



## **The possibility and timing for a sea waterway via the Lake Iznik (Turkey)**

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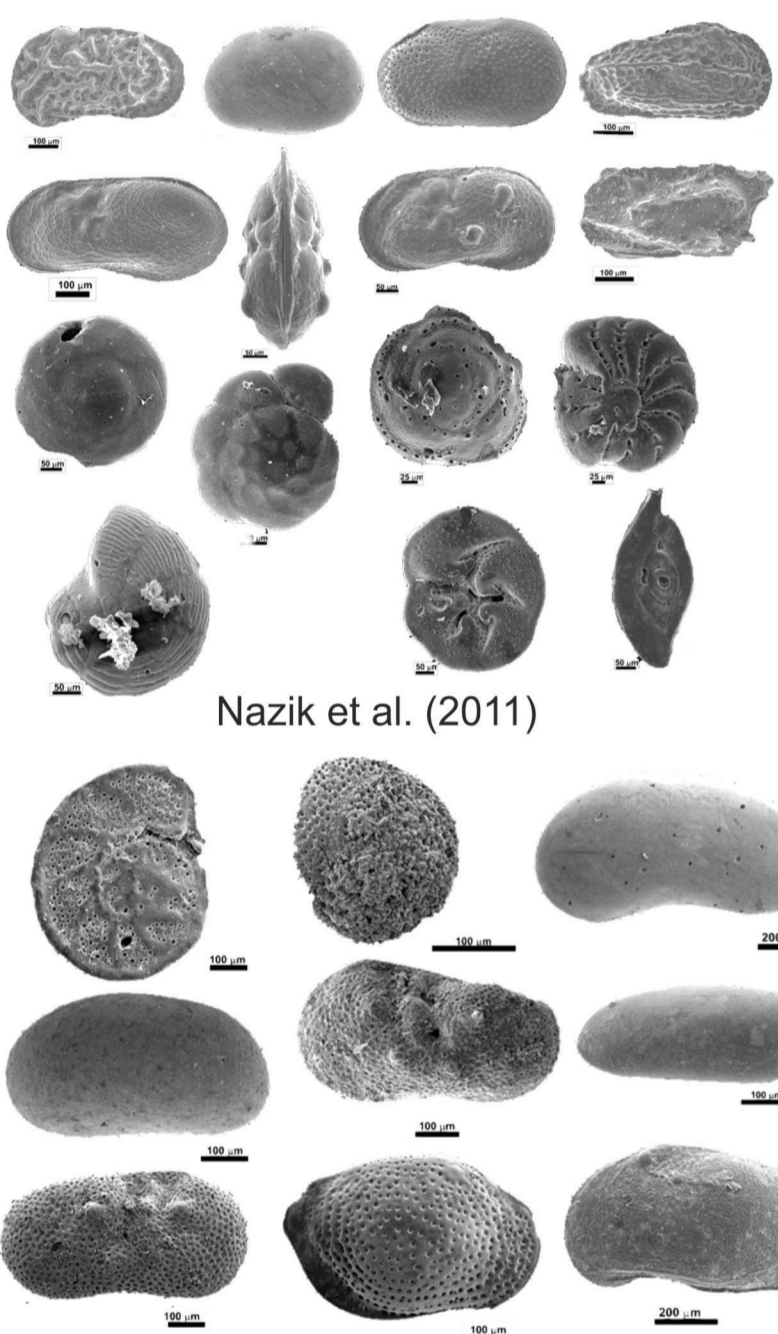
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The Sea of Marmara is connected to the Black Sea through the Bosphorus strait. The idea of another waterway existed between these seas during the late Quaternary is much of great interest to scientific community. Taking into account the marine microfaunal composition collected from lake surface sediments some researchers claim that there was an alternative waterway connection via the lakes of Iznik and Sapanca, located at the eastward extensions of the Gulf of Gemlik and Izmit Bay, respectively. In addition a Holocene age is suggested for the latest flooding event. On the contrary, other researchers who have questioned the possibility for a waterway connection through these lakes and the lower course of Sakarya River during the Holocene or the late Pleistocene, claim that a marine connection could not be possible for at least the past 500,000 years. On the basis of the global sea-level change and regional tectonic uplift rates, for example, a connection between the Lake Iznik and the Sea of Marmara may not have been possible after 310,000 years BP.

