Observations and models of heat and salt transport at a deepwater Gulf of Mexico vent

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ABSTRACT

We present a multiphase heat and salt transport model to describe salinity and temperature anomalies at a deepwater Gulf of Mexico vent in lease blocks MC852/853. In our model, water supplied from depth transports heat and salt, and free gas transports only heat. We show that there is a unique gas and water flux that will reconcile salinity and temperature anomalies and introduce a new method for estimating gas and water flux from vents. Our model indicates that vents in the Gulf of Mexico may expel significant amounts of gaseous hydrocarbons that are comparable to the discharge from the BP oil well blowout.

CLICK ON IMAGE FOR LARGER VIEW

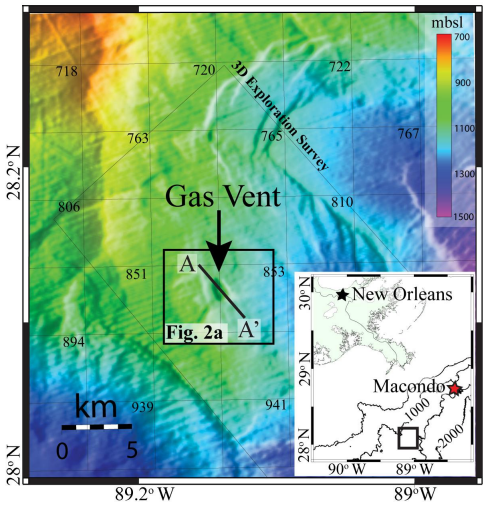


Fig. 1: Bathymetric map of the Ursa Basin in the northern Gulf of Mexico. The gas vent at leaseblocks MC852/853 is located ~210 km SSE of New Orleans in 1070 meters water depth.

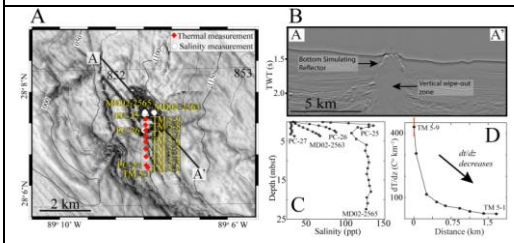
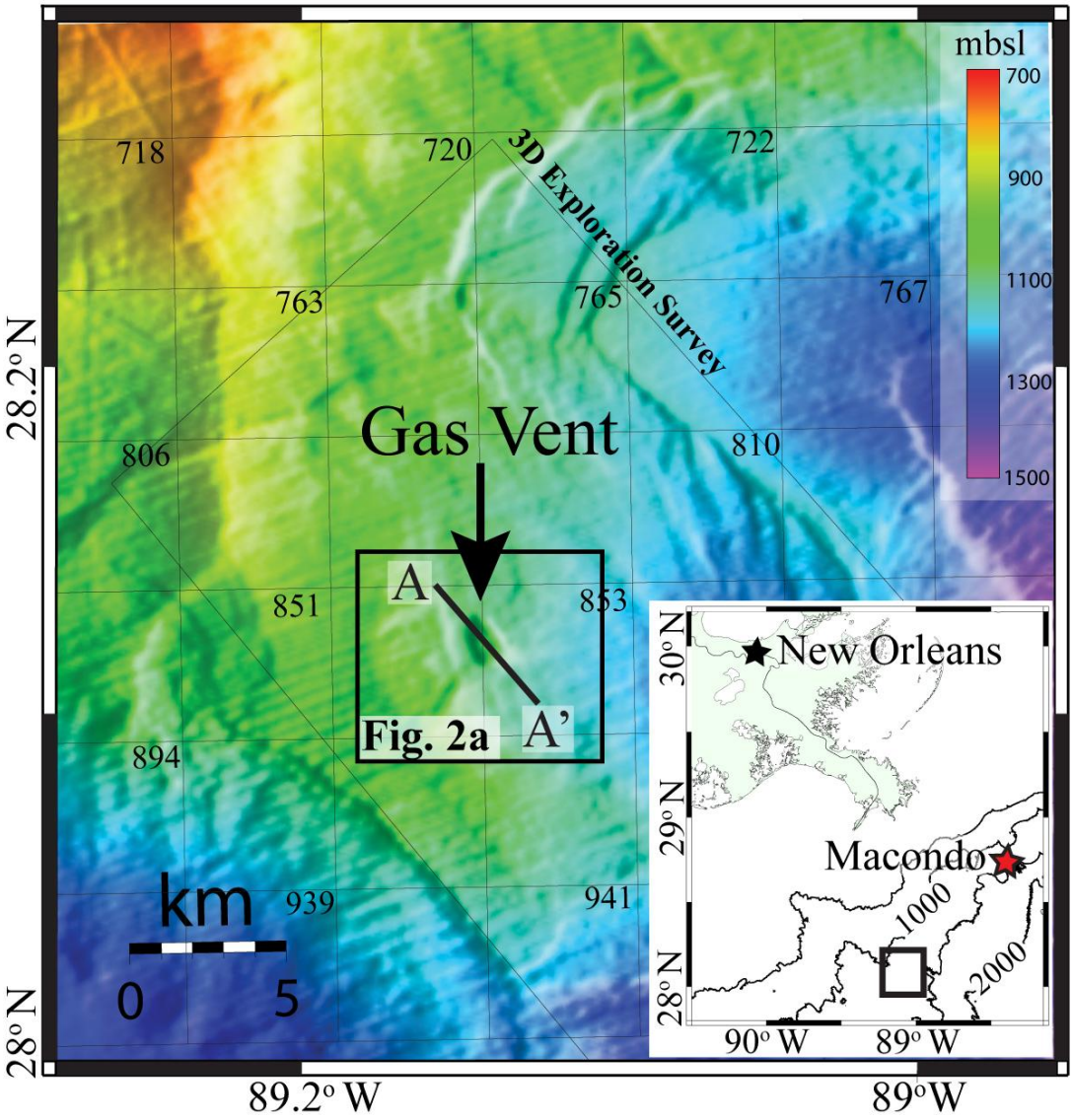


