Geophysical Research Abstracts
Vol. 21, EGU2019-16635-1, 2019
EGU General Assembly 2019

Subsurface gas hydrate plugs: evidence for a new type of hydrate deposit

Benedict Campbell and Mads Huuse
School of Earth and Environmental Science, University of Manchester, Manchester, United Kingdom
(benedict.campbell@env-res.ox.ac.uk)

Gas hydrates represent a significant but largely untapped hydrocarbon resource that are present in most deepwater basins. The habitat of gas hydrates ranges from low-saturation muddy sediments to high saturation sandstone hosted hydrates, massive veins and hydrate pingos. Using a high-quality three-dimensional seismic reflection survey, this paper documents two types of shallow subsurface features in the Lüderitz Basin, offshore Namibia.

The 62 buried features are characterized by: 1) Small increased amplitude anomalies with ellipse geometries, up to 40 ms velocity pull-up below, 10-32 ms high and 50-370 m wide (n=28); and 2) Concave depressions in strata, 150-450 m in diameter (n=34). We interpret this evidence as the first documented example of subsurface gas hydrate plugs (massive hydrate forming as mounds within the gas hydrate stability zone), and associated dissociation collapse structures. The amplitude anomalies also show observational similarities to blow out pipes from Norway, Angola and Nigeria.

The discovery of subsurface gas hydrate plugs gives new insight into the formation of hydrate within the subsurface. From plug nucleation in high permeability and porosity strata, to their demise during burial, when they eventually subside beneath the gas hydrate stability zone leading to plug dissociation and release of methane into the free gas accumulation below the hydrate, in turn feeding plug growth up dip via inclined permeable strata. Modelling each plug as a cone, in the study area there could be an estimated $6.4x10^6$ – $9.3x10^6$ $m^3$of hydrate within these plugs (minimum and maximum estimates found using minimum and maximum diameter of anomalies, when calculating cone volume). This can be used to inform world estimates of gas hydrate along continental margins and give insight into methane currently overlooked from the global methane budget.

By comparing the geometry, size and pull-up of the identified blow out pipes to the anomalies in this study, subsurface hydrate plugs can provide an alternative interpretation. This re-interpretation would have important implications when considering shallow surface fluid flow, especially for risk analysis in petroleum exploration.