

Comparison of the 2015 Abkatun (Mexico) and 2013 Hercules-265 (USA) Blowout Events in the Southern and Northern Gulf Using Benthic Foraminiferal Species Richness as an Environmental Proxy for Contamination

Bryan J. O'Malley¹, Patrick T. Schwing¹, David J. Hollander¹
1. University of South Florida, College of Marine Science, St. Petersburg, FL 33701

Introduction:

In April 2015, the Abkatun oil platform exploded in the Southern Gulf of Mexico (SGoM). This event is analogous to the Hercules-265 natural gas explosion in the Northern Gulf of Mexico (NGoM) in 2013. A decrease in benthic foraminiferal species diversity was coincident with increased sedimentary petrochemical concentrations near the Hercules 265 rig (Romero et al. 2016). Foraminifera have been used in many applications as sensitive bio-indicators of environmental contamination (Mojtahid, 2006, Yanko, 1999, Seiglie, 2004). The purpose of this study was to apply foraminifera as bioindicators of contamination following the Abkatun event and subsequently compare those records to the Hercules event in the NGoM.

Objectives:

- To compare species richness (S) of benthic foraminifera from a shallow water contamination event in the NGoM (Hercules) to one in the SGoM (Abkatun).
- To test the use of benthic foraminifera as bio-indicators of short-term petrochemical contamination events.

Methods:

- Three multicores were collected in August 2013 from the HC-265 site along an 18km transect SE of the rig.
- Three multicores were collected in August 2015 from the Abkatun site along a 28km transect NW of the platform.
- All of the cores were subsampled at 2mm increments
- 0-50mm were analyzed for the NGoM
- 0-80mm were analyzed for the SGoM
- At least 300 foraminifera were identified to the species level in each increment.
- Fisher's Alpha (S), a measure of species richness, was determined using the Paleostatistics software suite (PAST).

