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Submarine landslide risk in the Sea of Marmara revisited after MARNAUT cruise

M. S. Özeren(1), N. Cagatay(1), A.M. C. Şengör(1), Tiphaine Zitter(2), Naci Görür(1), Pierre Henry(2), Luca Gasperini(3), Louis Geli(4), Nazmi Postacioglu(1), Kadir Eris(1), Nabil Sultan(4)

(1) Istanbul Technical University, Istanbul, Turkey, (2) College de France, Chaire de Géodynamique, Aix en Provence, France, (3) ISMAR, Bologna, Italy, (4) Ifremer, Brest, France (ozerens@itu.edu.tr)

The Sea of Marmara, located along the eastern continuation of the North Anatolian Fault (NAF), is prone to submarine landslides and associated tsunamis because of its special stratigraphic, tectonic and bathymetric characteristics. Several paleo- and potential- submarine landslide areas have been mapped from the high resolution multi-beam bathymetric data. The recent MARNAUT cruise (may-june 2007) involving manned submersible dive observations of the slopes, together with sediment, rock and fluid sampling shed new light to the issue of submarine landslides. Assesment of slope stability was also investigated with high resolution seismic, 10 m-long gravity coring, yo-yo piezometer measurements and 4 months-long coupled piezometer-OBS operations.

The largest known paleo-landslide occured off Tuzla, east of Istanbul, around 17000 years ago, on the eastern part of the northern slope bounding the 1275 m-deep Cinarcik Basin. It roughly locates where the Main Marmara Fault changes its strike, slightly bending towards north. The mass failure has a total surface area of around 32.5 km2, and is today characterized by an increased microseismic activity. The scars wall was explored with the Nautile and exhibits outcrops of dark shales belonging to the Paleozoic basement of the Istanbul Zone. Shale beddings were observed south-dipping towards the basin center, and up to 1.5 cubic meters shale blocks were sitting on top of the landslide material. The presence of these dipping shale layers together with

the very steep slopes (>20º) increase the risk of submarine landslides in the northern Cinarcik Basin where the expected seismicity risk is high.

The southern slopes bounding the Sea of Marmara are less steep, yet surprisingly, very obvious high-energy landslide morphology was explored on the southern edge of the Cinarcik Basin at 1100m depth. The basis of the unstable slope, explored with the Nautile, exhibits several meters large tumbled blocks and occurence of methane seepages with large black patches, bacterial mats and huge carbonate blocks.

Furthermore, high resolution seismic imaged buried debris flow to the west of the Tekirdag Basin that took place during the marine-lacustrine transition (around 12ka BP). This period also correlates with the decrease of sediment transport activity through the canyon . Overall, we could argue that the risk of a catastrophic sedimentary slide seems moderate compared to what it was 12-17 ka BP, but the steep cliff north of Cinarcik Basin is a different kind of hazard, and fairly insensitive to sea level change and related variations of sedimentary input.