

STRUCTURE AND VARIABILITY OF THE ABYSSAL WATER MASSES OF THE EASTERN MEDITERRANEAN

Vanessa Cardin ^{1*}, Manuel Bensi ¹, Dagmar Hainbucher ² and Angelo Rubino ³

¹ Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Trieste, Italy - vcardin@ogs.trieste.it

² Universitat Hamburg - Institut für Meereskunde, Hamburg - Germany

³ Università Cà Foscari - Venezia, Italy

Abstract

During the EMT water inflowing the Adriatic basin were characterised by an anomalous low salinity. After the year 2003 saltier waters associated with the Aegean Sea outflow at higher horizons, were able to enter the Adriatic basin and create the necessary conditions for the deep convection in the Southern Adriatic Pit. The newly dense waters formed profoundly differ from waters of Adriatic origin observed in the region previously being saltier and warmer than in the past. To confirm this, cruises in two specific periods (2003 and 2008) were analysed. Data analysis confirmed the increase in salt and temperature in the abyssal area of the Ionian Sea (Zone A) so as the presence of Adriatic Dense water (ADW) in the northwestern Ionian (Zone C)

Keywords: Eastern Mediterranean, Adriatic Sea, Circulation, Water Convection, Deep Waters

Using in situ data collected during the last 10 years we investigated the structure and variability of the abyssal water masses of the Eastern Mediterranean Basin (EM). Waters inflowing the Adriatic basin were characterized by an anomalous low salinity over the entire water column and by the absence of the typical salinity maximum associated with inflowing Levantine Intermediate Water (LIW). After the year 2000, saltier waters were able to enter the Adriatic basin and were able to create the necessary conditions for deep convection in the South Adriatic Pit. The dense waters which were formed since then, however, profoundly differ from waters of Adriatic origin observed previously in the region: they are substantially saltier and warmer than in the past. A tendency toward warming and, especially, salinification, seems to be confirmed by the preliminary analysis of very recent data acquired in the area [1], which agrees with the conjecture that very salty intermediate waters flowing toward the Adriatic basin contribute to reinforce the Adriatic source of EMDW. To confirm this tendency, temperature, salinity, and oxygen data sampled during 2008 SESAME cruises in the central (Zone A) and northeastern (Zone C) part of the Ionian basin are compared with the same parameters data obtained during previous years on the METEOR71-3 (2007) and POS298 (2003) cruises (figure 1).

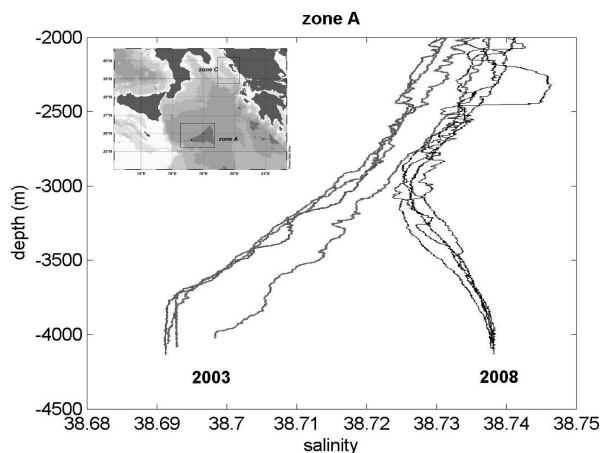


Fig. 1. Deep layer salinity profiles carried out during the 2003 and 2008 cruises in the central Ionian Sea.

The analysis of thermohaline parameters of the 2008 cruises confirms the differences in the EMDW properties for the deep layer (>3000 m) between 2003 and 2008 [2], while no significant changes are observed between the 2007 and 2008 cruises. The analysis of profiles positioned in Zone C (northeastern Ionian), collected during March 2008 cruise, shows clearly the presence of a vein of Adriatic Deep Water in the layer between 1300-1500 m. Oxygen values (figure 2), potential temperature and salinity present similar characteristics as those found previously in the Southern Adriatic Pit at ~800m, which seems to outflow almost geostrophically and which may be attributed to the Adriatic Deep Water (ADW).

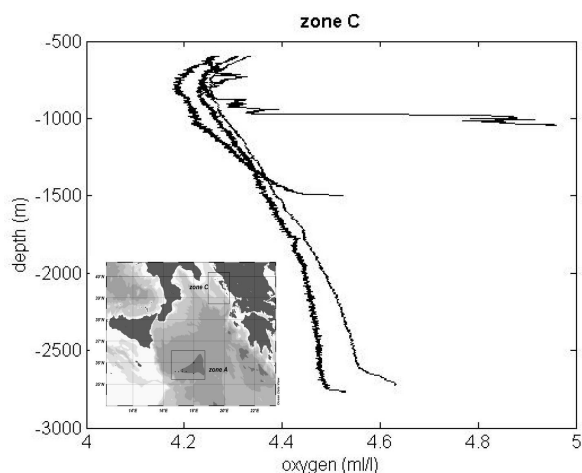


Fig. 2. Oxygen profiles from CTD casts carried out during the SESAME (2008) cruises in the northwestern zone.

Another branch of water follows the south westerly direction from the Otranto Strait reaching the deepest part of the central Ionian. We observe a general increase of temperature and salinity, hence density, during the period 2003-2008 in the bottom layers of the central Ionian Sea. This could be directly related to the changes in the thermohaline properties of the water mass coming from the Adriatic Sea described above. This trend is confirmed through the time series of temperature and salinity recorded in the Southern Adriatic Pit, which shows an increase of salinity and temperature for both Adriatic Deep Waters (ADW) and LIW between 2003 and 2008 [3]. Starting in 2008, however, this trend seems to have reverted again, as lower intermediate salinity waters are now observed to enter the Adriatic Basin.

References

- 1 - Cardin V. and Gacic M., 2008. Are decadal variations of Adriatic thermohaline properties related to the Eastern Mediterranean Transient (EMT)? In: Climate warming and related changes in Mediterranean marine biota, F. Briand Ed. *CIESM Workshop Monographs*, 35, 152 pages, Monaco
- 2 - Rubino A., and Hainbucher D., 2007. A large abrupt change in the abyssal water masses of the eastern Mediterranean, *Geophys. Res. Lett.*, 34, doi: 10.1029/2007GL031737
- 3 - Hainbucher D., Rubino A., and Klein B., 2006. Water mass characteristics in the deep layers of the western Ionian Basin observed during May 2003, *Geophys. Res. Lett.*, 33, L05608, doi: 10.1029/2005GL025318.