusing on specific site characterization, modeling, simulation, and a pilot injection test.

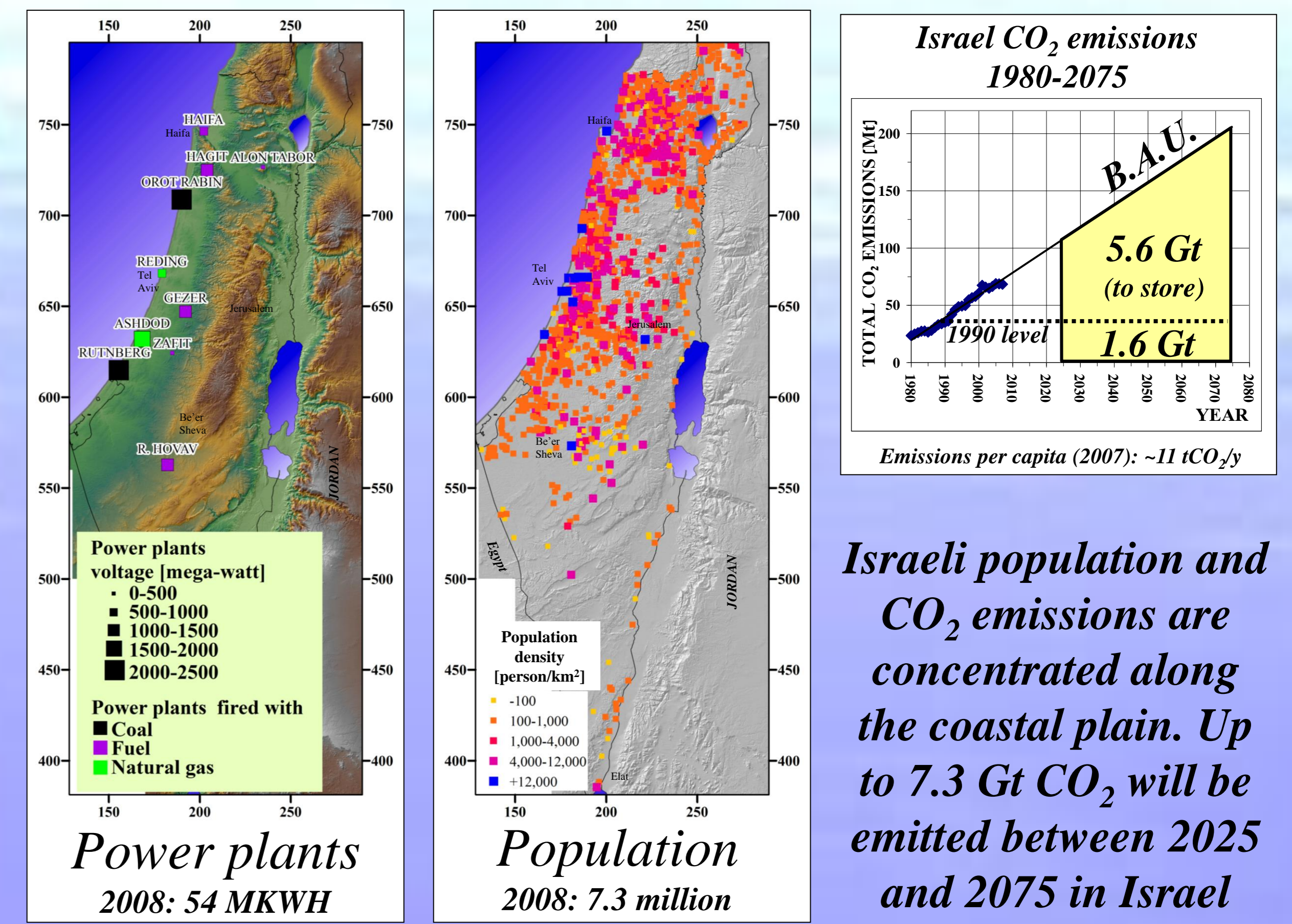
## Where are we?