Sampling Locations

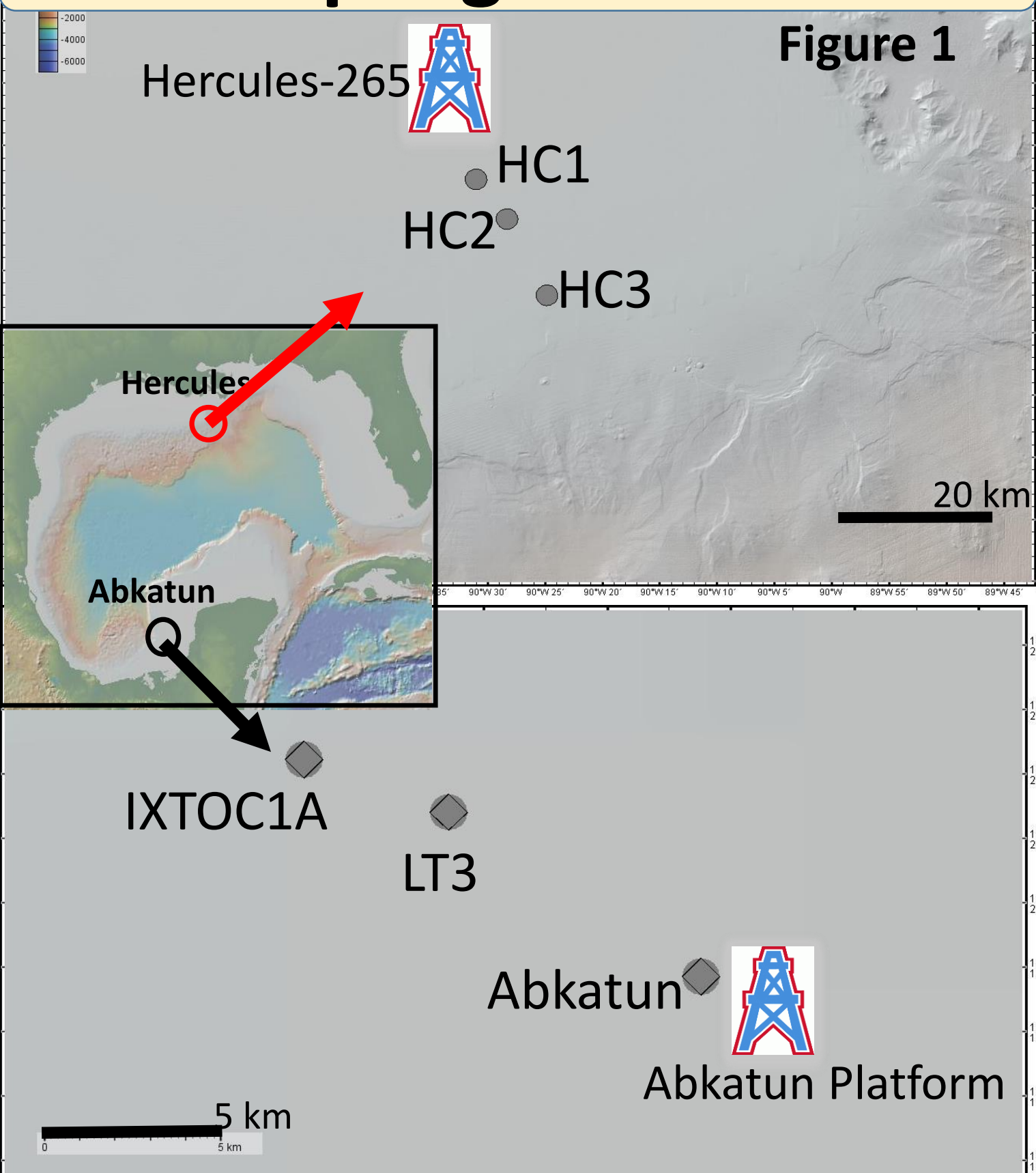


Figure 1

I. Biostratigraphy

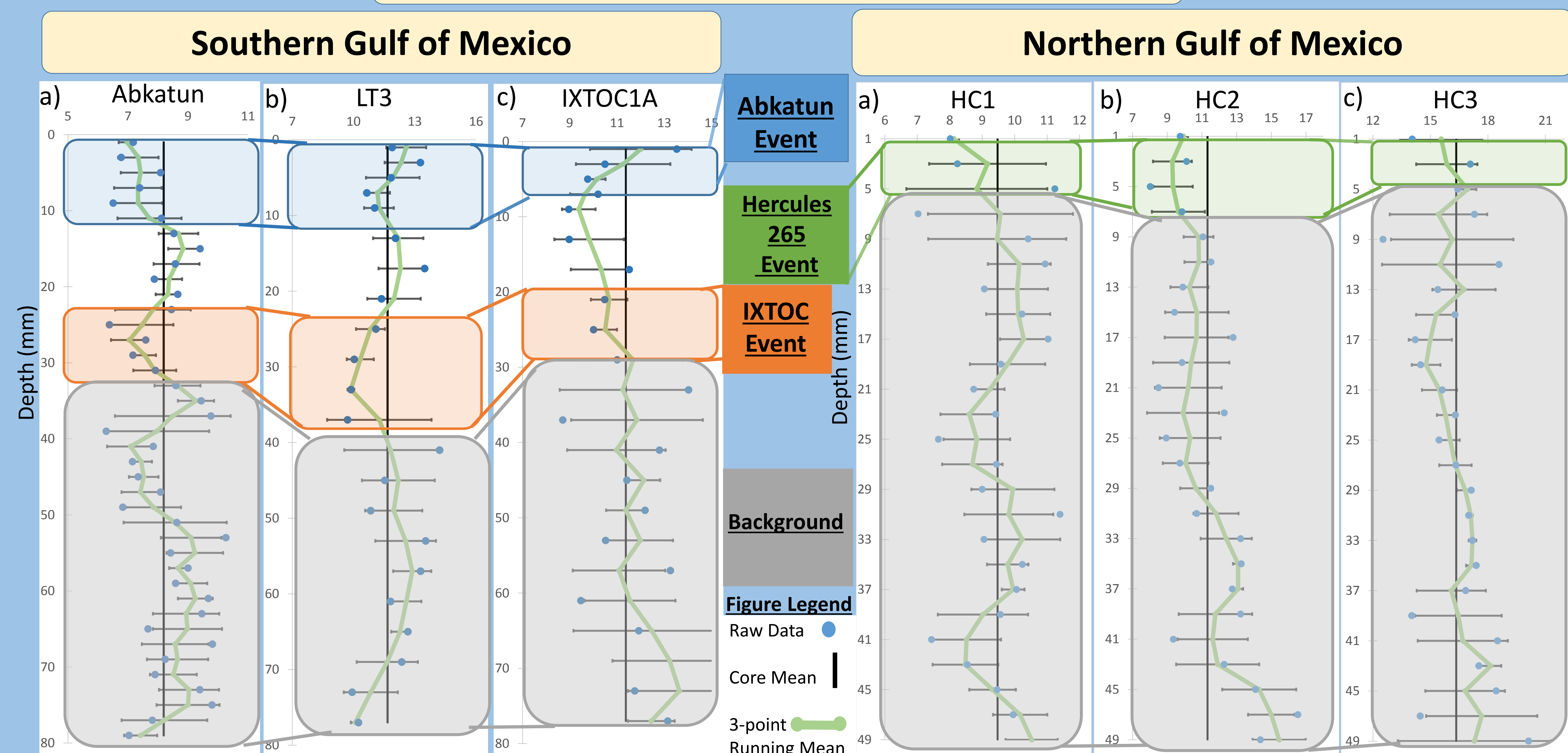


Figure 2a) Fisher's Alpha (S) at the Abkatun event (blue) and the IXTOC event (orange) significantly decrease from the background mean (grey).

