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Heat flow pattern in the gas hydrate drilling areas of northern south china sea and the implication for further study

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Numerous seismic reflection profiles have been acquired by China Geological Survey (CGS) in the Northern Slope of South China Sea (SCS), clearly indicating widespread occurrence of free gases and/or gas hydrates in the sediments. In the year 2007 and 2013 respectively the gas hydrate samples are successfully recovered during two offshore drilling exploratory programs. Results of geothermal data during previous field studies along the north continental margin, however, show that the gas hydrate sites are associated with high geothermal background in contrast to the other offshore ones where the gas hydrates are more likely to be found in the low geothermal regional backgrounds. There is a common interesting heat flow pattern during the two drilling expeditions that the gas hydrate occurrences coincide with the presences of comparatively low geothermal anomalies against the high thermal background which is mainly caused by concentrated fluid upward movements into the stability zone (GHSZ) detected by the surface heat flow measurements over the studied fields. The key point for understanding the coupling between the presences of the gas hydrates and heat flow pattern at regional scale is to know the cause of high heat flows and the origin of forming gases at depth. We propose that these high heat flows are attributed to elevated shallow fault-fissure system due to the tectonic activities. A remarkable series of vertical faults and fissures are common on the upper continental slope and the forming gases are thought to have migrated with hot advective fluid flows towards seafloor mainly via fault-fissure system from underlying source rocks which are deeper levels than those of the GHSZ. The present study is based on an extensive dataset on hydrate distribution and associated temperature field measurements collected in the vicinity of studied areas during a series of field expeditions organized within the framework of national widely collaborative projects. Those observations bring new insights to our growing understanding of the stability of this dynamic hydrate reservoir in the continental margin shallow subsurface, and alert us that occurrence patterns may be more complex than previously thought. So the future aim of this program is to better understand the factors constraining the distribution of hydrate deposits, and the processes involved in gas hydrate formation.