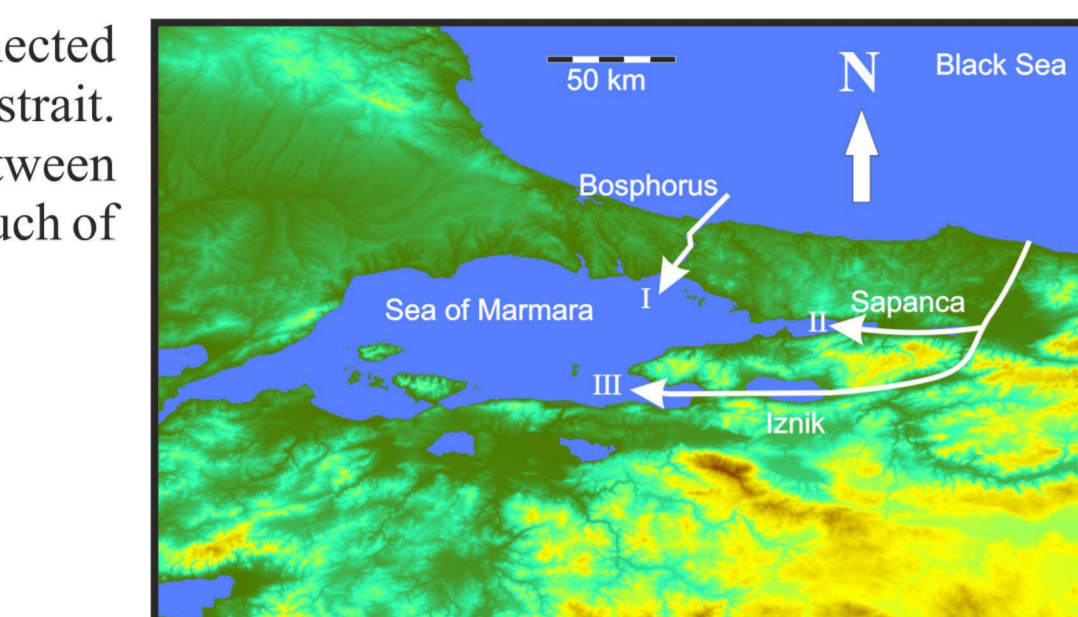
Both of the lakes, representing adjacent E-W-oriented narrow depressions, are controlled by the transpressional effects of the northern and central segments of the North Anatolian Fault (NAF) zone since the Late Miocene - Pliocene. On the basis of available seismic reflection data, the deep trough along the southern margin of Lake Iznik has been evolved under the control of a releasing bend system. Similar to the Hersek Pass separating the outer and central sub-basins of the Izmit Bay at present, this system formed the Karsak Pass between the Lake Iznik and the Gulf of Gemlik, and the brackish waters discharged into the Sea of Marmara. At present, the central segment of the NAF cuts this system and extends towards the Gulf of Gemlik, which is separated from the Lake Iznik by the uplifted Karsak sill (+83 m), similar to the pressure ridge on the Hersek Delta. Therefore the main trough of the Lake Iznik existed before the evolution of the NAF, implying that the lake is a superimposed basin. The secondary normal faults observed in the lake and its environs are responsible for the vertical tectonic movements. Depending on these regional changes and those occurred in the east of the Lake Iznik, e.g. a transpressional interruption at Pamukova, the water discharge ceased at the end of middle Pleistocene, even more precise reconstruction of the sea flooding history of the region need other supportive data. The distribution of some dominant benthic foraminifers across the biogeographic barriers can be explained by adaptation of some marine microfaunal composition to their new home. The transition from normal-marine waterway to a brackish lake fauna must be marked by decreases in species diversity about 310,000 years ago. At present the water quality of the Lake Iznik is changing towards mesotrophic stage from brackish stage. Their biogeographic imprints should be looked for in the composition of the entire assemblage, in general, rather than in the presence or absence of a few dominant species.



**PROBLEM:** The Sea of Marmara is connected to the Black Sea through the Bosphorus strait. The idea of another waterway existed between these seas during the late Quaternary is much of great interest to scientific community.



