LETTER

Location of natural oil seep and chemical fingerprinting suggest alternative explanation for deep sea coral observations

In the article by White et al. (1) we find that the authors prematurely linked the condition of a single coral community to the *Deepwater Horizon* oil spill, without evaluating other plausible explanations, including the presence of natural oil and gas seeps near the coral, and the potential for underwater landslides to carry seep sediments onto the coral.

The single coral location in question, (28.67211° N, –88.47641° W), of 11 studied, is on the western slope of the faulted west flank of the Biloxi salt dome, an area of active oil and gas seepage. The site is some 21 m down slope and between 310 and 350 m southwest of proven, active areas of gas and probable oil seeps (Fig. 1). It is plausible that episodic oil seepage has impacted this coral colony and also that slope instability and subsequent turbid, sediment-laden flows could have impacted it.

The authors claim the coral colony was in the path of the "…100-m-thick deep-water plume of neutrally buoyant water enriched with petroleum hydrocarbons from the Macondo…." However, the base of this water layer in the vicinity of the coral was located by a conductivity-temperature-depth cast on June 2, 2010 (Gordon Gunter 019, http://www.nodc.noaa.gov/General/DeepwaterHorizon/oceanprofile.html) at 1,230 m, some 140 m above the corals, which are on the seabed at 1,370 m. In other words, the corals were below the measured layer that contained Macondo oil.

In addition, extensive measurements of hydrocarbon concentrations (2) in the deep layer within 20 km of the wellhead indicate no more than 0.1–1.0 mg/L (ppm) of oil and 1–10 μg/L (ppb) of polycyclic aromatic hydrocarbons (PAHs) was present, hardly the concentrations that would produce the brown flocculent material observed and sampled.

Additionally, the detailed geochemical and statistical analyses required in this deep sea environment are absent from the article. Similar PAH compositions and biomarker signatures occur in oils from the South Louisiana Sweet Crude "oil family" area, which includes Biloxi Dome as well as the Macondo oil well. The published GC×GC qualitative comparisons and/or the simplistic single biomarker maturity ratio [Ts/(Ts+Tm); Ts, 18 alpha (H) 22,29,30 trisnorhopane; Tm, 17 alpha (H) 22,29,30 trisnorhopane] are not sufficient to establish a match. Pairwise statistical comparisons to biomarker concentrations and biomarker ratios in the purported source (Macondo oil) and the floc are required.

The authors report that floc and the oil from the Macondo well have consistent fingerprints. However, a rigorous correlation analysis (R^2) applied to 21 hopanoid biomarker ratios comprising 30+ individual hopanes delivers a strong correlation ($R^2 > 0.97$) between Macondo oil and a produced oil sample collected from the Kepler field at the southern end of the Biloxi Dome before Macondo was drilled. High correlation of oil samples collected from different wells at different times show the importance of using all relevant data to establish the origin of an oil sample. Biloxi oil seeps and Macondo oil are difficult to distinguish and will not be distinguished by the method used by the authors.

We therefore respectfully suggest that the authors fully consider other relevant data and plausible explanations for the condition of this particular coral community.

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1. White HK, et al. (2012) Impact of the *Deepwater Horizon* oil spill on a deep-water coral community in the Gulf of Mexico. *Proc Natl Acad Sci USA*, 10.1073/pnas.1118029109.
2. Boehm PD, Cook LL, Murray KJ (2011) Aromatic hydrocarbon concentrations in seawater: Deepwater Horizon Oil Spill. *Proceedings 2011 International Oil Spill Conference* (American Petroleum Institute, Washington, DC). Available at: http://www.iosc.org/papers_posters/IOSC-2011-371-file001.pdf. Accessed on July 27, 2012.

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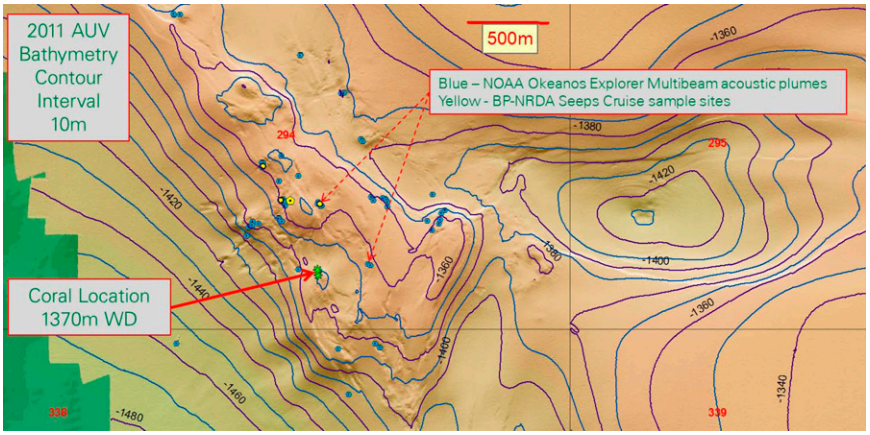

Fig. 1. Seabed location of corals downslope from the local high and oil seeps on the western side of the Biloxi Dome. Complex seafloor is the site of hardgrounds and seabed seeps. AUV, autonomous underwater vehicle; BP-NRDA, BP Natural Resource Damage Assessment; NOAA, National Oceanic and Atmospheric Administration; WD, water depth.