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Cold seeps in the North Anatolian Fault zone, Sea of Marmara: hints for a deep connection

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A great part of the scientific interest of cold seeps in tectonically active settings lies in the expectation that at least some of them are influenced by physical and chemical processes occurring at seismogenic depths. The Marnaut cruise of Ifremer RV Atalante in May-June 2007 investigated cold seeps in the Sea of Marmara and their relationship with the North Anatolian Fault system. This cruise combined observations, sampling and long term instrument deployments with the Nautile manned submersible, as well as operations from the ship (sounding, heat flow and pore pressure measurements, coring and water column sampling). Manifestations of fluid expulsion commonly observed from the submersible are black patches of reduced sediment with bacterial mats and authigenic carbonates. Focused outflow of brackish water and/or emission of gas bubbles were also observed at several sites. The distribution of gas seeps was investigated with a 38 kHz single beam echo-sounder SIMRAD EK-60. Gas emissions in the water column appear systematically associated with deep-rooted active faults. In particular, gas emissions are found in Cinarcik Basin above a buried transtensional shear zone, which displayed aftershock activity at its eastern end after the 1999 Izmit earthquake. On the Western High, hydrocarbon and gas emissions were found on a diapiric ridge at a few hundred metres from the main fault zone and are associated with gas hydrates containing a thermogenic gas mixture. Pore water analyses also imply

multiple sources. The brackish end member fluid was trapped in the sediment during the last glaciation when the Sea of Marmara was a lake and represents a widespread shallow source. However, the composition of water expelled at the hydrocarbon seep is influenced by diagenetic reactions at depths. We conclude from these preliminary results that deep processes influence fluid expulsion though the seafloor of the Sea of Marmara in various ways. Further studies are ongoing.