Nazik et al. (2011)

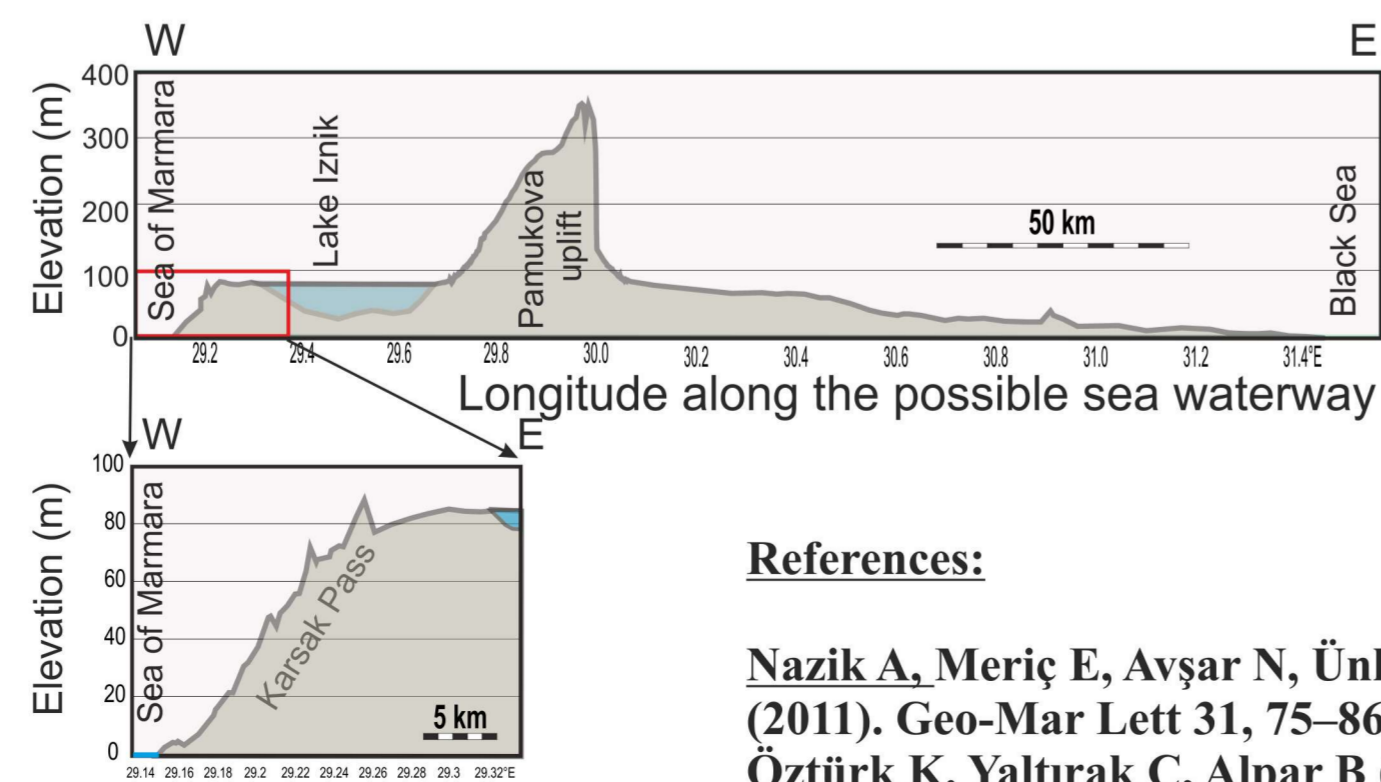