## Geological map of Israel

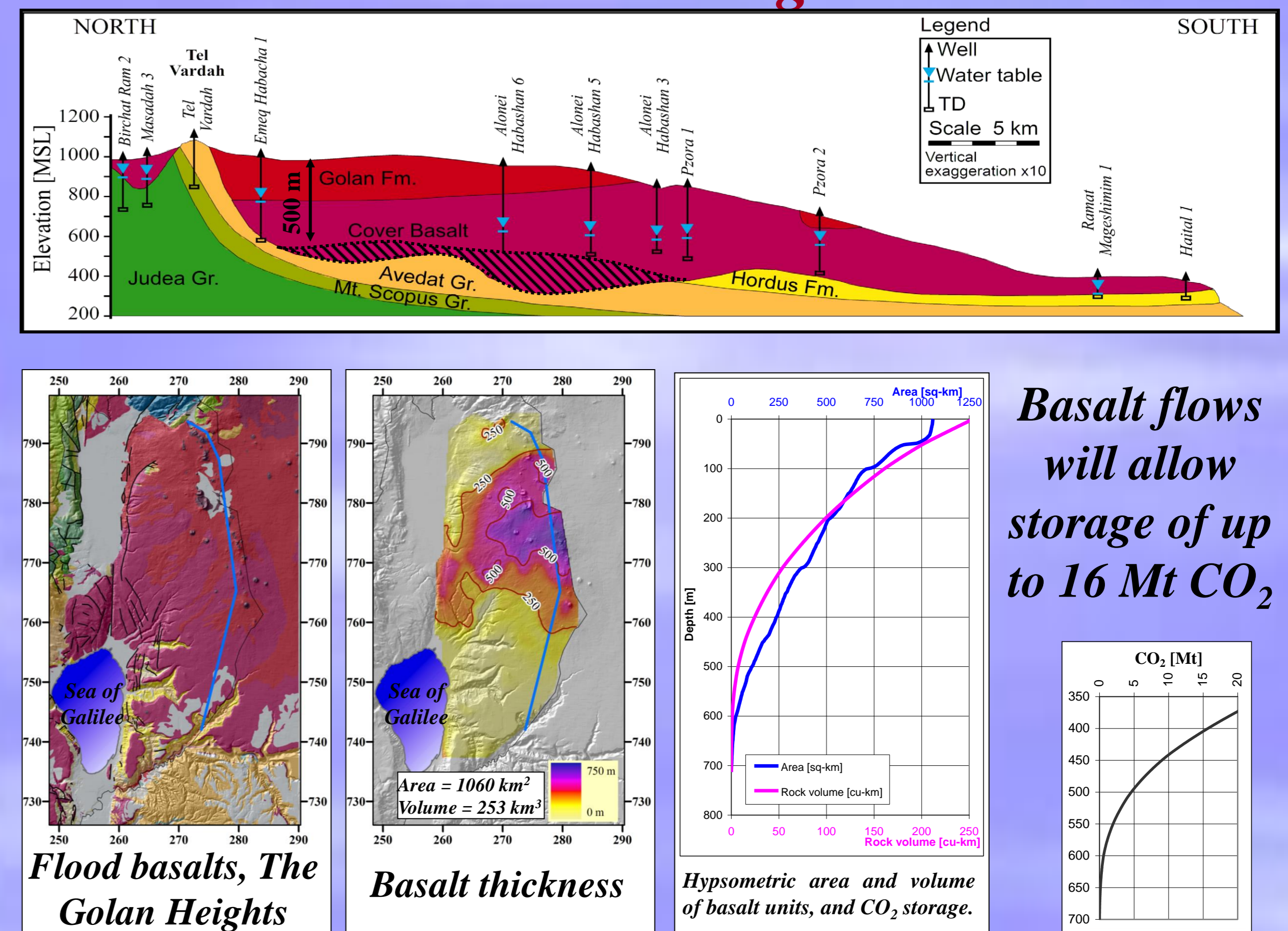


## CO<sub>2</sub> emission in Israel



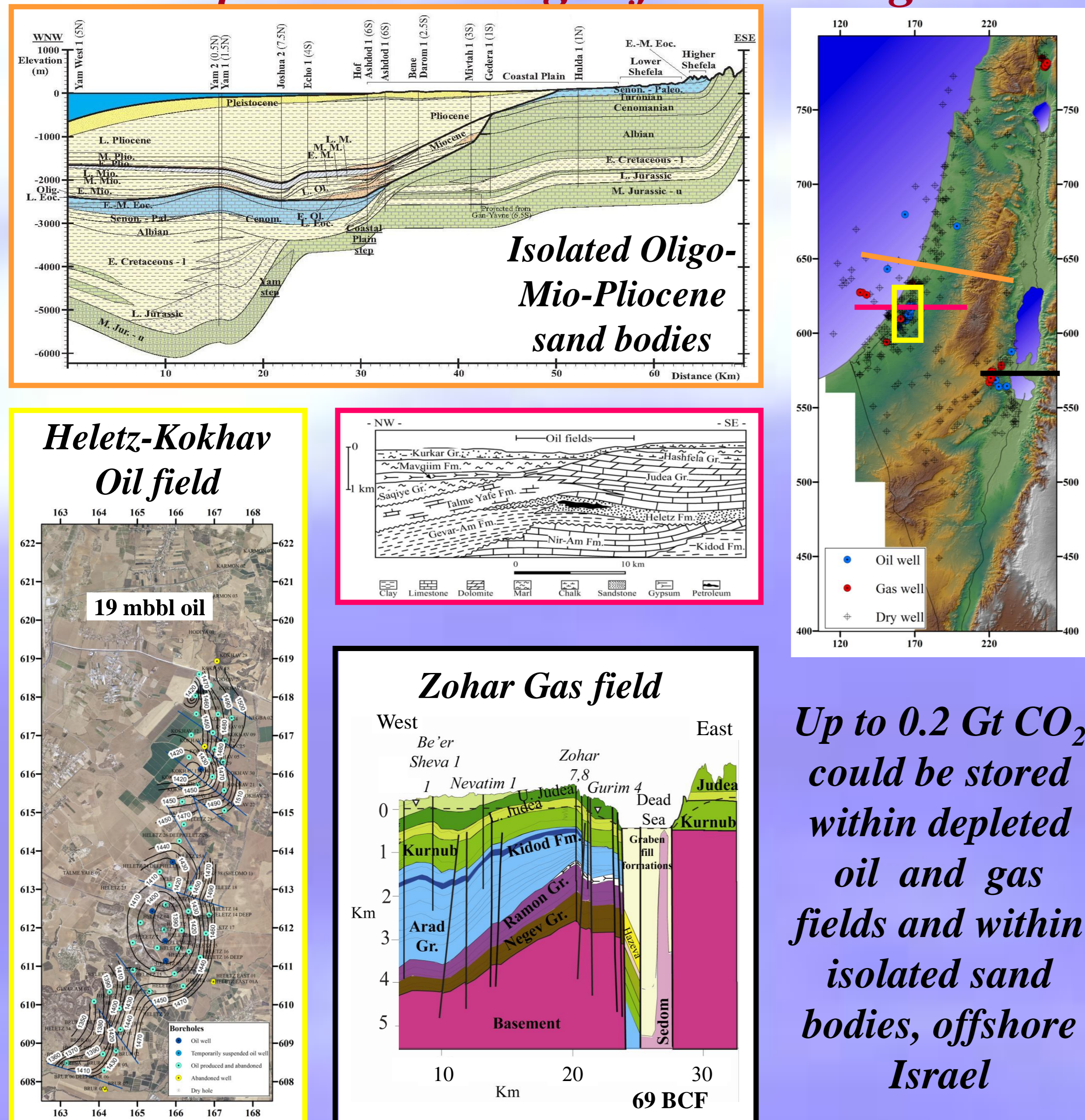
Israeli population and CO<sub>2</sub> emissions are concentrated along the coastal plain. Up to 7.3 Gt CO<sub>2</sub> will be emitted between 2025 and 2075 in Israel