Figure 2b, 2c) Fisher's Alpha (S) at the surface (blue) is not significantly affected by the Abkatun event. Fisher's Alpha at the IXTOC event (orange) is significantly lower than the background mean (grey).

Figure 3a, 3b) Fisher's Alpha (S) at the surface, during the Hercules-265 event (green), significantly decreases from the background mean (grey).

Figure 3c) Fisher's Alpha (S) of the surface (green), during the Hercules event is not significantly different from the background mean (grey).

II. Spatio-temporal Analysis

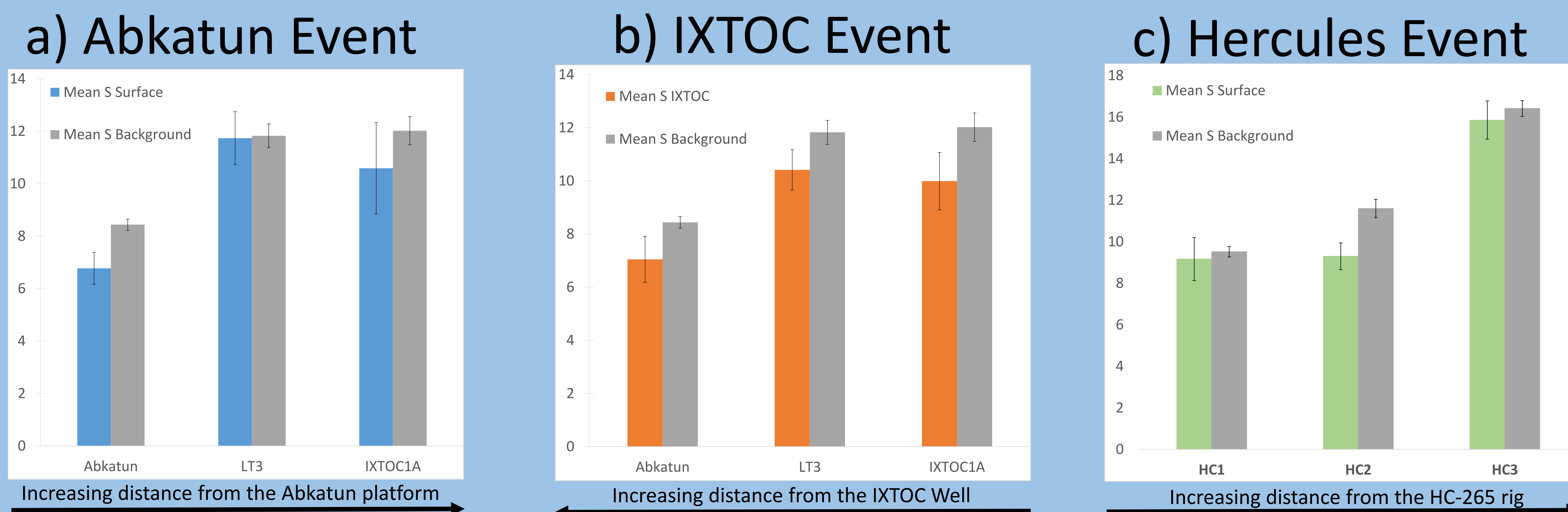


Figure 4a) Fisher's Alpha (S) indicates a short-term impact during the Abkatun event at the Abkatun site only. The background mean of Abkatun is significantly lower than both LT3 and IXTOC1A implying a long-term effect on foraminiferal diversity at that site.

Figure 4b) Fisher's Alpha (S) indicates a significant decrease in foraminiferal diversity during the IXTOC event at all three sites.

Figure 4c) Fisher's Alpha (S) increases with distance from the Hercules-265 rig. HC1 and HC2 indicate long-term impact while HC3 remains unaffected. HC2 shows a short-term impact at the surface.

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Discussion:

SGoM

- Short-term impact: The Abkatun event (2 days) had a negative impact on foraminiferal diversity (S) at the Abkatun site.
- Long-term impact: The foraminiferal diversity (S) at the Abkatun site indicates that it has experienced a long-term (decades) impact compared to LT3 and IXTOC1A (Figure 2a).
- The IXTOC oil spill was recorded as a decrease in foraminiferal diversity at all three sites (Abkatun, LT3, IXTOC1A).

NGoM

- Short-term impact: The Hercules event (<1 week) had a negative impact on foraminiferal diversity (S) at HC2 (8 km away from rig).
- Long-term: The foraminiferal diversity (S) at the HC1 site indicates that it has also experienced a long-term impact (decades) relative to HC2 and HC3.
- The decrease in foraminiferal diversity at the surface of HC2 (8 km from rig), relative to background, suggests impact from Hercules event

Conclusions :

- Records of foraminiferal diversity suggest a long-term (decades) impact nearest the Hercules and Abkatun platforms.
- Foraminiferal diversity suggests that the Hercules event affected sites up to 8 km away, while the Abkatun event affected an area less than 1 km away from the platform.