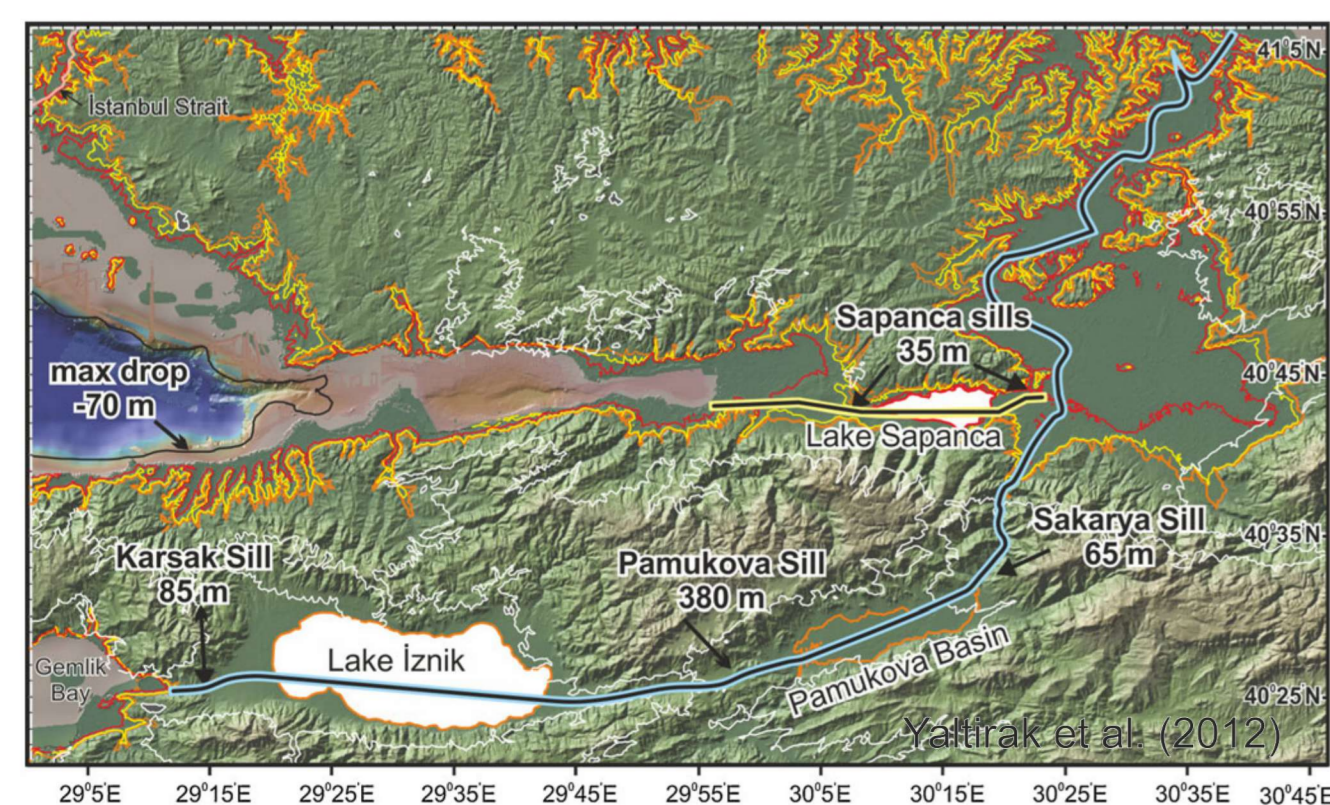


