SEISMIC OCEANOGRAPHY. CORRELATION BETWEEN SEISMIC IMAGES AND OCEANOGRAPHIC DATA OF THE WATER COLUMN STRUCTURE

Berta Biescas[1], Francisco Machin[2], Josep Lluis Pelegrí[3], Valentí Sallarés[4], Eulàlia Gràcia[5]

[1]Unitat de Tecnologia Marina – CMIMA (CSIC). Passeig Marítim de la Barceloneta 37-49, Barcelona 08003. biescas@cmima.csic.es

[2]Institut de Ciències del Mar – CMIMA (CSIC). Passeig Marítim de la Barceloneta 37-49, Barcelona 08003. fmachin@icm.csic.es

[3]Institut de Ciències del Mar – CMIMA (CSIC). Passeig Marítim de la Barceloneta 37-49, Barcelona 08003. pelegri@icm.csic.es

[4]Unitat de Tecnología Marina – CMIMA (CSIC). Passeig Marítim de la Barceloneta 37-49, Barcelona 08003. vsallares@cmima.csic.es

[5]Unitat de Tecnologia Marina – CMIMA (CSIC). Passeig Marítim de la Barceloneta 37-49, Barcelona 08003.

Multichannel seismic (MCS) imaging is becoming a new tool for oceanographic research (Holbrook et al, 2003). These new oceanographic images provide snapshots of the water column reflectivity with horizontal resolution about three orders better than typical oceanographic data (10 m versus 10 km), so they are potentially very helpful for oceanographers to investigate the internal structure of the water and the causes of the reflectivity. With this general aim, simultaneous MCS and oceanographic data were acquired in June 2006 in the Gulf of Cadiz with R/V Hespérides, in the framework of the Euromargins-SWIM oceanographic survey. 12 Expandable Bathythermograph (XBT) probes were dropped while shooting along a 50 km seismic profile, with the purpose of directly comparing obtained seismic images and temperature data. MCS data were acquired using a 1050 cu. in. source and a 2400 m, 96 channels streamer. Other oceanographic variables, such as salinity (Machín and Pelegrí, 2007), velocity (Chen and Millero, 1977), temperature, velocity and salinity gradients, and Turner angles (Ruddick, 1983) were calculated based on XBT data and plotted on top of seismic images.

The analysis of seismic and oceanographic data shows that seismic reflectors are placed in regions of large temperature and salinity gradients, in many occasions in areas prone to double diffusion, both in salt-finger and diffusive regimes. This leads us to hypothesize that double diffusion may be an important mechanism to generate internal layers (fine structure) visible as reflectors in seismic images. Once these layers are generated they may last long enough to remain visible far away from their area of generation, in regions that are no longer prone to double diffusion. Additionally, it seems possible that some internal layering may originate as a result of shear-mixing during the outflow of the Mediterranean water, through a mechanism such as the one proposed by Pelegrí and Sangrà (1998).

References

Chen, C.T. and F.J. Millero, 1977. Speed of sound in seawater at high pressures. J. Acoust. Soc. AM. 62(5), pp 1129-1135.

Holbrook, W.S., P. Páramo, S. Pearse, R.W. Schmitt, 2003. Thermohaline Fine Structure in an Oceanographic Front from Seismic Reflection Profiling. Science, Vol. 301, 8, pp 821-824..

Machín, F.J., J. L. Pelegrí, 2007. A simple inverse method to elucidate the structure of the ocean. Submitted to Geophysical Research Letters.

Pelegrí, J.L. and P. Sangrà, 1998. A mechanism for layer formation in stratified geophysical flows. Journal of Geophysical Research, Vol. 103, No. C13, pp 30,679-30,693.

Ruddick. B., 1983. A practical indicator of the stability of the water column to double-diffusive activity. Deep-Sea Research, Vol. 30, No. 10A, pp 1105-1107.