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## Biogeochemistry of Hydrocarbon Seeps on the Campeche Escarpment, Southern Gulf of Mexico

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### ABSTRACT

Unusual hydrocarbon seep features, so-called “asphalt volcanoes,” were explored in the southern Gulf of Mexico offshore Campeche, Mexico in the spring of 2006. Guided by data from satellite imagery that showed evidence for persistent oil seeps in the region, we investigated lava-like flows of solidified asphalt along the rim of a dissected salt dome at a water depth of 9850 ft (3000 m).

Asphalt was present on the sea floor in a wide range of apparent ages, from fresh, soft material to eroded and broken pieces, with numerous intermediate stages. Fresh asphalt contained copious thermogenic gas and gas hydrate. Surface crusts comprised slabs of authigenic carbonate with layers of oil pooled beneath. Sediments were anoxic with H<sub>2</sub>S concentrations of 8 to 13 millimoles (mM). Gas hydrate formed layers and mounds in the surface sediments. Alkalinity profiles showed values from 29 to 35 mM, indicating oxidation of hydrocarbons by reduction of seawater sulfate. Molecular and isotopic compositions of gas hydrate and sediment headspace indicate moderately mature, thermogenic gas. Oily sediment extracts and asphalt pieces were composed of a degraded mixture of hydrocarbons with a peak at *n*-C<sub>30</sub> and a few resolved C<sub>29</sub> to C<sub>32</sub> hopanes.

The collective data indicate that the area has been subjected to repeated, extensive eruptions of liquid asphalt. The mechanical energy of these eruptions coupled with the destabilization of gas hydrate deposits may contribute to the observed faulting, slope failure, and mass wasting at other salt-related structures on the Campeche slope.