**SIGHT 1:** From marine microfaunal composition collected from the bottom sediments of the lakes of Iznik and Sapanca, some researchers claim an alternative waterway connection by way of the eastward extensions of the Gulf of Gemlik and Izmit Bay, respectively. A Holocene age is also suggested for the latest flooding event.

### TECTONIC AND STRATIGRAPHIC SETTINGS

The basin of Lake Iznik is controlled by the transpressional effects of the segments of the North Anatolian Fault (NAF) zone since the Late Miocene - Pliocene (Öztürk et al., 2009). The E-W trending deep trough, in front of the southern shore, is developed under the control of a releasing bend system. This system caused the opening of Karsak Pass into the Gulf of Gemlik, where the lake waters discharged into the Sea of Marmara. At present, a segment of the NAF accompanies this system and extends towards the Gulf of Gemlik, which is separated from the Lake Iznik by the uplifted Karsak sill (+83 m). Therefore the main trough of Lake Iznik existed before the evolution of the NAF, implying that the lake is a superimposed basin. The Lake Iznik is brackish at present, turning into a mesotrophic one.

**SIGHT 2:** On the contrary, other researchers who have questioned the possibility for a waterway connection through the Lakes of Iznik and Sapanca and the lower course of Sakarya River during the Holocene or the late Pleistocene, reject a marine connection at least for the last 500,000 years. The basic criteria on this judgement are the actual topography, global sea-level changes and regional tectonic uplift rates.

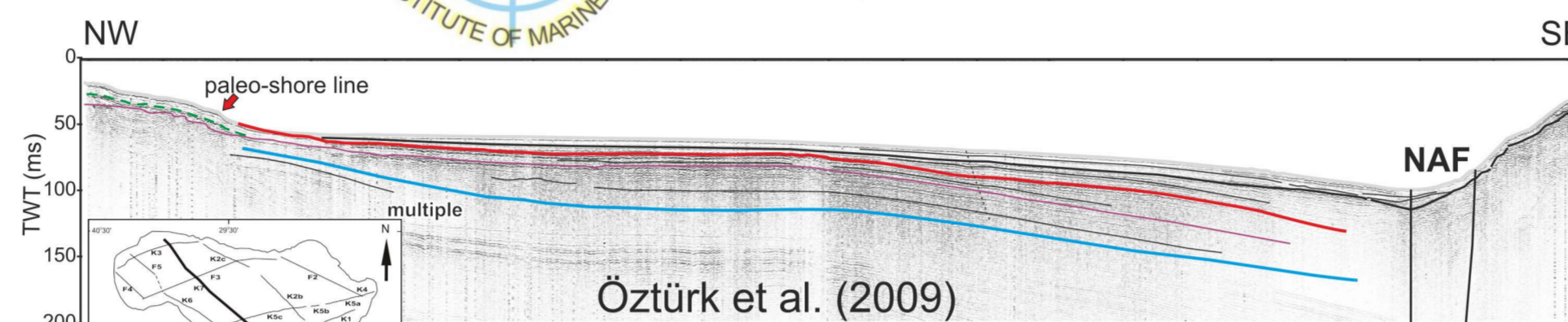


### References:

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Öztürk K, Yaltirak C, Alpar B (2009). *Marine Geology*, 190, 307–327.

Yaltirak C, Ülgen UB, Zabcı C, Franz SO, Akçer Ön S, Sakınç M, Çağatay MN, Alpar B, Öztürk K, Tunoğlu C, Ünlü S (2012). *Geo-Marine Letters*, doi.10.1007/s00367-011-0270-y.

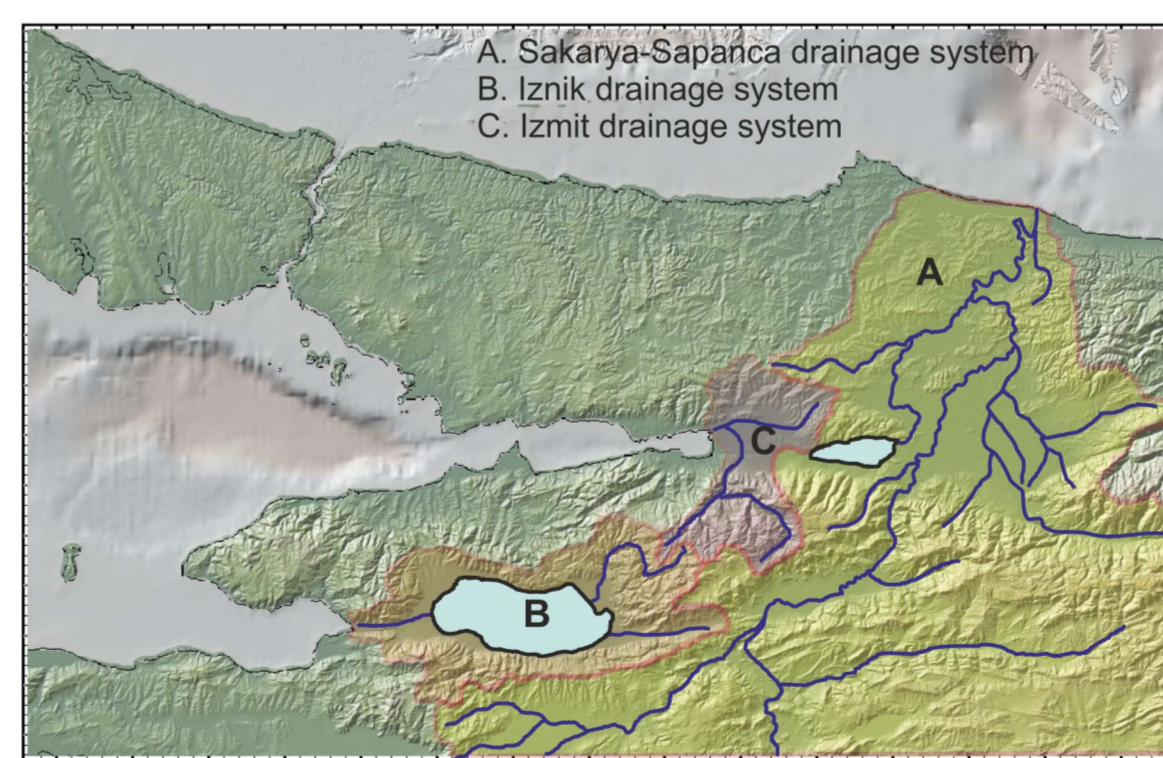
# possibility and timing for a sea waterway via the lake iznik (turkey)