## Basalt storage



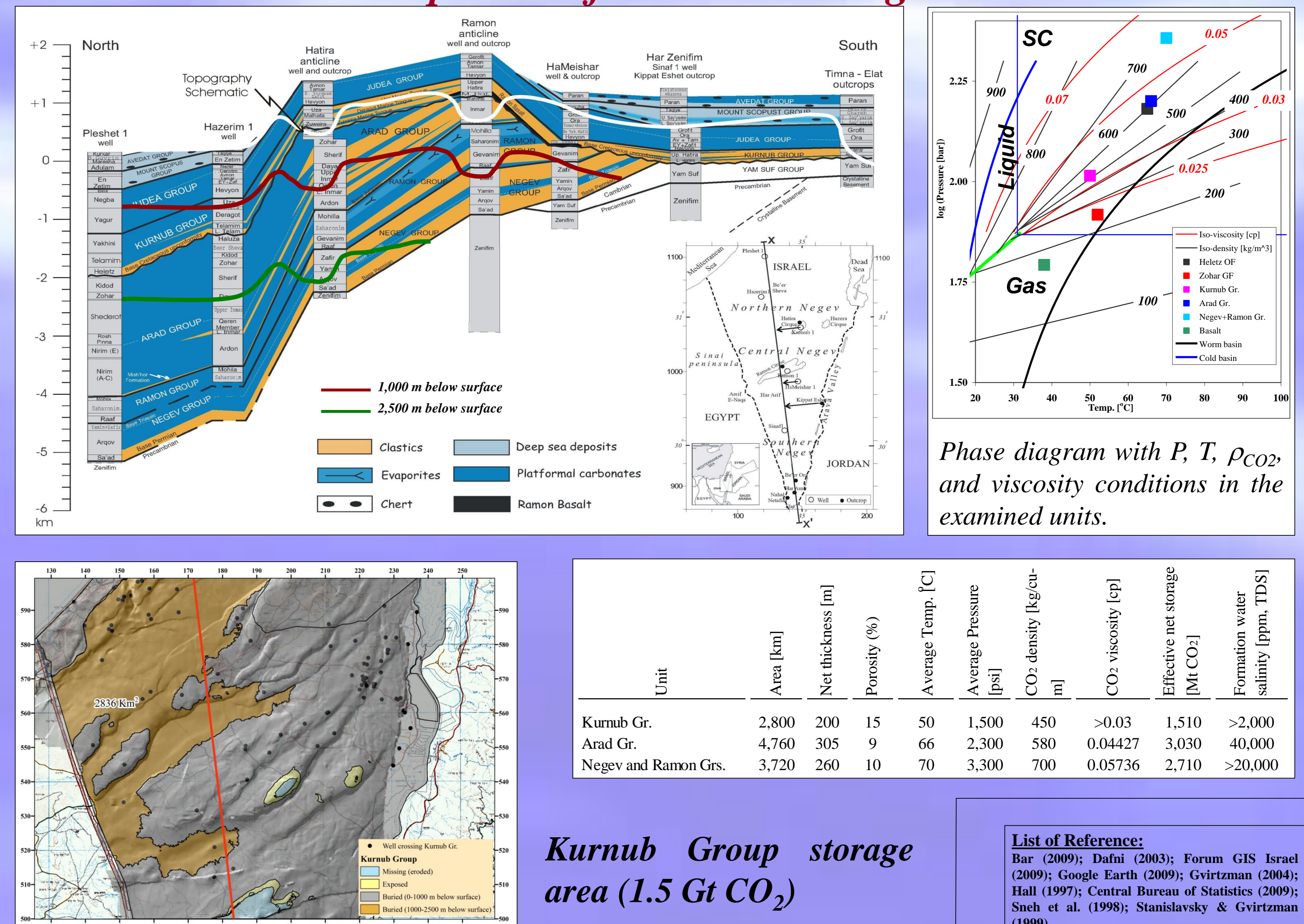
Basalt flows will allow storage of up to 16 Mt CO<sub>2</sub>

## Depleted oil and gas fields storage



Up to 0.2 Gt CO<sub>2</sub> could be stored within depleted oil and gas fields and within isolated sand bodies, offshore Israel

## Deep saline formation storage



Kurnub Group storage area (1.5 Gt CO<sub>2</sub>)

List of Reference:  
Bar (2009); Dafni (2003); Forum GIS Israel (2009); Google Earth (2009); Gvirtzman (2004); Hall (1997); Central Bureau of Statistics (2009); Sneh et al. (1998); Stanislavsky & Gvirtzman (1999).

Unit	Area [km <sup>2</sup> ]	Net thickness [m]	Porosity (%)	Average Temp. [°C]	Average Pressure [psi]	CO <sub>2</sub> density [kg/cu-m]	CO <sub>2</sub> viscosity [cp]	Effective net storage [Mt CO <sub>2</sub> ]	Formation water salinity [ppm, TDS]
Kurnub Gr.	2,800	200	15	50	1,500	450	>0.03	1,510	>2,000
Arad Gr.	4,760	305	9	66	2,300	580	0.04427	3,030	40,000
Negev and Ramon Grs.	3,720	260	10	70	3,300	700	0.05736	2,710	>20,000