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Holocene paleoecology of the southwestern Black Sea shelf using ostracods as proxies

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The late Quaternary evolution of the Black Sea is a point of contention amongst earth scientists. The debate became prominent in the late 1990's when Ryan & Pitman (1998) postulated a catastrophic flood (the Flood Hypothesis). They argued that over the past two million years the Black Sea has been predominantly a freshwater lake intermittently invaded by marine water at times of global sea level highstands. During the younger Dryas stadial, ~12.9–11.6 ka cal BP, the Black Sea was an isolated freshwater lake at -150 m. When the northern glaciers began to melt in the Flandrian interstadial, they proposed that the water in the Mediterranean and Marmara Sea broke through an unconsolidated sediment dam and catastrophically inundated the Black Sea via the Marmara Sea at ~9.4 ka cal BP (Ryan et al. 2003).

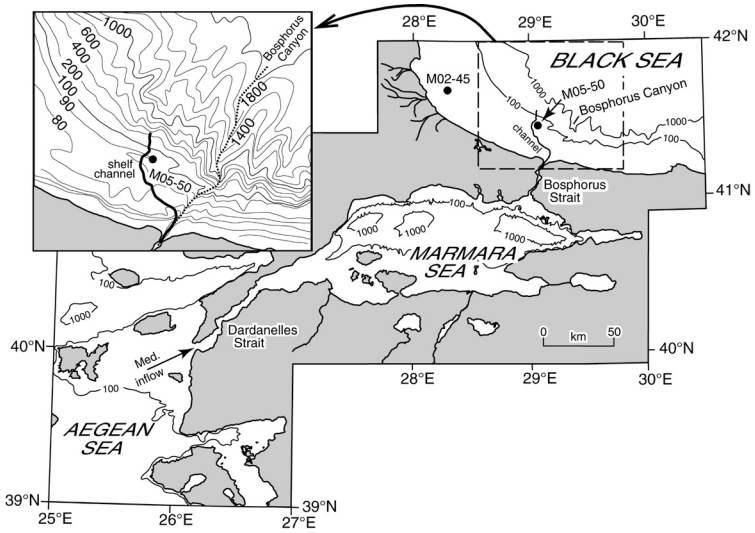

Fig. 1: Regional map showing the connecting straits between the Aegean Sea and the Black Sea. Isobaths in metres. The locations of long piston cores M05-50 and M02-45 are indicated (from Flood et al. 2009).

The conclusions of Hiscott et al. (2002), Aksu et al. (2002a), Aksu et al. (2002b), Hiscott et al. (2007) contradict the deluge theory. Hiscott et al. (2007) used a variety of geochemical, floral, and faunal data from core M02-45 (Fig. 1), including ostracods, to indicate brackish conditions until ~9.4 ka cal BP, a first aborted incursion of a small amount of Mediterranean water, and then a progressive increase in Mediterranean inflow resulting in conditions suitable for Mediterranean molluscs and ostracods by ~8.0 ka cal BP.

Here, we further utilise ostracod fossils to reconstruct the Holocene ecology of the Black Sea with particular focus on changes in salinity. The ostracods were collected from 730 cm-long piston core M05-50 (Fig. 1) raised from the southern Black Sea shelf at a current water depth of 91 m.

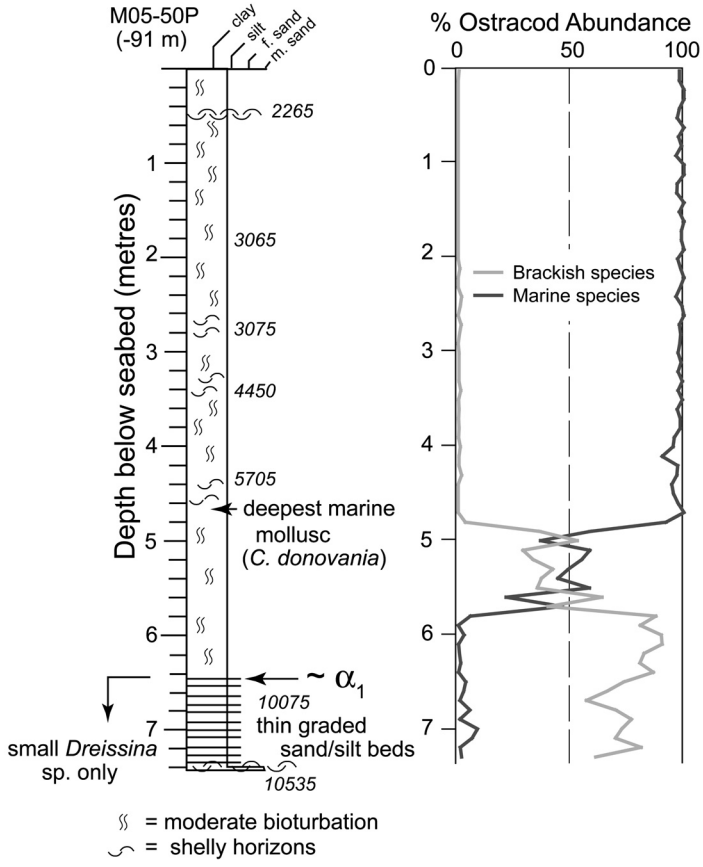

Fig. 2: Graphic section for core M05-50. Dates are given in calendar years in italics to the right of the column. To the right is a graph of % abundances of marine and brackish species.

The southwestern Black Sea shelf is generally flat and dips gently to the north. It is dissected by a prominent 10–35 m-deep channel (Fig. 1) created by a saline density current flowing in from the Aegean (Mediterranean) from ~8.0-8.5 ka cal BP to present (Flood et al. 2009). Core M05-50 was collected on the eastern levee of this channel. The water depth at this site is marginally above the chemocline separating an oxygenated surface water mass from the deep anoxic environment for which the Black Sea is so famous. The base of core M05-50 dates to 10,535 cal yr using a 1000 yr reservoir age for 14C dates older than 7600 yr and 415 yr for younger ^{14}C dates. Figure 2 shows a graphic section for the core with radiocarbon dates corrected to calendar years.

Ostracods are abundant and very well-preserved throughout the core. A plot of percent abundances of ostracod species (Fig. 2) illustrates the change from brackish to marine assemblages. The changes in the assemblages appears to be gradual rather than abrupt, beginning at 580 cm depth in the core and becoming essentially fully marine above 480 cm.

The brackish assemblage is dominated by *Loxoconcha lepida* (Stepanaitys, 1962), *Candona* sp. aff. *schweyeri* (Schornikov, 1964), *Amnicythere quinquetuberculata* (Schweyer, 1949), *Amnicythere bacuana* (Livental, 1929), and *Heterocythereis* sp. aff. *amnicola* (Sars, 1887). After reconnection, the marine assemblage contains typical Mediterranean species dominated by *Palmoconcha agilis* (Ruggieri, 1967), *Hiltermannicythere rubra* (Müller, 1894), *Carincocythereis carinata* (Roemer, 1838), *Pterygocythereis jonesii* (Baird, 1850), *Cytheroma* sp. aff. *variabilis* (Müller, 1894), *Costa edwardsi* (Roemer, 1838), *Leptocythere multipunctata* (Seguenza, 1884), and *Loxoconcha littoralis* (Müller, 1894). The ostracod data contradicts the hypothesis that an instantaneous flood took place and strongly suggests that the Black Sea was brackish rather than freshwater prior to a gradual and systematic reconnection to the Mediterranean.

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