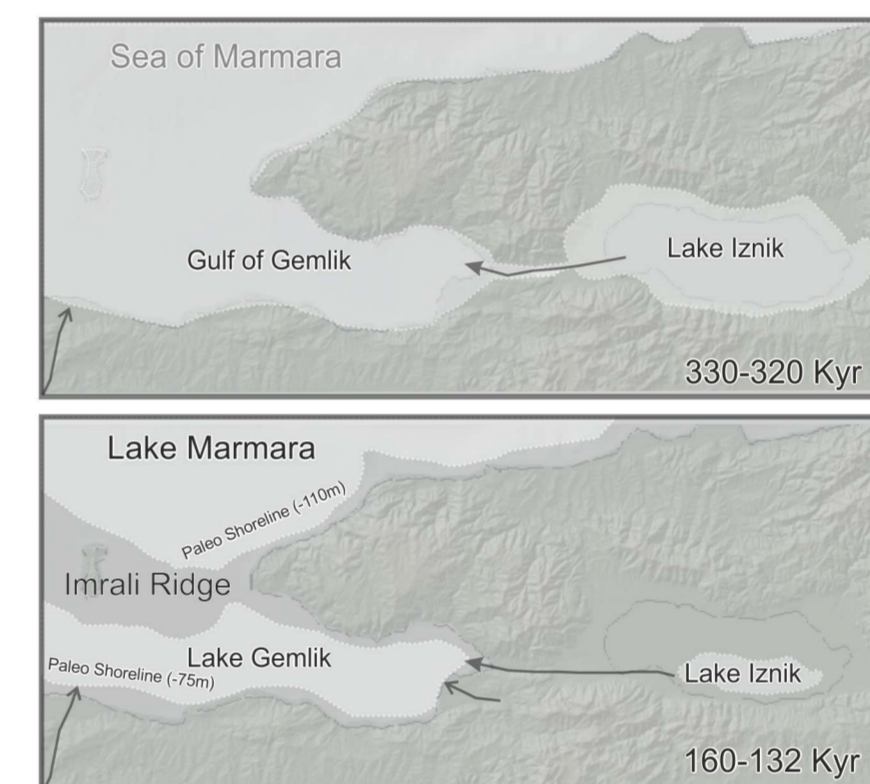
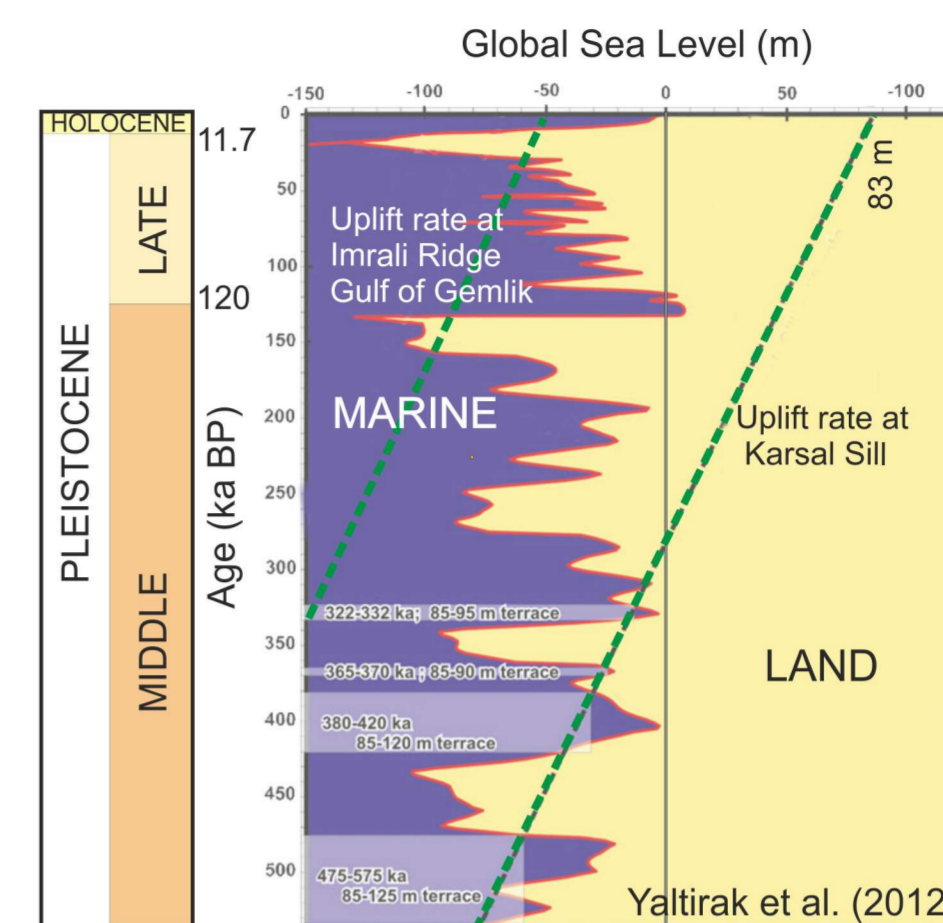
The middle strand of the NAF controls the Lake Iznik since the Late Miocene - Pliocene. The secondary normal faults in the area are responsible for the vertical tectonic movements.