Fig. 2: The deepwater vent at MC852/853 is elevated 75 meters relative to the surrounding seafloor, and its core is roughly circular with a 1.2 km diameter. Elevated salinities and temperature gradients have been observed at the vent.



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Back

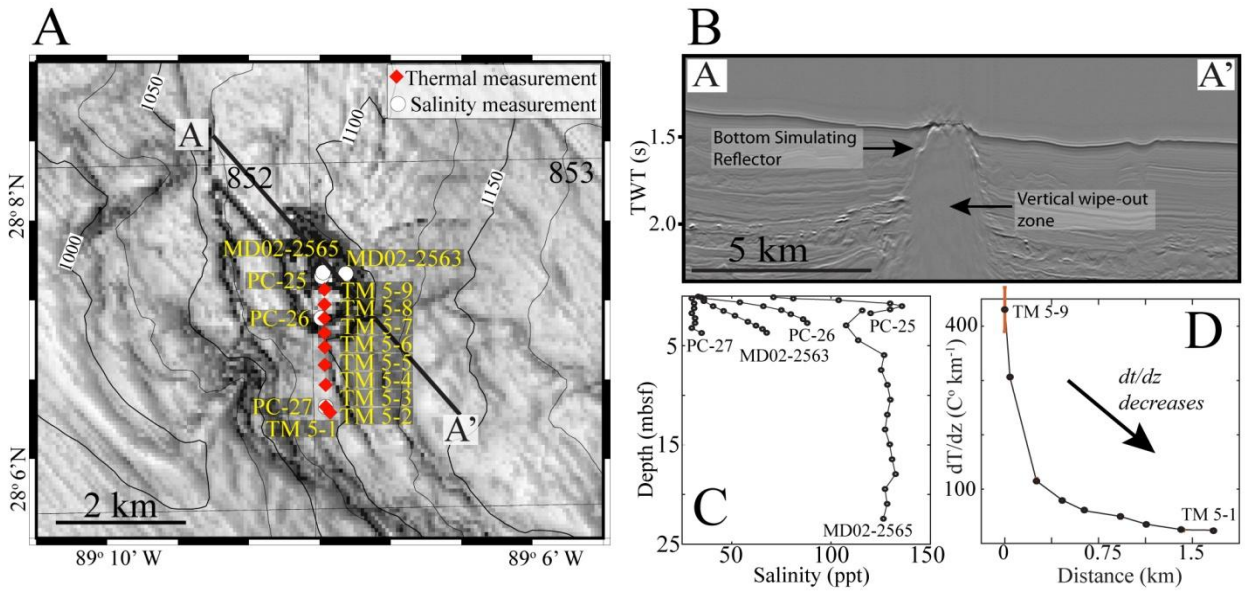

Fig. 2: (A) Seismic dip map with locations of piston core and thermal gradient measurements. Seismic dip maps emphasize steeper gradients with darker colors. The dark oval in the center of map view indicates the location of the vent edifice. (B) Seismic reflection profile through the gas vent. The BSR rises rapidly at the vent boundaries and is horizontal within a few meters of the seafloor directly beneath the vent. Acoustic blanking in the vent conduit records the presence of gas. (C) Salinity gradients measured by piston core. (D) Temperature gradients measured in upper 3 meters of the sediment column. Error bars are smaller than symbol size unless an orange error bar is present.

Back