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# *Interactive comment on* "Seafloor observations at Campeche Knolls, southern Gulf of Mexico: coexistence of asphalt deposits, oil seepage, and gas venting" *by* Heiko Sahling et al.

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See comments and edits in text and figures (scanned as separate .pdf files; attached).

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Discussion paper

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**Seafloor observations at Campeche Knolls, southern Gulf of Mexico: coexistence of asphalt deposits, oil seepage, and gas venting**

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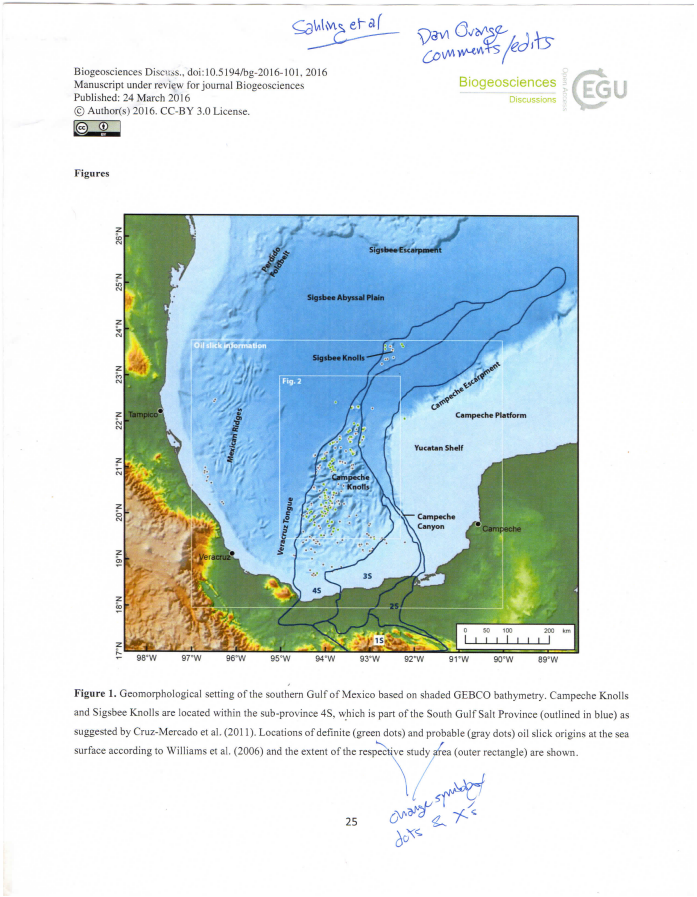
**Abstract.** We studied asphalt deposits, oil seepage and gas venting during a multidisciplinary cruise in the Bay of Campeche, southern Gulf of Mexico. We conducted multibeam bathymetric mapping with an autonomous underwater vehicle and performed seafloor observations as well as sampling with a remotely operated vehicle. While previous studies concentrated on the asphalt volcano Chapopote Knoll, we confirmed that asphalt deposits at the seafloor occurred across numerous other knolls and ridges in water depths between 1230 and 3150 m; this is evidence that the outflow of heavy oil is a common component of hydrocarbon seepage of Campeche Knolls. The outflow of heavy oil either created whips or sheets floating in the water that subsequently descend and pile-up as meter high stacks at the seafloor over time or spread at the seafloor forming flows ranging from meters to tens of meters in diameter. Unlike seafloor-covering asphalts known from other continental margins, those in our study include relatively fresh material. Seafloor observations documented how chemosynthetic communities develop on the asphalts, with bacterial mats and juvenile vestimentiferan tubeworms colonizing the most recent flows.

Gas bubble emissions were an additional widespread component of hydrocarbon seepage at Campeche Knolls. The hydrocarbon gas had thermogenic origins, as indicated by the composition ($C_1/C_2$-ratio: 14 to 185) and stable carbon isotopic signature of methane ($\delta^{13}C$-$CH_4$: -45.1 to -49.8 ‰). Gas emissions were detected by multibeam echosounder at water depths as great as 3420 m over Tsanyao Yang Knoll. Gas emissions occurred at sites without large asphalt deposits (Tsanyao Yang Knoll) as well as through old, fragmented asphalts (Mictlan Knoll, Chapopote Knoll). The gas emissions feed gas hydrate deposits at shallow seafloor depth. Gas hydrate formed mounds that were ~10 m wide by several meters high in soft sediments and filled the space within fragmented asphalts. The largest gas hydrate mounds supported dense colonies of 1-2 m long

1

**Fig. 1.** scanned text with edits and comments



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Campeche Canyon
Campeche
Tampico
Veracruz
Mexican Ridges
Veracruz Tongue
4S
3S
2S
1S
98°W 97°W 96°W 95°W 94°W 93°W 92°W 91°W 90°W 89°W
26°N 25°N 24°N 23°N 22°N 21°N 20°N 19°N 18°N 17°N
0 50 100 200 km

Figure 1. Geomorphological setting of the southern Gulf of Mexico based on shaded GEBCO bathymetry. Campeche Knolls and Sigsbee Knolls are located within the sub-province 4S, which is part of the South Gulf Salt Province (outlined in blue) as suggested by Cruz-Mercado et al. (2011). Locations of definite (green dots) and probable (gray dots) oil slick origins at the sea surface according to Williams et al. (2006) and the extent of the respective study area (outer rectangle) are shown.

25

change symbol dots ≤ X

**Fig. 2.** scanned figures with edits and comments



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