STAGE	LITHOLOGY	ENVIRONMENT	AGE
HOLOCENE	[Yellow pattern]	Fluvial / marine	29-9.7 ka
PLEISTOCENE	[Pink pattern]	Marine Lacustrine	160-132 ka
	[Green pattern]	Marine Delta	330-600 ka

The stratigraphic setting in the Gulf of Gemlik (Yaltirak and Alpar, 2002) can be correlated with the lacustrine terraces around the Lake Iznik which represent the coast of the paleo-Iznik lake when it reached its maximum during Pleistocene.



The drainage basin of the Lake Iznik is clearly separated from the drainage basin of the Sakarya River, including the Lake Sapanca.



Reconstruction of the sea waterway from the Lake Iznik into the Gulf of Gemlik.

### CONCLUSIONS

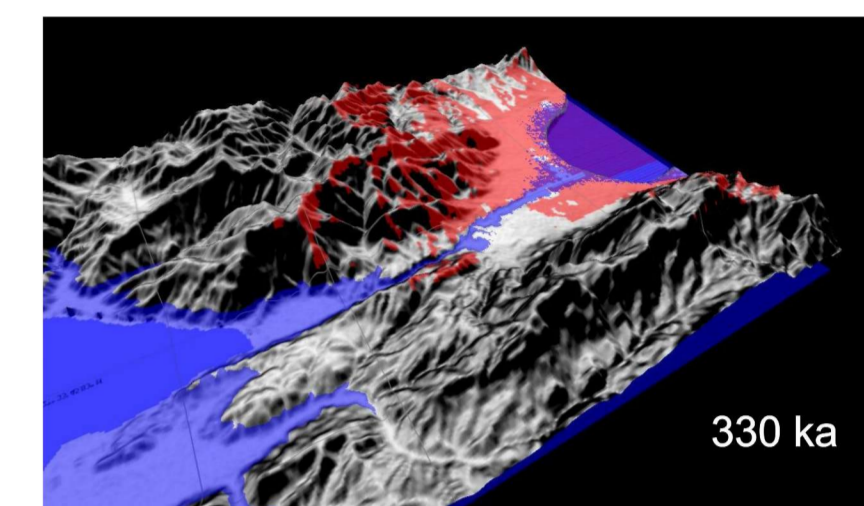
Considering the regional tectonic changes around the Lake Iznik and the transpressional interruption at Pamukova region, the water discharge from the Lake Iznik into the Gulf of Gemlik (sometimes Gemlik Lake) terminated at the end of middle Pleistocene, even more precise reconstruction of the sea flooding history of the region need other supportive data.

