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Salinity changes on the south-western shelf of the Black Sea during the Holocene

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The reconnection of the Black Sea to the Mediterranean, via the Marmara Sea gateway, has provoked intense debate (Ryan et al. 1997; Aksu et al. 2002; Ryan et al. 2003; Hiscott et al. 2007; Yanko-Hombach 2007). One particular aspect of this debate regards the salinity of the Black Sea prior to the establishment of the current two-way flow through the Bosphorus Strait. Recent attempts at determining palaeosalinity have shown the problem to be complex with differing approaches suggesting either a freshwater or brackish water body before reconnection to the Mediterranean. For example, Yanko-Hombach (2007) used benthic foraminifera to argue for a semi-fresh to brackish water composition in this period. This was challenged by Soulet et al. (2010) who used modelled geochemical results to argue for fresh water bottom water conditions at least until ~9 ka cal yr BP. A clear disagreement exists dependent on the proxies used and the geographical location within the Black Sea. Ostracods have so far been an underused proxy but one that could be utilised very effectively to examine questions about salinity. Here we present fossil ostracod assemblages analysed in two sediment cores taken from locations on the south-western shelf of the Black Sea (Fig. 1).

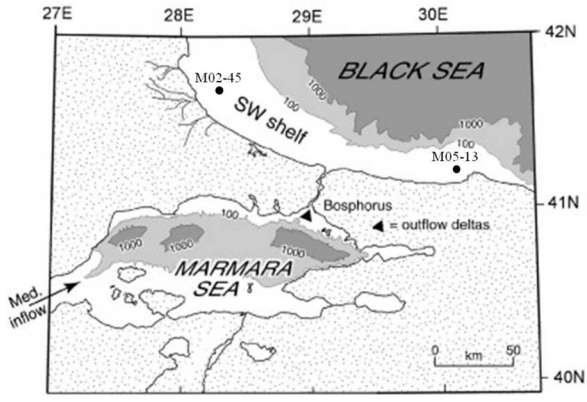

Fig. 1: Location of the two sedimentary cores on the south-western shelf of the Black Sea (adapted from Hiscott et al. 2007).

Both datasets are used to make a tentative, qualitative, reconstruction of past salinity levels, on the south-western shelf, with a particular focus on assemblages found in the early Holocene. A broader assessment of the salinity of the Black Sea after its reconnection with the Mediterranean Sea is also presented. The ostracod assemblages from these two studies are consistent with brackish bottom water conditions in the early Holocene.

The use of two cores separated by ~150 km allows for geographical changes to be examined, as well as the temporal changes throughout the Holocene. Each core has an independent chronology based on AMS dates. Dates are presented as calibrated year BP with two reservoir corrections applied to the raw dates. Prior to 7600 yr BP dates are calibrated with a correction factor of 1000 yr (see BAHR et al. 2008) and shells younger than 7600 yr BP have a 415 yr correction factor based on a clear indication of strong connection with the world ocean by 7600 yr BP (HISCOTT et al. 2007). Data and images are also presented with un-calibrated ages to help facilitate comparison with previous studies in the Black Sea.

M02 45 (41°41'N 28°19'E) is a 9.5 m core of Holocene sediment recovered at a current water depth of ~70 m. AMS dating and stratigraphic analysis suggests a hiatus

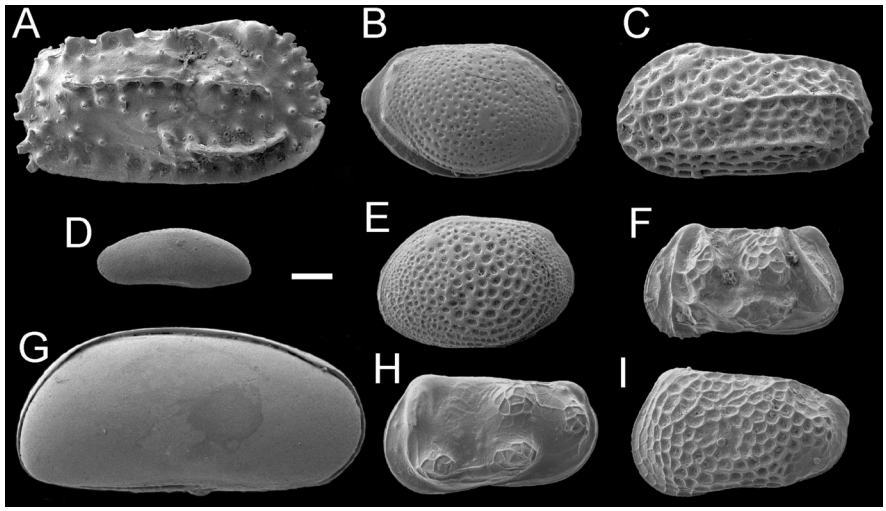

Fig. 2: Selected ostracod taxa from Core 45P: A, *Carinocythereis carinata* (ROEMER, 1838), male RV; B, *Palmoconcha agilis* (RUGGIERI, 1967), female RV; C, *Hiltermannicythere rubra pontica* (DUBOWKSI, 1939), female LV; D, *Cytheroma marinovi* SCHORNIKOV, 1967, female LV; E, *Loxoconcha lepida* STEPANAITYS, 1962, female LV; F, *Euxinocythere bacuana* (LIVENTAL 1929), female LV; G, *Candona schweyeri* SCHORNIKOV, 1964, female carapace, right side; H, *Amnicythere quinquetuberculata* (SCHWEYER 1949), female LV; I, *Amnicythere olivia* (LIVENTAL, 1938), female LV. Scale bar = 100 μm.

between 2050–5465 cal yr BP (see HISCOTT et al. 2007). Ostracods have been counted to an age ~9400 cal yr BP.

M05 13 (41°09'N 31°07'E) is an 8.3 m core recovered at a present water depth ~75 m. One hiatus has been identified at 7805–8070 cal yr BP. The core dates to an age of ~10,000 cal yr BP. Ostracod preservation in the two cores is good throughout and in parts excellent. In certain sections, preservation of soft parts has been observed.

Assemblages including *Amnicythere olivia* (LIVENTAL, 1938), *Amnicythere quinquetuberculata* (SCHWEYER, 1949), *Candona schweyeri* SCHORNIKOV, 1964, *Euxinocythere bacuana* (LIVENTAL, 1929) and *Loxoconcha lepida* STEPANAITYS, 1962, are present before reconnection. After reconnection, assemblages including *Carinocythereis carinata* (ROEMER, 1838), *Cytheroma marinovi* SCHORNIKOV, 1967, *Hiltermannicythere rubra pontica* (DUBOWKSI, 1939) and *Palmoconcha agilis* (RUGGIERI, 1967) are present (Fig. 2). Combined with dinoflagellate cyst data, a better evaluation of the salinity at the top and bottom of the water column can be made. Therefore, also briefly presented here is dinoflagellate cyst data from the same cores. This proxy indicates that surface salinity was brackish prior to the establishment of the two-way flow (MARRET et al. 2009).

We explore in detail the preliminary finding that the key indicator species suggest that the salinity of the Black Sea prior to reconnection was brackish before becoming more marine in character.

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