The transition from normal-marine waterway to a brackish lake fauna must be marked by dramatic decreases in species diversity about 310,000 years ago. The distribution of some dominant benthic foraminifers across the present biogeographic barriers can be explained by adaptation of some marine microfaunal composition to their new home. Therefore the biogeographic imprints should be looked for in the composition of the entire assemblage, in general, rather than in the presence or absence of a few dominant species.

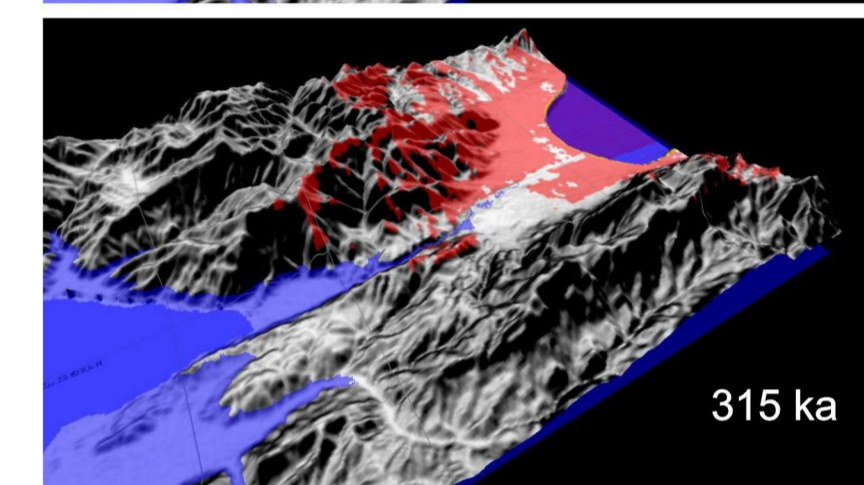
### Acknowledgement:

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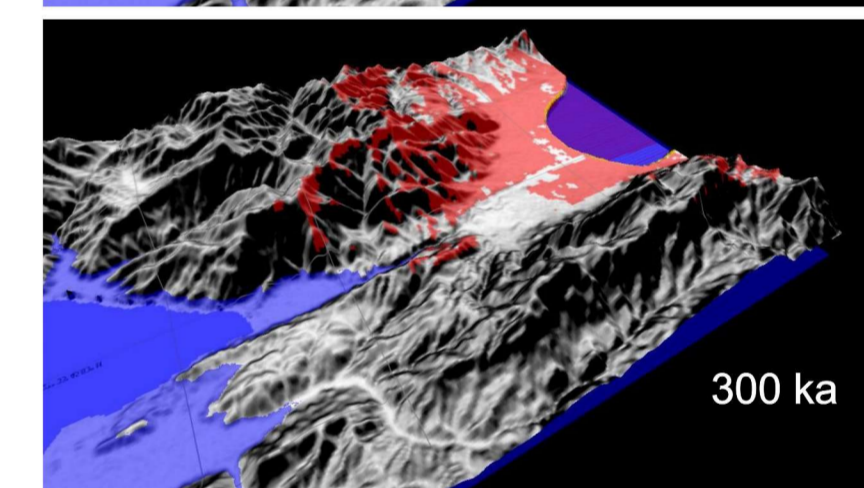
The latest water connection between the Lake Iznik and Sea of Marmara could only be 320 BP depending on tectonic uplift rates determined from the Pleistocene terraces in the region (Yaltirak et al., 2012).



330 ka



315 ka



300 ka